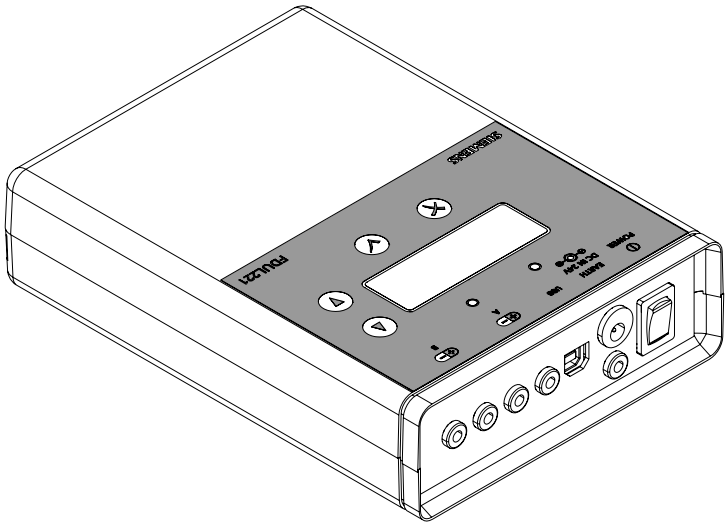
SIEMENS



FDUL221

Line tester

Technical Manual

008250_i_en_--
2013-08-15

Building Technologies

Control Products and Systems

Legal notice

Technical specifications and availability subject to change without notice.

© 2005-2013 Copyright by Siemens Switzerland Ltd

Transmittal, reproduction, dissemination and/or editing of this document as well as utilization of its contents and communication thereof to others without express authorization are prohibited. Offenders will be held liable for payment of damages. All rights created by patent grant or registration of a utility model or design patent are reserved.

Issued by:
Siemens Switzerland Ltd.
Infrastructure & Cities Sector
Building Technologies Division
International Headquarters
Gubelstrasse 22
CH-6301 Zug
Tel. +41 41 724-2424
www.siemens.com/buildingtechnologies

Edition: 2013-08-15
Document ID: 008250_i_en_--

Table of contents

1 About this document 5
1.1 Technical terms 7
1.2 Applicable documents 7
1.3 History of changes 8
2 Safety 11
2.1 Safety instructions 11
2.2 Safety regulations for the method of operation 13
2.3 Standards and directives complied with 14
3 Comparison of software functions 15
4 Introduction 17
4.1 Line topologies 17
4.2 Line separation function 19
5 Structure and function 20
5.1 Overview 20
5.1.1 Details for ordering / scope of delivery 25
5.1.2 Product version ES 27
5.2 Setup 28
5.2.1 Display 29
5.2.2 Symbols 30
5.2.3 LED indication 31
5.2.4 Button assignment 31
5.2.5 Connections 32
5.2.6 Connection to terminal strip 34
5.2.7 Battery compartment 35
5.3 Accessories 36
5.3.1 9 V lithium manganese dioxide battery 36
5.3.2 MCL-USB adapter FDUZ221 36
5.3.3 MCL-USB (radio) adapter FDUZ227 36
5.4 Function 37
5.4.1 Power supply 37
5.4.2 User language 37
5.4.3 'EL' operation mode 38
5.4.4 Functions in the 'Topology' menu 38
5.4.5 Functions in the 'Configuration' menu 39
5.4.6 PC operation 39

6 Operation 40
6.1 Navigating in the menu tree 40
6.1.1 Menu trees for 'EL' operation mode 43
6.2 The 'device' function 45
6.3 Connecting the line tester to the line 47
6.4 Switching the line tester on / off 49
6.5 Configuring the line tester 50
6.6 Reading in line topology 51
6.7 Viewing line topology 51
6.7.1 Loop 52
6.7.2 Stub 52
6.7.3 Sub-stub on loop 53
6.7.4 Impermissible sub-stubs 54
6.7.5 'Config. sounder base' function 54
6.8 Starting up a line 54
6.9 Saving a line topology 55
6.10 Opening a saved line topology 56
6.11 Operating the line tester with a PC 56
6.12 Transferring a saved line topology to a PC 57
6.13 Table of faults 58
6.14 Tips for troubleshooting on the detector line 61
6.14.1 Error search using the 'bisection' method 61
6.14.2 Error search using the 'measure line device' method 62
6.14.3 Explanation of ground fault measurement (for FDUL221 variant 3 only) 63
7 Maintenance / Repair 64
7.1 Testing the line tester 64
7.1.1 Selftest 64
7.1.2 Testing calibration 66
7.2 Replacing batteries 67
7.2.1 Service life of the batteries 68
7.3 Firmware update 69
8 Specifications 71
8.1 Technical data 71
8.2 Environmental compatibility and disposal 73
Index 74

1 About this document

Goal and purpose

This document contains all necessary information on the FDUL221 line tester with firmware version V4.x or higher.

Three variants of the FDUL221 line tester are described.

- Variant 1 (RS232) applies to FDUL221 with an RS232 serial interface
- Variant 2 (MC link) applies to FDUL221 with an MC link serial interface
- Variant 3 (USB interface) applies to FDUL221 with an integrated USB interface

Following the instructions consistently will ensure that the product can be used safely and without any problems.

Target groups

The information in this document is intended for the following target groups:

Target group	Activity	Qualification
Project Manager	● Coordinates the deployment of all persons and resources involved in the project according to schedule. ● Provides the information required to run the project.	● Has obtained suitable specialist training for the function and for the products. ● Has attended the training courses for Project Managers.
Project engineer	● Sets parameters for product depending on specific national and/or customer requirements. ● Checks operability and approves the product for commissioning at the place of installation. ● Is responsible for troubleshooting.	● Has obtained suitable specialist training for the function and for the products. ● Has attended the training courses for Product Engineer.
Installation personnel	● Assembles and installs the product components at the place of installation. ● Carries out a performance check following installation.	● Has received specialist training in the area of building installation technology or electrical installations.
Commissioning personnel	● Configure the product at the place of installation according to customer-specific requirements. ● Check the product operability and release the product for use by the operator. ● Searches for and corrects malfunctions.	● Has obtained suitable specialist training for the function and for the products. ● Has attended the training courses for commissioning personnel.
Maintenance personnel	● Carries out all maintenance work. ● Checks that the products are in perfect working order. ● Searches for and corrects malfunctions.	● Has obtained suitable specialist training for the function and for the products.

Conventions for text marking

Markups

Special markups are shown in this document as follows:

▷	Requirement for a behavior instruction
⇨	Intermediate result of a behavior instruction
⇨	End result of a behavior instruction
[➙ X]	Reference to a page number
'Text'	Quotation, reproduced identically
<Key>	Identification of keys

Supplementary information and tips

The 'i' symbol identifies supplementary information and tips for an easier way of working.

Document identification

The document ID is structured as follows:

ID code	Examples
ID_ModificationIndex_Language_COUNTRY -- = multilingual or international	A6V10215123_a_de_DE A6V10215123_a_en_-- A6V10315123_a_--_--

Date format

The date format in the document corresponds to the recommendation of international standard ISO 8601 (format YYYY-MM-DD).

1.1 Technical terms

Term	Explanation
ABS	Acrylonitrile-butadiene-styrene (plastic)
AI	Alarm indicator
ES	Product version
FDnet/C-NET	Addressed detector line
PC Linetester Tool FXS2017	Line tester software
GW	Gateway
HW	Hardware
Line device	Devices which can be connected to the detector line
MC link	Maintenance and commissioning link, Interface to service devices
PC	Personal computer
PSP	Product Support Platform
PP	Polypropylene (plastic)
SW	Software
True RMS	True root mean square value of voltage characteristic
Variant 1 (RS232)	FDUL221 with RS232 interface No. A5Q00004397
Variant 2 (MC link)	FDUL221 with 3.5 mm socket No. A5Q00022100
Variant 3 (USB interface)	FDUL221 with USB interface No. A5Q00055304

1.2 Applicable documents

Document ID	Title
008331	List of compatibility (for 'Sinteso™' product line)
009052	FS20 Fire detection system - Commissioning, Maintenance, Troubleshooting
009854	Installation MCL-USB Adapter FDUZ221
A6V10210416	FS720 Fire detection system - Commissioning, Maintenance, Troubleshooting
A6V10229261	List of compatibility (for 'Cerberus PRO™' product line)
A6V10336734	Installation Radio gateway FDCW221
A6V10347735	Installation MCL-USB adapter (radio) FDUZ227
A6V10395483	Line tester – operating instructions for electricians

1.3 History of changes

The reference document's modification index applies to all languages into which the reference document is translated.

The first edition of a language version or a country variant may, for example, have the modification index 'd' instead of 'a' if the reference document already has this modification index.

The table below shows this document's history of changes:

Modification index	Edition date	Brief description
i	2013-08-15	'Technical data' chapter extended New chapter explaining ground fault measurement Editorial changes made
h	2013-05-15	Document adapted for firmware version V4.x Addresses updated Support for a maximum of 252 addresses Legal notice added Editorial changes made Change to date format in line with ISO 8601 specifications (yyyy-mm-dd format). New functions and the 'EL' operation mode re-included New chapters: Introduction, line topologies line separation function, overview, MCL-USB adapter (radio) FDUZ227 as accessory, user language, 'EL' operation mode, menu trees for 'EL' operation mode, sub-stub on loop, sub-stub on loop/stub, saving a line topology, opening a saved line topology, transferring a saved line topology to a PC, table of faults, tips for troubleshooting on the detector line, error search using the 'bisection' method, error search using the 'device measurement' method 'Technical terms' chapter amended 'Applicable documents' chapter revised New variants added to the 'Details for ordering/scope of delivery' chapter Information on the product version added to the 'Product version ES' chapter Editorial changes made to the 'Setup' and 'Display' chapters, new figure Symbols removed, new symbols added, adjustments to text in the 'Symbols' chapter Editorial changes made to the 'LED indication' chapter, figures added Additions to the 'Connections' chapter, figures added Editorial change made to the 'Connection to terminal strip' chapter, figure updated New figure added to the 'Battery compartment' chapter 'Accessories' chapter updated with 'MCL-USB adapter (radio) FDUZ227' Application amended in the '9 V lithium manganese dioxide battery' chapter Text changes in the 'Function' chapter Editorial changes made to the 'Power supply' chapter, new figure Text amended in the 'Functions in the 'Topology' menu' chapter and figure changed Text amended in the 'Functions in the 'Configuration' menu' chapter and figure changed Text changed in the 'PC operation' chapter Menu trees shown separately in the 'Navigating in the menu tree' chapter, additional menu tree for the 'EL' operation mode, text adjusted

Modification index	Edition date	Brief description
		Menu trees for 'EL' operation mode Text changes in 'The 'device' function' chapter Text amended in the 'Connecting the line tester to the line' chapter, new figures added Text amended in the 'Switching the line tester on and off' chapter, 'Switching on for configuration' added, new figures added Text changed in the 'Configuring the line tester' chapter Text changed in the 'Read in the line topology' chapter Text added and changed in the 'Viewing line topology' chapter Text and figure changed in the 'Loop' chapter Text and figure changed in the 'Stub' chapter Text and figure changed in the 'Operating the line tester with a PC' chapter Editorial changes made to the 'Testing the line tester' chapter Text and figure changed in the 'Selftest' chapter 'Replacing internal fuses' chapter removed Text and figure replaced in the 'Replacing batteries' chapter Text changed in the 'Service life of the batteries' chapter Variant 3 added to the 'Firmware update' chapter, description added, figure added Data changed in the 'Technical data' chapter Text changed in the 'Environmental compatibility and disposal' chapter, figure added
g	2010-04	Scope of delivery added to chapter on details for ordering Suppliers on the Intranet added Notes relating to version 1 (RS232) and version 2 (MC link) added
f	2009-10	Editorial changes undertaken Chapters restructured Notes relating to version RS232 removed 'Connection to terminal strip' chapter added
e	2007-09	Air humidity changed Technical terms added Note in chap. 5.3.1 added SW update with engineering tool (chap. 6.5)
d	2007-02	Chap. 7 Technical data: Line voltage and humidity corrected
c	2007-02	New version with MC link interface
b	2005-01	Name of division
a	2004-12	Software version 2.5.6

The language versions and country variants produced by a local company have the same modification index as the corresponding reference document. They are not however included in the table below.

The table below shows the published language versions with the corresponding modification index:

Modification index	en_--	de_--	fr_--	it_--	es_--
i	X	X	X	X	X
h	X	X	X	X	X
g	X	X	X	X	X
f	X	X	X	X	X
e	X	X	X	X	X
d	X	X	X	X	X
c	X	X	X	X	X
b	X	X	X	X	X
a	X	X	X	X	X

X = published

– = no publication with this modification index

2 Safety

2.1 Safety instructions

The safety notices must be observed in order to protect people and property.

The safety notices in this document contain the following elements:

- Symbol for danger
- Signal word
- Nature and origin of the danger
- Consequences if the danger occurs
- Measures or prohibitions for danger avoidance

Symbol for danger

	This is the symbol for danger. It warns of **risks of injury**. Follow all measures identified by this symbol to avoid injury or death.

Additional danger symbols

These symbols indicate general dangers, the type of danger or possible consequences, measures and prohibitions, examples of which are shown in the following table:

General danger

Explosive atmosphere

Voltage/electric shock

Laser light

Battery

Heat

Signal word

The signal word classifies the danger as defined in the following table:

Signal word	Danger level
DANGER	DANGER identifies a dangerous situation, which **will result directly in death or serious injury** if you do not avoid this situation.
WARNING	WARNING identifies a dangerous situation, which **may result in death or serious injury** if you do not avoid this situation.
CAUTION	CAUTION identifies a dangerous situation, which **could result in slight to moderately serious injury** if you do not avoid this situation.
NOTICE	*NOTICE* identifies possible damage to property that may result from non-observance.

How risk of injury is presented

Information about the risk of injury is shown as follows:

	⚠ **WARNING**
	Nature and origin of the danger Consequences if the danger occurs • Measures / prohibitions for danger avoidance

How possible damage to property is presented

Information about possible damage to property is shown as follows:

!	*NOTICE*
	Nature and origin of the danger Consequences if the danger occurs • Measures / prohibitions for danger avoidance

2.2 Safety regulations for the method of operation

National standards, regulations and legislation

Siemens products are developed and produced in compliance with the relevant European and international safety standards. Should additional national or local safety standards or legislation concerning the planning, assembly, installation, operation or disposal of the product apply at the place of operation, then these must also be taken into account together with the safety regulations in the product documentation.

Electrical installations

⚠ WARNING

Electrical voltage

Electric shock

- Work on electrical installations may only be carried out by qualified electricians or by instructed persons working under the guidance and supervision of a qualified electrician, in accordance with the electrotechnical regulations.

- Wherever possible disconnect products from the power supply when carrying out commissioning, maintenance or repair work on them.
- Lock volt-free areas to prevent them being switched back on again by mistake.
- Label the connection terminals with external external voltage using a 'DANGER External voltage' sign.
- Route mains connections to products separately and fuse them with their own, clearly marked fuse.
- Fit an easily accessible disconnecting device in accordance with IEC 60950-1 outside the installation.
- Produce earthing as stated in local safety regulations.

Assembly, installation, commissioning and maintenance

- If you require tools such as a ladder, these must be safe and must be intended for the work in hand.
- When starting the fire control panel ensure that unstable conditions cannot arise.
- Ensure that all points listed in the 'Testing the product operability' section below are observed.
- You may only set controls to normal function when the product operability has been completely tested and the system has been handed over to the customer.

Testing the product operability

- Prevent the remote transmission from triggering erroneously.
- If testing building installations or activating devices from third-party companies, you must collaborate with the people appointed.
- The activation of fire control installations for test purposes must not cause injury to anyone or damage to the building installations. The following instructions must be observed:
  - Use the correct potential for activation; this is generally the potential of the building installation.
  - Only check controls up to the interface (relay with blocking option).
  - Make sure that only the controls to be tested are activated.
- Inform people before testing the alarm devices and allow for possible panic responses.
- Inform people about any noise or mist which may be produced.
- Before testing the remote transmission, inform the corresponding alarm and fault signal receiving stations.

Modifications to the system design and the products

Modifications to the system and to individual products may lead to faults, malfunctioning and safety risks. Written confirmation must be obtained from Siemens and the corresponding safety bodies for modifications or additions.

Modules and spare parts

- Components and spare parts must comply with the technical specifications defined by Siemens. Only use products specified or recommended by Siemens.
- Only use fuses with the specified fuse characteristics.
- Wrong battery types and improper battery changing lead to a risk of explosion. Only use the same battery type or an equivalent battery type recommended by Siemens.
- Batteries must be disposed of in an environmentally friendly manner. Observe national guidelines and regulations.

Disregard of the safety regulations

Before they are delivered, Siemens products are tested to ensure they function correctly when used properly. Siemens disclaims all liability for damage or injuries caused by the incorrect application of the instructions or the disregard of danger warnings contained in the documentation. This applies in particular to the following damage:

- Personal injuries or damage to property caused by improper use and incorrect application
- Personal injuries or damage to property caused by disregarding safety instructions in the documentation or on the product
- Personal injury or damage to property caused by poor maintenance or lack of maintenance

2.3 Standards and directives complied with

A list of the standards and directives complied with is available from your Siemens contact.

3 Comparison of software functions

The table below displays the main differences in terms of functionality for the following software:

- Line tester FDUL221
- FDUL221 line tester in 'EL' operation mode
- 'PC Linetester Tool FXS2017' software

FDUL221	FDUL221-EL	FXS2017	Function and description
✓	✓	✓	**Localizing line devices** The internal alarm indicator for the line devices can be activated. ● All line devices on ● All line devices off ● Selected line device on ● Line device with error ● Line device at the end of a stub line
✓	✓	✓	**External AI of the selected line device*** The external alarm indicator of the selected line device is activated automatically.
✓	✓	✓	**Summary** List of the types of line devices used.
✓	✓	✓	**Overall measurement of the detector line** Resistance measurements for the entire detector line.
✓	✓	✓	**Partial measurement of the detector line*** Resistance measurements between start of line and individual line device. See also chapter 'Error search using the 'measure line device' method [→ 62]'.
✓	—	✓	**MC link/FDUD29x support** Information on the individual line device can be displayed on the FDUD29x detector tester (e.g. the customer text recorded via the 'PC Linetester Tool FXS2017' software or the topology number). The line device outputs can be activated.
✓	—	✓	**Searching for and configuring the sounder base** The sounder base is configured in such a way that it can subsequently be activated via the corresponding function in the 'Devices' menu. This configuration is retained and only needs to be carried out once. The 'Config Buzzers' command is only required in order to find the sounder base each time the detector line is read in for existing systems with sounder bases manufactured prior to 2007.
✓	—	✓	**Converting the detector line** Multiple protocol detectors (e.g. FDOOT241-Ax) can be switched to FDnet operation. In order for this to happen, the detector line is started up repeatedly.
✓	—	✓	**Device status information** Details can be found in the 'The 'device' function [→ 45]' chapter.
✓	—	✓	**Controlling switching outputs of the line devices** Details can be found in the 'The 'device' function [→ 45]' chapter.
✓	—	✓	**Resetting D-Bus addresses** Set all D-Bus addresses to 0. This function is only required in special cases (e.g. when commissioning the FDCW221 radio gateway).
—	—	✓	**Assigning D-Bus addresses** The D-Bus addresses for all line devices are set according to the topology address. This is also possible with offset.
—	✓	✓	**Saving line topologies** It is possible to save several line topologies in the line tester. See also chapter 'Saving a line topology [→ 55]'.

FDUL221	FDUL221-EL	FXS2017	Function and description
—	—	✓	**Opening a saved line topology** The saved topology can be transferred using the 'PC Linetester Tool FXS2017' software and sent by e-mail, for example.
✓	—	—	**Selftest** The settings are automatically checked during the selftest. See also chapter 'Testing the line tester [→ 64]'.
—	—	✓	**Customer texts** Customer texts (in the hardware tree at the 'Devices' level) can be recorded.
—	—	✓	**Data export in PDF, CSV, FSM formats** Export function of the read-in topologies, e.g. to be able to keep a record of installed devices.

***Possible with firmware version V4.x.x or higher

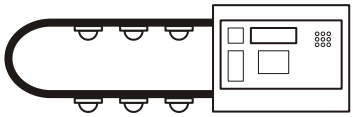
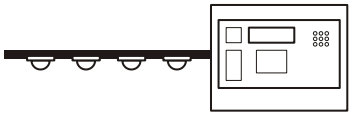
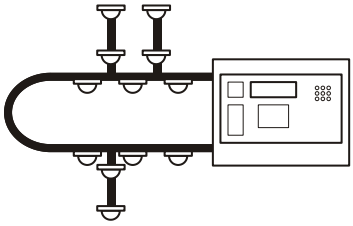
✓ Function available
— Function not available
FDUL221 Standard
FDUL221-EL 'EL' operation mode
FXS2017 'PC Linetester Tool FXS2017' software

4 Introduction

The basics of detector lines are described below. An understanding of the basics is a prerequisite for operating the FDUL221 line tester.

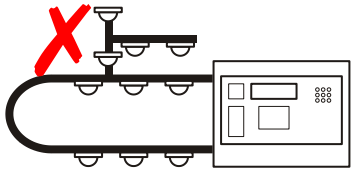
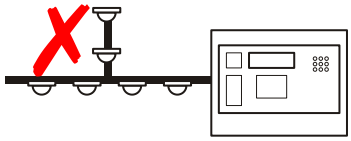
4.1 Line topologies

In the FDnet/C-NET, the following topologies are admissible.

	Loop
	Stub
	Sub-stubs on loop

Permissible topologies

No other topologies are admitted. The 'Sub-stub on sub-stub' topology in particular is not permitted.

	Sub-stub on sub-stub with a loop
	Sub-stub on stub

Impermissible topologies

Technical specifications

- All FDnet/C-NET devices have an integrated line separator.
- Only one stub may branch off between two adjacent line devices.
- When there are several stubs next to one another, a line separator FDCL221 must be connected between each one.
- Maximum number of stubs/loops:

Max. number of stubs/loops (sub-stubs)	Loop resistance $R_{cable} + R_{iso}$	Pure cable resistance R_{cable}
5	< 240 Ω	< 180 Ω
10	< 210 Ω	< 150 Ω
20	< 150 Ω	< 100 Ω
40	< 100 Ω	< 60 Ω

Number of sub-stubs depends on line resistance

R_{cable}: Pure cable resistance of loop (measured on the loop terminal)

R_{iso}: Total of separator resistances of line devices on loop (0.5 Ω per line device)

4.2 Line separation function

All FDnet/C-NET devices have an integrated line separator.

It has two functions:

- Short-circuit and open line monitoring
- Allows branching of stubs between two FDnet/C-NET devices

Short-circuit monitoring

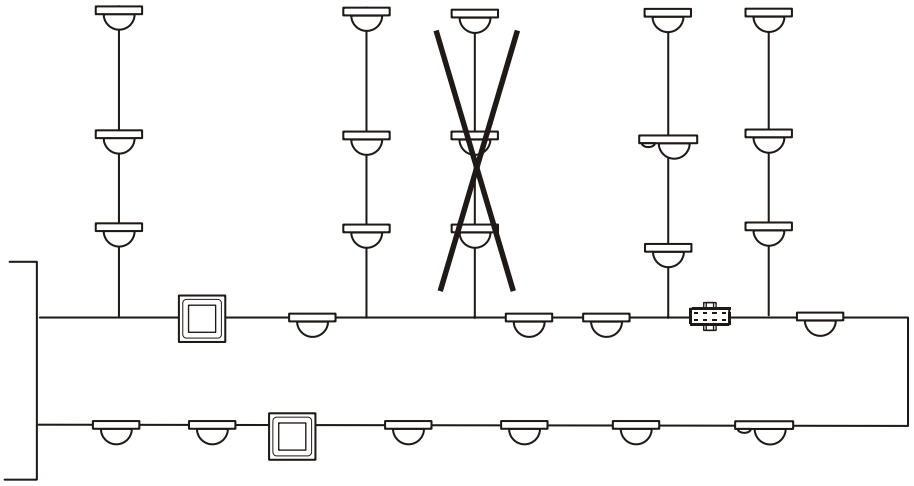
In the case of a short-circuit on the detector line, the line separator automatically isolates the faulty line section. This is to ensure that, in the case of a short-circuit, only the faulty line section fails, not the complete detector line.

Open line

If the detector line is a loop, no line devices fail in the case of open line.

Branching off from a stub

- Only one stub is permitted between two FDnet/C-NET devices.
- If there is more than one stub between two FDnet/C-NET devices, a line separator must be fitted between the stubs.



Use of line separators on a loop

5 Structure and function

Various functions are available depending on which software is installed: A comparison of the functions can be found in chapter 'Comparison of software functions [➙ 15]'.

5.1 Overview

The line tester FDUL221 serves for system diagnostics on an addressed detector line.

- Reads the line topology
- Detects cable errors
  - Short-circuit
  - Open line
  - Ground fault
  - Resistors
- Measures resistances
- Shows the arrangement of the line devices on the detector line
- Shows the current status of the line devices
  - Detects errors
  - Shows the address
  - Allocates an address in the event of double assignment or missing address
- Saves line topologies in 'EL' operation mode
- Communicates with the 'PC Linetester Tool FXS2017' software

The FDUL221 line tester is controlled by buttons.

If a line device is connected or removed later, the line topology previously read in is not updated automatically.

The FDUL221 line tester can be operated independently or with the ’PC Linetester Tool FXS2017’ software.

Features of the FDUL221 line tester

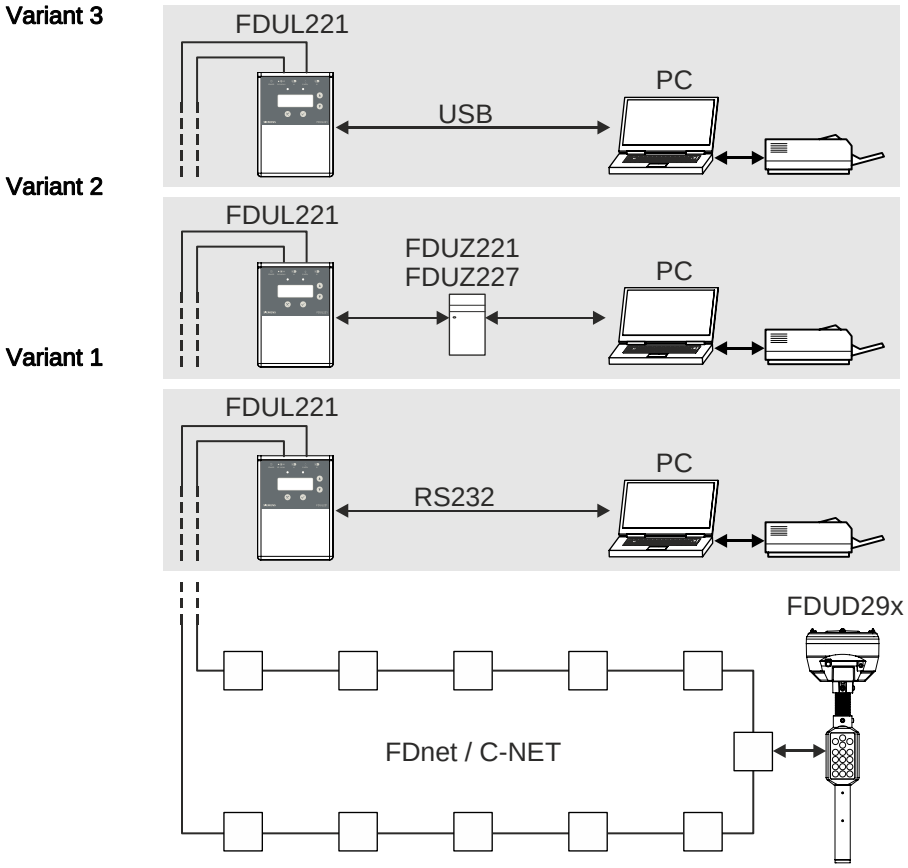
- Battery or mains operation
- Multi-line display
- Backlight
- Loadable language variants
- Automatic address correction
- Clearly arranged operating and indication elements
- Save read-in topologies
- Generate a report for the read-in topologies
- Transfer reports to a connected PC using the ’PC Linetester Tool FXS2017’ software

Fields of application

- Addressed detector line (FDnet/C-NET)
- Recognition of the FDnet/C-NET devices
- Recognition of the line topology
- Error search and diagnosis
- Installation (control and acceptance)
- Interface between FDnet/C-NET and PC

Connections to the detector line and PC

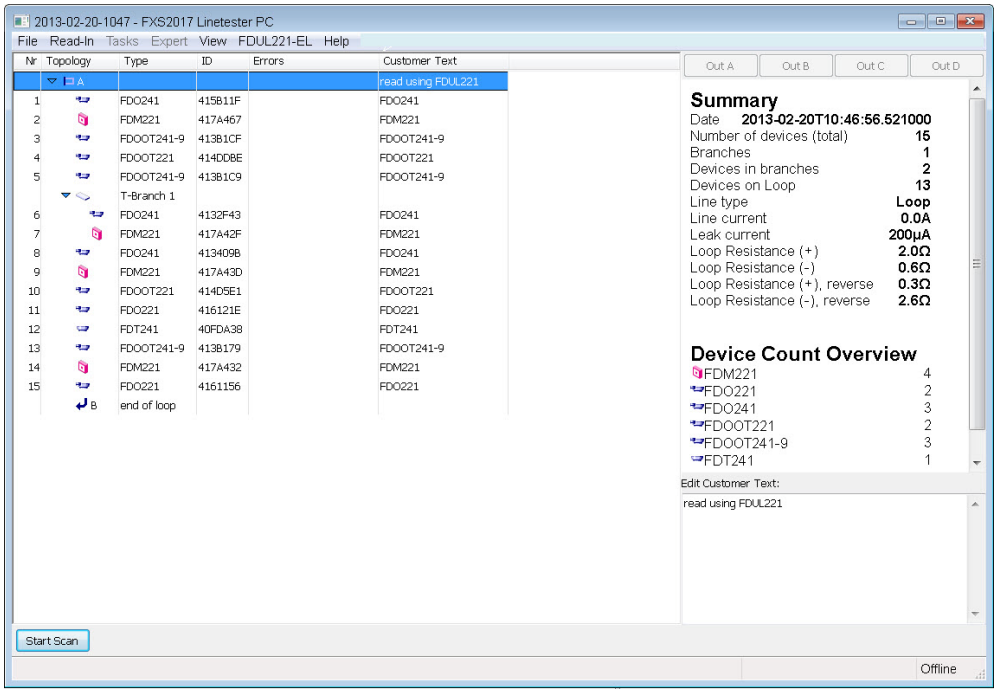
The following figure shows the connection between the FDUL221 and the PC for different variants of the FDUL221 line tester.



Addressed detector line with testers

Variant 3	Direct PC connection with cable to USB interface
Variant 2	PC connection via FDUZ227/FDUZ221
Variant 1	Direct PC connection with cable to RS232 interface

'PC Linetester Tool FXS2017' software



The 'PC Linetester Tool FXS2017' software enables all the functions of the FDUL221 to be carried out from the PC.

- Multilingual user interface
- Read-in, display and save lines
- Manage files
- Graphical representation of the line
- Display detailed information about the devices

The 'PC Linetester Tool FXS2017' software is supplied on a CD with the FDUL221 line tester or can be downloaded from the Intranet[1].

[1)] obtain from: **C**ustomer **S**upport **C**enter/PSP Product Support Platform CSC address: https://intranet.sbt.siemens.com/fs/CSC/

'EL' operation mode

The FDUL221 line tester can be used in 'EL' operation mode by electricians. In the 'EL' operation mode, detector lines can be read in, checked and saved.

To change the operation mode, a firmware update must be carried out on the FDUL221 line tester [→ 69].

Special operating instructions (document A6V10395483) can be downloaded from the Intranet [1] for the 'EL' operation mode. See also ".

The firmware and the 'PC Linetester Tool FXS2017' software is supplied on a CD with the FDUL221 line tester or can be downloaded from the Intranet[1].

[1)] obtain from: **C**ustomer **S**upport **C**enter/PSP Product Support Platform CSC address: https://intranet.sbt.siemens.com/fs/CSC/

See also

Applicable documents [→ 7]

5.1.1 Details for ordering / scope of delivery

With the order number A5Q00004397, the latest variant of the FDUL221 line tester is always supplied with the stated scope of delivery.

Details for ordering and scope of delivery for variant 3 (USB) with ES≥10

Designation	Type	Order no.	Scope of delivery
Line tester, complete	FDUL221	A5Q00004397	● FDUL221 line tester with USB connection (A5Q00055304) ● FDUL221-A line connection kit (with terminal strip) ● FDUL221-B power unit kit (network adapter for power supply) ● FDUL221-D PC software on CD[1] – Software: 'PC Linetester Tool FXS2017' – Software: 'Line tester firmware updater' – File: Operating instructions ● USB cable type A – type B, 1.8 m, black (A5Q00020783) ● Technical manual, language: English (document 008250) ● Operating instructions for electricians, language: English/German (document A6V10395483) ● Case
[1]Also obtain on Intranet from **C**ustomer **S**upport **C**enter/PSP Product Support Platform =>https://intranet.sbt.siemens.com/fs/CSC/			

Details for ordering and scope of delivery for variant 2 (MC link)

Designation	Type	Order no.	Scope of delivery
Line tester, complete	FDUL221	A5Q00004397	● FDUL221 line tester (A5Q00022100) ● FDUL221-A line connection kit (with terminal strip) ● FDUL221-B power unit kit (network adapter for power supply) ● FDUL221-D PC software on CD[1] – Software: 'PC Linetester Tool FXS2017' – Software: 'Line tester firmware updater' – File: Operating instructions ● Technical manual, language: English (document 008250) ● Case
[1]Also obtain on Intranet from **C**ustomer **S**upport **C**enter/PSP Product Support Platform =>https://intranet.sbt.siemens.com/fs/CSC/			

Details for ordering and scope of delivery for variant 1 (RS232)

Designation	Type	Order no.	Scope of delivery
Line tester, complete	FDUL221	A5Q00004397	● FDUL221 line tester with RS232 connection (A5Q00004397) ● FDUL221-A line connection kit ● FDUL221-B power unit kit (network adapter for power supply) ● FDUL221-C PC cable (RS232) ● FDUL221-D PC software on CD[1] – Software: 'PC Linetester Tool FXS2017' – Software: 'Line tester firmware updater' – File: Operating instructions ● Technical manual, language: English (document 008250) ● Case
[1]Also obtain on Intranet from **C**ustomer **S**upport **C**enter/PSP Product Support Platform =>https://intranet.sbt.siemens.com/fs/CSC/			

Spare parts

Designation	Type	Order no.	Comment
Line connection set	FDUL221-A	A5Q00008436	_
Power unit set	FDUL221-B	A5Q00008437	_
USB cable type A – type B, 1.8 m, black	_	A5Q00020783	_
Adapter cable	FDUD292-A	A5Q00004990	MC link, use with FDUZ221/FDUZ227
PC cable (RS232)	FDUL221-C	A5Q00008438	For variant 1 only (RS232)

5.1.2 Product version ES

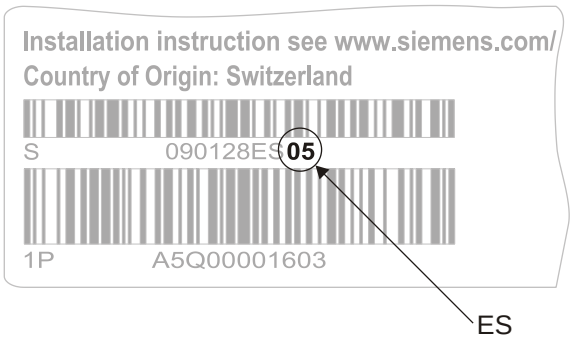
The product version ES provides the technical status of a device in terms of software and hardware. The product version is provided as a two-digit number.

You will find the details of your device's product version:

- On the packaging label
- On the product label or the type plate

Product version on the packaging label

Details of the product version can be found directly on the packaging label in the barcode:



Example of a packaging label with details of the product version

Product version on the product label and the type plate

Details of the product version can be found after the device order number:

Example of a product label with details of the product version

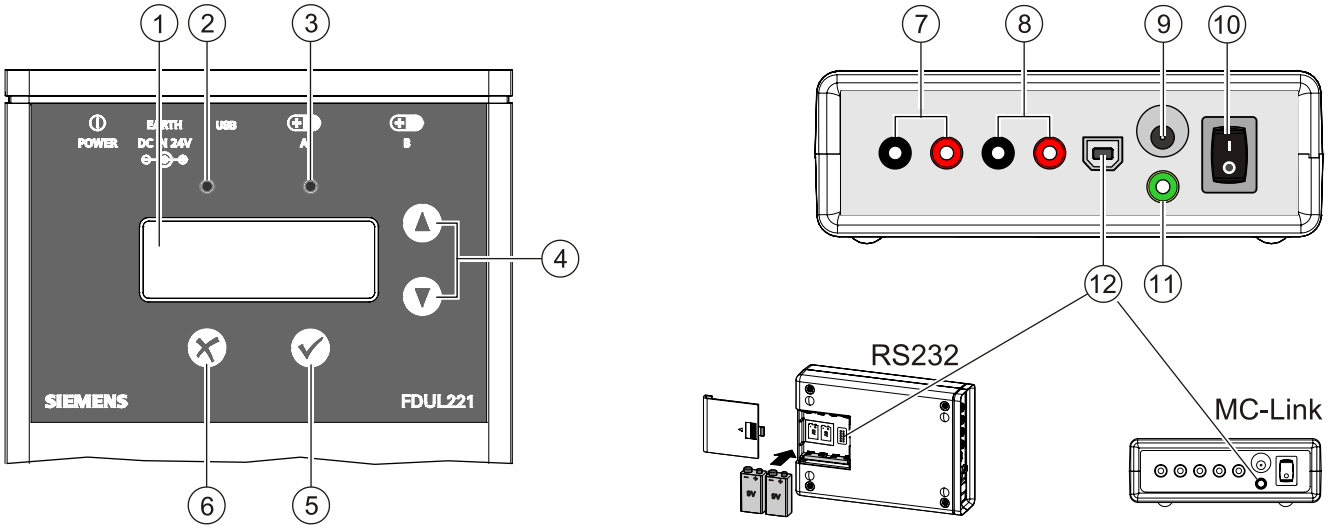
Depending on the product and various approvals, the product labels may differ in terms of the information type and layout.

Look for your device's order number on the product label.

You will find the product version after the order number.

5.2 Setup

The FDUL221 line tester is built in a plastic housing. The power is supplied by batteries or with the FDUL221-B power unit.



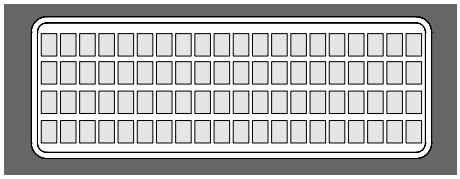
Setup

Item	Symbol/ Element	Description	Function
1		Display	● Adjustable backlight and contrast ● Scrolling plain text and symbol display
2		LED red	● Flashes slowly in the event of an error during startup ● Flashes rapidly when PC is connected
3		LED green	● Flashes faintly during normal operation ● Flashes brightly when reading in the line topology or when PC is connected ● Lights up when scrolling
4		Up/down buttons	● Scrolling (up/down) between and within the menus ● Scrolling (right/left) within a function, e.g. in Device Info or in LCD Setup
5		OK button	● Confirming a selection, e.g. entering a menu or a function ● Starting a procedure, e.g. activating tests ● Activating a function, e.g. switching relays, sounds and alarm indicators
6		Exit button	● Quitting a function or a menu ● Cancelling a procedure ● Starting the 'Configuration' menu tree (together with the 'on/off' switch)
7		B (+) red B (-) black	Connection for line end for a loop
8		A (+) red A (-) black	Connection for line start for a loop/stub and for a single line device

Item	Symbol/ Element	Description	Function
9		Socket	External power supply via the supplied FDUL221-B power unit (DC 24 V, 625 mA)
10		On/Off switch	I = On O = Off
11		Socket 'Yellow/green'	Connection for the ground wire or shielding
12		USB connection type B	Connection to PC (in the case of older FDUL221 line testers also RS232 interface or MC link)

5.2.1 Display

The FDUL221 line tester has a 4-line display with 20 characters per line.



Features

- Adjustable backlight
- Adjustable contrast
- Automatic adjustment of the vertical and horizontal scroll function with the ▲▼ buttons
- Display of plain text and symbols

5.2.2 Symbols

The table below lists the displayed symbols and their meaning.

Symbol	Meaning
	Battery operation The level shown in the symbol indicates the charge state of the partially discharged batteries Example: Symbol on left for low battery charge state Symbol on right for high battery charge state
	External power supply (mains operation)
	Cursor position displays
	• Down arrow → Start of stub line • Up arrow → End of stub line • No symbol → The line device is on a loop
	Shows the previous line device
	Line device was removed after reading in the topology
	Error/fault on a line device
	Line device was replaced after being removed
	Line device displays an alarm
	Line device is on a sounder base
	Line device on a loop or stub
	Last line device on the stub
	First line device on the sub-stub
	Line device on a sub-stub
	Last line device on the sub-stub
	Single line device on a stub
	Ground fault

5.2.3 LED indication

The LEDs indicate the operating condition of the FDUL221 line tester.

Element	Description	Function
LED red	Flashes slowly	Error when starting up the FDUL221 line tester
LED red	Flashes rapidly	Connection to PC, e.g. download
LED green	Flashes weakly	Normal operation
LED green	Flashes brightly	Reading in the line topology
LED green	Lit up	▲ ▼ buttons pressed
LED green	Flashes rapidly	Connection to PC, e.g. download

See also

Setup [→ 28]

5.2.4 Button assignment

Different functions are assigned to the command buttons.

Symbol	Button	Function
▲	Up	• Upward movement between and within the menus • Movement to the right within a function, e.g. in Device Info or in LCD Setup
▼	Down	• Downward movement between and within the menus • Movement to the left within a function, e.g. in Device Info or in LCD Setup
✓	OK	• Confirming a selection, e.g. entering a menu or a function • Starting a procedure, e.g. activating tests • Activating a function, e.g. switching relays, sounds and alarm indicators
✕	Exit	• Quitting a function or a menu • Cancelling a procedure • Starting in configuration mode (together with the 'on/off' switch)

5.2.5 Connections

Connection for external power supply

- For the power supply, only connect the FDUL221-B power unit kit to the socket.

USB connection to the PC

- Connect the USB cable to the socket to connect to the PC.

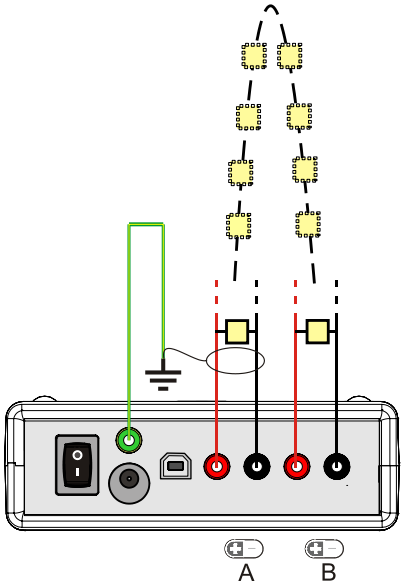
Ground connection

- Connect the ground wire/shielding to the yellow/green socket and connect the other end to the ground potential.

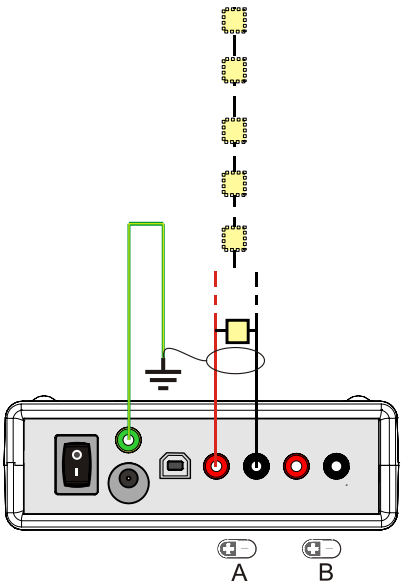
Detector line connections

!	*NOTICE*
	Connecting the FDUL221 line tester incorrectly may damage the hardware. Connecting the fire detection installation and the FDUL221 line tester to the detector line at the same time can result in irreparable damage to the line interface or the FDUL221 line tester. • Only connect the line tester once the detector line has been separated from the fire detection installation.

- Connect the detector line which is separate from the fire control panel according to the following figures.
- Connect both ends of the line to the sockets on the FDUL221 line tester.



Connection for a loop



Connection for a stub or a single line device

Connection for a loop

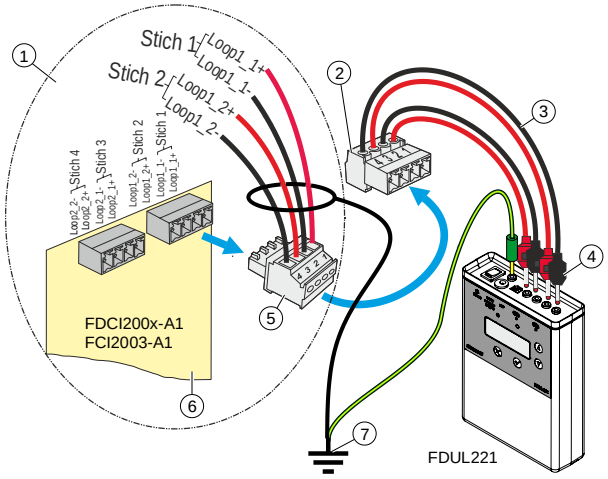
- Connect the ends of the feed line to line 'A'.
- Connect the ends of the return line to line 'B'.

Connection for a stub or a single line device

- Connect the ends of the line to line 'A'.

5.2.6 Connection to terminal strip

The supplied terminal strip makes it easier to connect a detector line.



Connection to terminal strip

1 Control panel
2 Terminal strip
3 Measurement line
4 Terminal plug
5 Terminal plug with feed/return line for the detector line
6 Periphery board or loop extension
7 Ground wire/shielding

The feed line for the detector line is directly connected to the terminal strip.

▷ The terminal strip, measurement line and the terminal plug are available.

1. Connect the terminal strip to the sockets on the FDUL221.

⇨ Terminal no. 1 is connected to socket A(+) with the terminal plug (red).
⇨ Terminal no. 2 is connected to socket A(-) with the terminal plug (black).
⇨ Terminal no. 3 is connected to socket B(+) with the terminal plug (red).
⇨ Terminal no. 4 is connected to socket B(-) with the terminal plug (black).

2. Loosen the feed line for the detector line on the FDI200x-A1 periphery board or FCI2003-A1 loop extension and connect the feed line to the terminal strip.

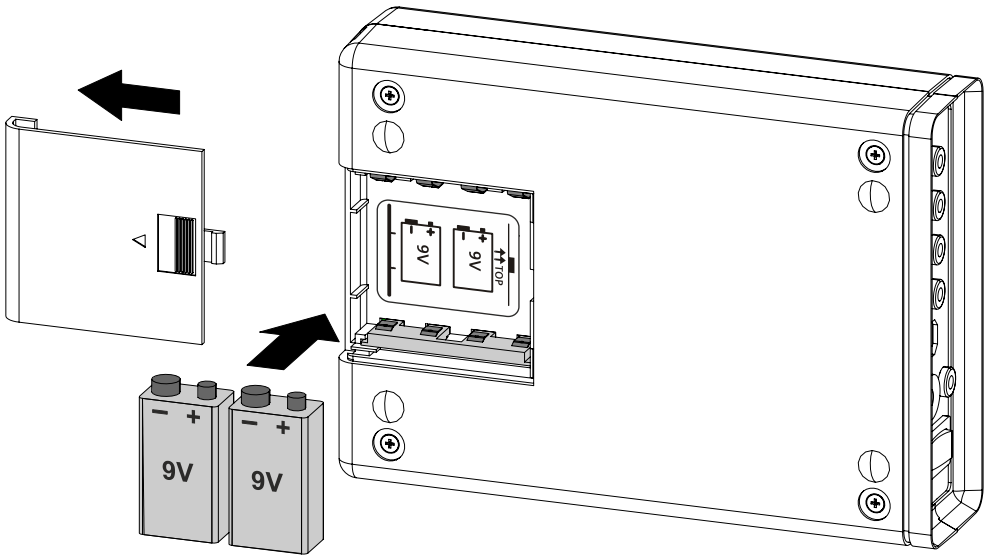
3. Connect the ground wire.

4. To detect shielding errors, connect the shielding to the ground wire.

⇨ The FDUL221 line tester is connected to the detector line.

5.2.7 Battery compartment

The battery compartment is on the underside of the FDUL221 line tester.
It is shut with a removable cover.

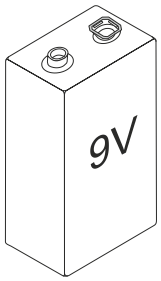


Battery compartment

1 Opened battery compartment with symbol indicating the correct location for the two batteries

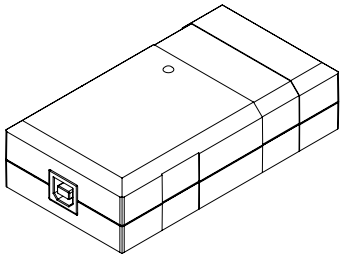
5.3 Accessories

5.3.1 9 V lithium manganese dioxide battery



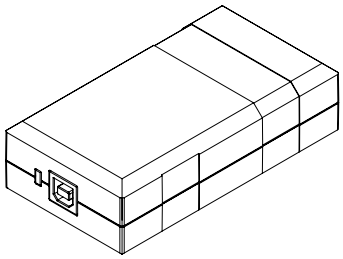
- For supplying radio detectors, radio gateways and service devices with power
- ULTRALIFE Lithium manganese dioxide type U9VL-J Li/MnO2 9 V, 1.2 Ah battery with pin cover
- Compatible with:
  - Radio gateway FDCW221
  - DOW1171 radio smoke detector
  - Radio test set DZW1171
  - Line tester FDUL221
  - Detector exchanger and tester FDUD292
  - Intelligent detector tester FDUD293
- Order no.: A5Q00004142

5.3.2 MCL-USB adapter FDUZ221



- For connecting FDnet/C-NET devices to a personal computer
- Interface converter for USB on MC link
- Compatible with:
  - Floor repeater terminal FT2010
  - Floor repeater display FT2011
  - Radio gateway FDCW221
  - Detector exchanger and tester FDUD292
  - Intelligent detector tester FDUD293
  - Line tester FDUL221
- For details, see document 009854 (assembly instructions)
- Order no.: A5Q00020131

5.3.3 MCL-USB (radio) adapter FDUZ227



- For connecting FDnet/C-NET devices to a personal computer
- Signals can be transmitted to SWING radio devices via radio
- Interface converter for USB on MC link
- Compatible with:
  - Floor repeater terminal FT2010
  - Floor repeater display FT2011
  - Radio gateway FDCW221 and FDCW241
  - Detector exchanger and tester FDUD292
  - Intelligent detector tester FDUD293
  - Line tester FDUL221
  - Radio manual call point FDM27x
  - Radio fire detector FDOOT271
- For details, please refer to document A6V10347735
- Order no.: S54323-F106-A1

5.4 Function

The functions of the FDUL221 line tester are divided into two independent modes.

Topology

This mode shows all information relating to the connected detector line [→ 38].

Configuration

This mode shows all information and settings for the FDUL221 line tester.

5.4.1 Power supply

The FDUL221 line tester can be operated via a power unit or with batteries.

Mains operation

The batteries may be inserted during mains operation.

- For mains operation, connect the FDUL221-B power unit to the socket for external power supply.

⇨ The mains operation is shown as a symbol in the display when the FDUL221 is switched on.

Mains operation

Battery operation

- For battery operation, insert two batteries into the battery compartment. Ensure they are inserted correctly. [→ 67]

⇨ In the case of battery operation, the charge state of the partially discharged batteries is shown.

Charge state of the partially discharged batteries

5.4.2 User language

The FDUL221 line tester can be operated with different user languages. To change the user language, the desired language must be selected during a firmware update. You will find more information in chapter 'Firmware update [→ 69]'.

5.4.3 'EL' operation mode

The FDUL221 line tester can be used in 'EL' operation mode. The 'EL' operation mode is only intended for use by electricians.

In 'EL' operation mode, the detector lines can be read in, checked and saved.

Changing the operation mode

To change the operation mode, a firmware update must be carried out on the FDUL221 line tester. The firmware for the 'EL' operation mode is marked with the suffix 'electrician'. You will find more information in chapter 'Firmware update [→ 69]'.

5.4.4 Functions in the 'Topology' menu

The following menus[1] and functions[1] are available in the 'Topology' menu tree:

Testing the line topology

- **Reading in the line**
- **Line devices**
  - Recognizing the line devices
  - Address
  - Series number
  - Device type
  - Checking the device status
  - Error list
  - Status
  - Activating the sounds of audio devices (not in 'EL' operation mode)
  - Alarm indicators
  - Line separation function (not in 'EL' operation mode)
  - Relay in input/output module (not in 'EL' operation mode)
- **Manage Memory** (only in 'EL' operation mode)
- **Error**
- **Monitoring**
  - Open line
  - Ground fault
  - Short-circuit
  - Missing line devices
  - New line devices
- **Config. sounder base** (not in 'EL' operation mode)
- **Type Overview**
- **Reset addresses**

[1] Depending on the operation mode, not all menus and functions are available.

See also

Navigating in the menu tree [→ 40]

5.4.5 Functions in the 'Configuration' menu

The following menus[1] and functions[1] are available in the FDUL221 line tester's configuration mode:

- Setting the LCD display
  - Contrast
  - Light mode
- Selftest
  - Display
  - LEDs
  - Power supply
  - Internal hardware
  - Line driver
  - Cable/fuse A+
  - Cable/fuse A-
  - Cable/fuse B+
  - Cable/fuse B-
- Mode: FDnet
  - Identification
- Load Factory Def. (default settings)
- Save & Exit
- End

[1] Depending on the operation mode, not all menus and functions are available.

See also

Navigating in the menu tree [→ 40]

5.4.6 PC operation

The FDUL221 line tester can communicate with a PC via cable for the following tasks:

- Firmware update for the FDUL221 line tester
- Transferring data from the FDUL221 line tester to a PC

See also

Operating the line tester with a PC [→ 56]

6 Operation

6.1 Navigating in the menu tree

There are two menu trees.

- The 'Topology' menu tree shows all information on the connected detector line.
- The 'Configuration' menu tree shows all information and settings on the FDUL221 line tester.

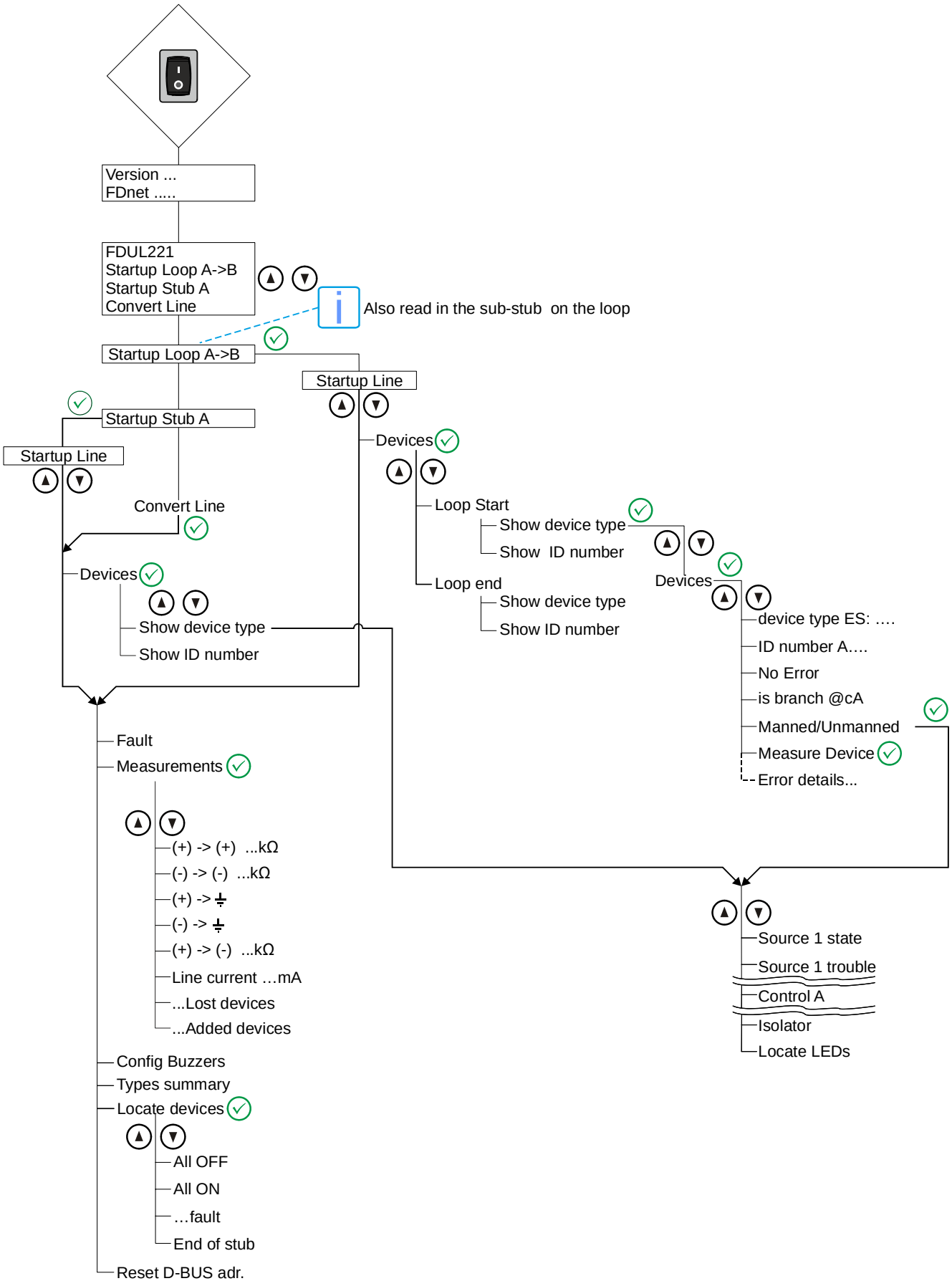
'EL' operation mode has its own menu trees [→ 43].

'Topology' menu tree

▷ The detector line is connected [→ 47].

1. Switch on the FDUL221 line tester.

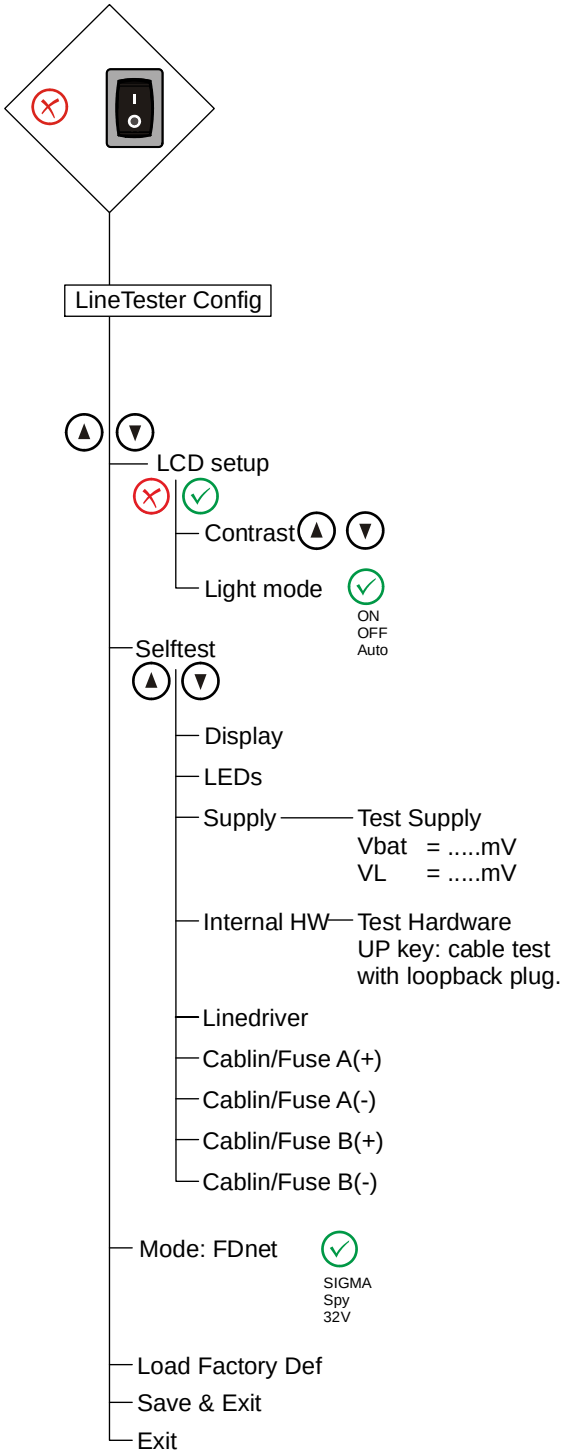
   ⇨ The software version is briefly shown on the display.
2. Use the buttons to navigate.
3. Select the following to read in the line topology:
   - For a loop or a sub-stub on a loop, select 'Startup Loop A->B'.
   - For a stub or a single line device, select 'Startup Stub A'.
4. Exit the 'Topology' menu tree by switching the FDUL221 line tester off.



Menu tree for 'Topology' for standard operation mode

'Configuration' menu tree

1. To navigate in the 'Configuration' menu tree, press the ⊗ button and switch the FDUL221 line tester on at the same time.
   ⇨ The display shows 'LineTester Config'.
2. Use the ▲▼✓⊗ buttons to navigate.
3. Exit the 'Configuration' menu tree via 'Save & Exit' or 'Exit'.



Menu tree for 'Configuration' for standard operation mode

6.1.1 Menu trees for 'EL' operation mode

1. To navigate in the 'Topology' menu tree, switch the FDUL221 line tester on.
2. To navigate in the 'Configuration' menu tree, press the ⊗ button and switch the FDUL221 line tester on at the same time.
   ⇨ The software version is briefly shown on the display.
3. Use the ▲▼✓⊗ buttons to navigate.

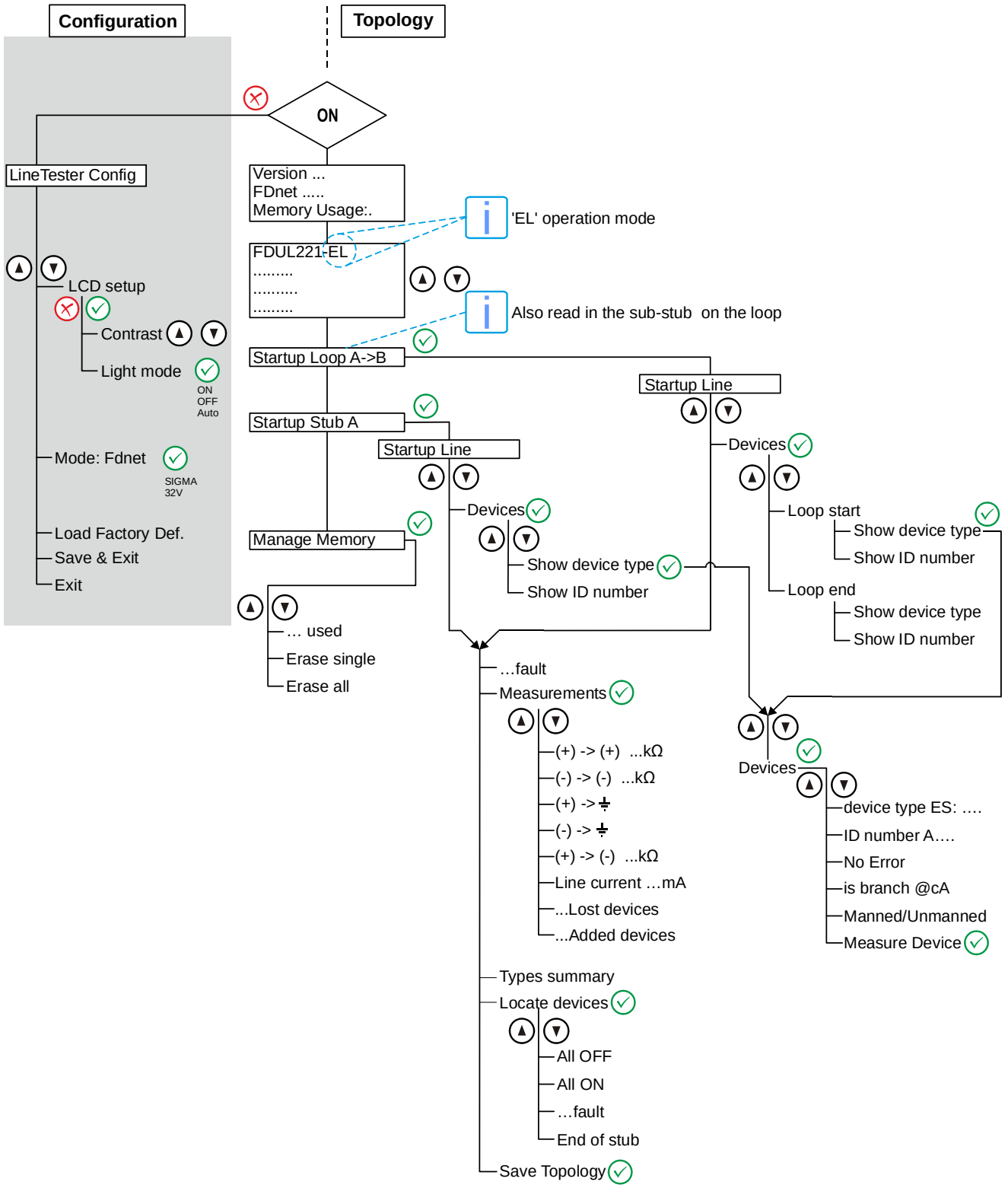
'Configuration' menu tree

1. To navigate in the 'Configuration' menu tree, press the ⊗ button and switch the FDUL221 line tester on at the same time.
   ⇨ The display shows 'LineTester Config'.
2. Use the ▲▼✓⊗ buttons to navigate.
3. Exit the 'Configuration' menu tree via 'Save & Exit' or 'Exit'.

'Topology' menu tree

▷ The detector line is connected [→ 47].

1. Switch on the FDUL221 line tester.
   ⇨ The software version is briefly shown on the display.
2. Use the ▲▼✓⊗ buttons to navigate.
3. Select the following to read in the line topology:
   - For a loop or a sub-stub on a loop, select 'Startup Loop A->B'.
   - For a stub or a single line device, select 'Startup Stub A'.
4. Exit the 'Topology' menu tree by switching the FDUL221 line tester off.



Menu trees for 'EL' operation mode

6.2 The 'device' function

The 'Devices' function is not available in 'EL' operation mode.

Meaning of the lines

The display shows the function of the line device in four lines. The internal and external alarm indicator of the selected line device flash.

Line	Display
1	● Input status ● Input fault ● Line device fault ● Outputs A, B, C, D ● Disconnector status ● Output of external alarm indicator
2	● Address for line device ● Status of first line
3	● Name of the line device ● Cursor (position display) for editing
4	● The serial number (identification number) and product version (ES) of the line device ● The position display when editing in plain text

If a line device has already been operated on a control panel, it will not be initialized again. The existing configuration is adopted by the control panel.

Example:

In the case of the FC20xx, FC72x or AlgoRex fire control panels, the inputs of a FDCIO222 that are not used (= not linked) are directly set to 'off' in the line device. The input status of the FDUL221 line tester is therefore not displayed.

Meaning of inputs

The display depends on the line device connected. The following table shows how the FDUL221 line tester displays inputs:

Danger level	Meaning	Display	Input status	Display	Input status	Display
0	No danger	'0'	Free	'-'	Not active	'-'
1	Possible danger	'1'	Resetting / Not ready	'r'		
2	Probable danger	'2'	Initial activation / testing	'a'	Active	'a'
3	Most likely danger	'A'	Alarm activation	'A'		

Assignment of outputs

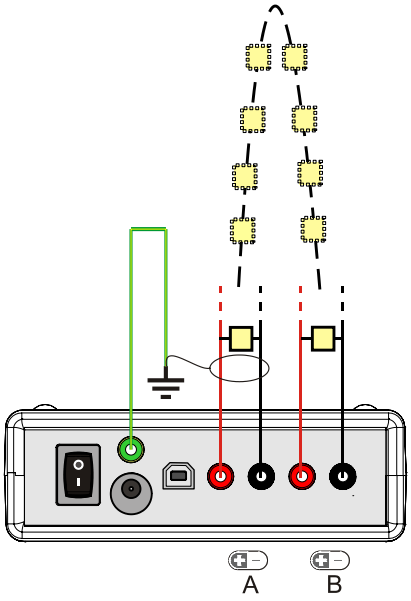
The assignment of the outputs A, B, C, D depends on the line device.

Line device	Output A	Output B	Output C	Output D	Notes
Point detector (thermal / optical)	Ext. AI	Activation of evacuation signal	Activation of alarm signal	-	-
Manual call point	Ext. AI	-	-	-	Not available for all line devices
Linear smoke detector	Ext. AI	-	-	-	-
Flame detector	Ext. AI	-	-	-	-
Input/ output modules	Activation of relay	Activation of relay	Activation of relay	Activation of relay	If output available
Transponder	Activation of relay	Activation of relay	Activation of relay	Activation of relay	If configured as output
Aspirating smoke detector	Reset	Day / Night	Standby	Normalize	-
Video fire controller	Start receptacle	Start receptacle	-	-	-
Alarm sounder	Ext. AI	Activation of evacuation signal	Activation of alarm signal	-	-
Alarm sounder with additional optical indicator	Ext. AI	Activation of evacuation signal	Activation of alarm signal	Activating the beacon	-
Sounder interbase	Ext. AI	Activation of evacuation signal	Activation of alarm signal	-	-
Sounder interbase with additional optical indicator	Ext. AI	Activation of evacuation signal	Activation of alarm signal	Activating the beacon	-
Addressable alarm indicator	Ext. AI	-	-	-	-
Radio gateway	Ext. AI	-	-	-	-

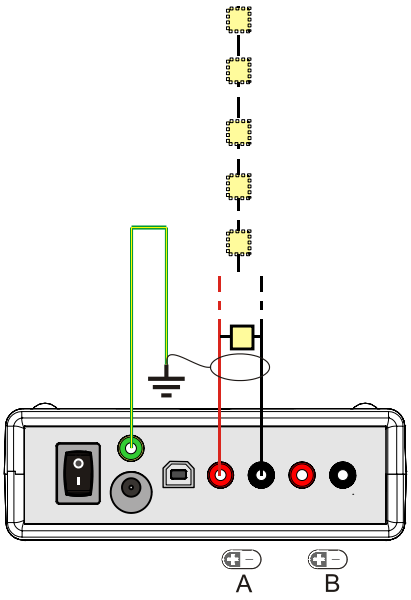
6.3 Connecting the line tester to the line

!	*NOTICE*
	The detector line is ready during testing. Connecting the FDUL221 line tester incorrectly may damage the hardware. • Detector lines, line sections or individual line devices to be tested must not be simultaneously connected to the control panel. • Observe the polarity of the connections when connecting the FDUL221 line tester.

You will find more detailed information in the fire detection system documentation.



Connection for loop



Connection for stub

▷ The lines to be checked must be disconnected from the control panel while testing is taking place.

1. Check that the lines are disconnected from the control panel and ensure that they remain disconnected during testing.
2. Connect the ground wire and connect the other end with the ground potential.
3. To detect shielding errors, connect the shielding to the ground wire.

For a loop:

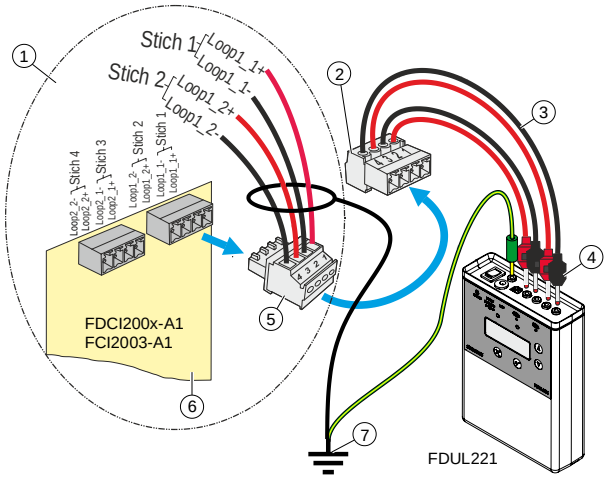
1. Connect both ends of the line to the FDUL221 line tester.
2. Connect the ends of the feed line to line 'A'.
3. Connect the ends of the return line to line 'B'.

For a stub or a single line device:

- Connect the ends of the line to line 'A'.

Connection to terminal strip on FDI200x-A1 periphery board or FCI2003-A1 loop extension

The terminal strip makes it easier to connect a detector line.



Connection to terminal strip

1 Control panel
2 Terminal strip
3 Measurement line
4 Terminal plug
5 Terminal plug with feed/return line for the detector line
6 Periphery board or loop extension
7 Ground wire/shielding

The feed line for the detector line is directly connected to the terminal strip.

▷ The terminal strip, measurement line and the terminal plug are available.

1. Connect the terminal strip to the sockets on the FDUL221 line tester.

⇨ Terminal no. 1 is connected to socket A(+) with the terminal plug (red).
⇨ Terminal no. 2 is connected to socket A(-) with the terminal plug (black).
⇨ Terminal no. 3 is connected to socket B(+) with the terminal plug (red).
⇨ Terminal no. 4 is connected to socket B(-) with the terminal plug (black).

2. Loosen the feed line for the detector line on the FDI200x-A1 periphery board or FCI2003-A1 loop extension and connect the feed line to the terminal strip.

3. Connect the ground wire.

4. To detect shielding errors, connect the shielding to the ground wire.

⇨ The FDUL221 line tester is connected to the detector line.

See also

Setup [→ 28]
Connections [→ 32]

6.4 Switching the line tester on / off

ON

- Move the switch into position <I>.

⇨ The 'Topology' menu is opened.

⇨ The display briefly indicates the firmware version of the FDUL221 line tester and 'FDnet …'.

	Display for 'EL' operation mode
Version: 4.0.5 FDnet 32V	Version: 4.0.5 FDnet 32V Memory Usage: 3/23 used

- Then the device designation is displayed with operation mode and the selection fields.

	Display for 'EL' operation mode
FDUL221 ●Startup Loop A→B Startup Stub A Convert Line	FDUL221-EL ●Startup Loop A→B Startup Stub A Manage Memory

⇨ The FDUL221 line tester is ready for operation.

Switching on for configuration

- To open the 'Configuration' menu tree press the button and switch the switch to the <I> position at the same time.

⇨ The 'Configuration' menu is opened.

⇨ The indicator in the display changes to the 'Startup Line' menu.

LineTester Config ●LCD setup Selftest Mode: FDnet 32V

⇨ The FDUL221 line tester is in the ’Configuration’ menu.

Switching off

- Move the switch into position <O>.

⇨ The indicator goes out.

⇨ If working with the FDUL221-B power unit, the power unit can be removed.

See also

Setup [→ 28]

6.5 Configuring the line tester

The FDUL221 line tester must be set to the relevant protocol if it is being used on a detector line. The protocol is permanently set in the 'EL' operation mode and cannot be configured.

Control panel	Protocol	Mode: FDnet
FC20xx	FDnet	32 V
FC72x	C-NET	32 V
CS114x	FDnet	32 V
SIGMASYS	FDnet	SIGMA
_	FDnet/C-NET	Spy

To configure, proceed as follows:

▷ The FDUL221 line tester is switched off.

1. Hold down the ⊗ button and switch the FDUL221 line tester on with the switch.
   ⇨ The FDUL221 line tester is in the 'Configuration' menu tree.
2. Select 'Mode: FDnet …' using the ▲▼ buttons.
3. Select the required protocol with the ✓ button.
4. Select further sub menus or a function with the ▲▼ buttons.
5. Further changes in the sub menu or function can be made in the same way.
6. To quit a sub menu or a function, press the ⊗ button.
7. To quit 'Configuration', select 'Save & Exit' or 'Exit'.

⇨ The FDUL221 line tester switches to the 'Topology' menu tree.

See also

Navigating in the menu tree [→ 40]

6.6 Reading in line topology

To read in the line topology, proceed as follows:

1. Disconnect the detector line or the line section from the control panel.
2. Connect the FDUL221 line tester to the detector line or line section. Adhere to the polarity [➙ 47].
3. Switch the FDUL221 line tester on [➙ 49].
4. Check whether 'FDnet …' matches the detector line. If not, reconfigure the FDUL221 line tester [➙ 50].
5. Select either 'Startup Loop A->B' or 'Startup Stub A'.
6. Press the ⓒ button.
   ⇨ The topology is read in and displayed automatically.
7. If you want to assign new line addresses while reading in, then select 'Convert Line'.

6.7 Viewing line topology

To view the line topology, proceed as follows:

1. Use the ▲▼ buttons to select the 'Devices' sub menu and confirm the selection with the ⓒ button.
   ⇨ The line topology and number of line devices are displayed.
2. Use the ▲▼ buttons to select either 'Devices on A' or 'Devices on B' and confirm the selection with the ⓒ button.
   ⇨ Depending on the line topology, the line devices are displayed.
3. Select a single line device.
   ⇨ The internal and external alarm indicator of the selected line device flash.
   ⇨ If the 'All ON' selection is active in the 'Locate devices' menu, the internal alarm indicators of all line devices detected by the FDUL221 line tester flash.

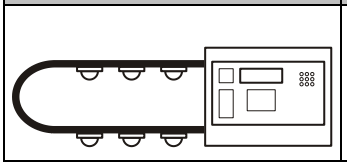
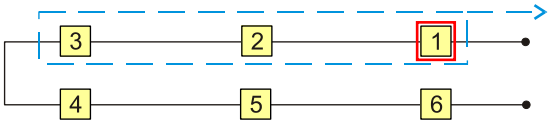
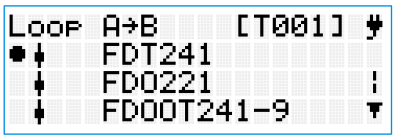
Technical requirements for line topologies

- All FDnet/C-NET devices have an integrated line separator. [➙ 19]
- Only one stub may branch off between two adjacent line devices.
- When there are several stubs next to one another, a line separator FDCL221 must be connected between each one.

The following chapters contain examples for line topologies and the display on the FDUL221 line tester.

6.7.1 Loop

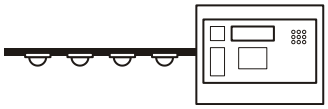
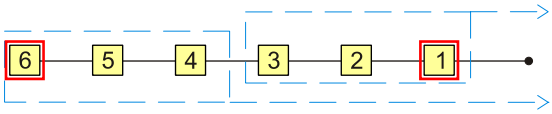
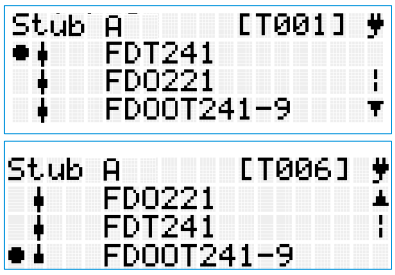
The 'loop' topology is permitted.

Detector line on the control panel	Arrangement of the line devices	Display
		

The line devices are displayed in the order of the loop. The display shows the number of the line device in brackets. E.g. [T001] for the first line device. In the case of the red outlined device, the internal alarm indicator flashes. If an external alarm indicator is connected to this device, the external alarm indicator also flashes.

6.7.2 Stub

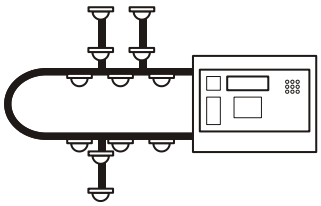
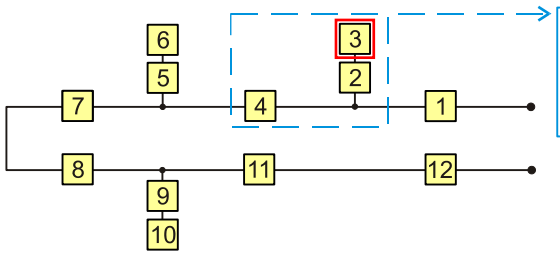
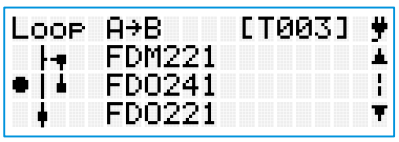
The 'stub' topology is permitted.

Detector line on the control panel	Arrangement of the line devices	Display
		

The line devices are displayed in the order of the stub. The display shows the number of the line device in brackets. E.g. [T001] for the first line device. In the case of the red outlined devices, the internal alarm indicator flashes. If an external alarm indicator is connected to these devices, the external alarm indicator also flashes.

6.7.3 Sub-stub on loop

The 'sub-stub on loop' topology is permitted.

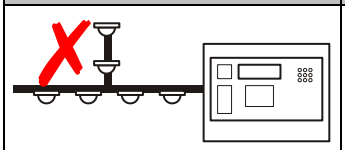
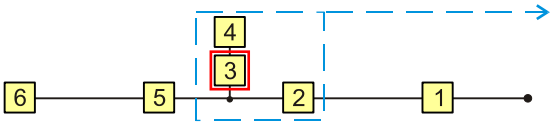
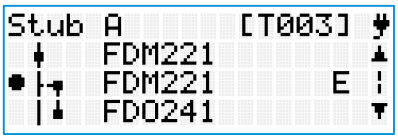
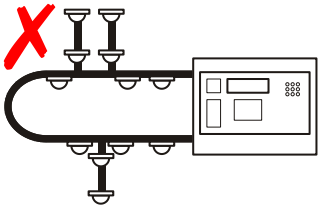
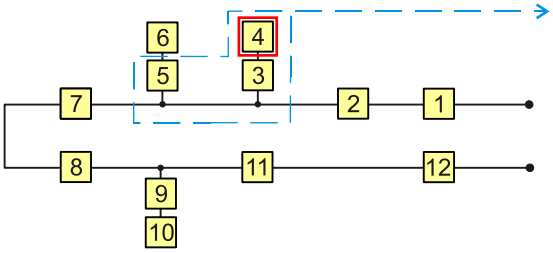
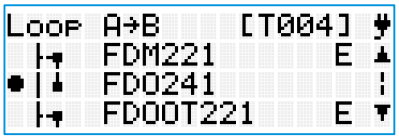
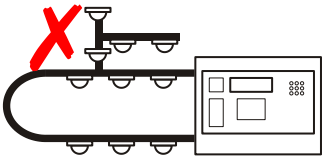
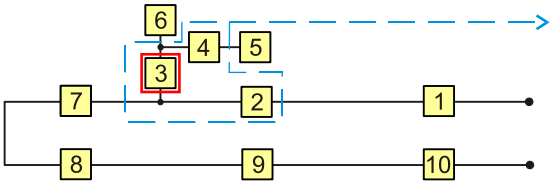
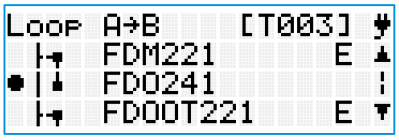
Detector line on the control panel	Arrangement of the line devices	Display
		

The line devices are displayed in the order of the loop. On the branch to the sub-stub, the line devices are displayed in the order of the sub-stub. The display shows the number of the line device in brackets. E.g. [T003] for the third line device. In the case of the red outlined device, the internal alarm indicator flashes. If an external alarm indicator is connected to this device, the external alarm indicator also flashes.

6.7.4 Impermissible sub-stubs

The following sub-stubs are not permitted:

- Sub-stub on stub
- Sub-stub on loop without line separation
- Sub-stub on sub-stub on loop

Detector line on the control panel	Arrangement of the line devices	Display
		
		
		

The line devices are displayed in the order of the loop/stub. On the branch to the sub-stub, the line devices are displayed in the order of the sub-stub. The line devices may be shown with incorrect symbols. The display shows the number of the line device in brackets. E.g. [T003] for the third line device. In the case of the red outlined devices, the internal alarm indicator flashes. If an external alarm indicator is connected to these devices, the external alarm indicator also flashes.

6.7.5 'Config. sounder base' function

The 'Config Buzzers' function is not available in 'EL' operation mode.

The 'Config Buzzers' function is only used for very old sounder bases (manufactured prior to 2007). During this process, the outputs of the line detectors briefly become active.

6.8 Starting up a line

When starting up a line, the detectors are generally not addressed again. The affected detectors are re-addressed if there are conflicting addresses or unaddressed devices.

6.9 Saving a line topology

Line topologies can be saved in the 'EL' operation mode. The memory capacity is limited and divided into 23 spaces. Extensive line topologies can occupy up to 4 spaces.

Position	Display
1	FDUL221-EL Startup Loop A→B Startup Stub A ●Manage Memory
2	Manage Memory ●3/23 used Erase single Erase all
3	Saving Topology Wait... [■■■■■■■■■■■■]
4	Stub A Summary Types summary Locate devices ●Save Topology
5	Saving Topology Wait... [■■■■■■■■■■■■]
6	Saving Topology Done, M3 written [■■■■■■■■■■■■■■■■] ◀OK▶

▷ The line topology is read in.

1. Make sure that you have sufficient memory capacity.
2. Select 'Manage Memory' (pos. 1).
3. To free up memory capacity, delete data that is not required in the menu tree (pos 2).
4. Navigate to 'Save Topology' in the menu tree.
5. Press the ⓒ button (pos. 4).
   ⇨ The saving process begins (pos. 3).
6. Wait until the saving process is complete (pos. 5).
   ⇨ The name of the storage space is displayed, e.g. M3 (pos. 6).
7. Note the assignment of the name to the detector line.
8. Press the ⓒ button.

⇨ The line topology is saved.

The topologies saved on the FDUL221 line tester can be transferred to a PC using the 'PC Linetester Tool FXS2017' software.

See also

Transferring a saved line topology to a PC [→ 57]
Navigating in the menu tree [→ 40]

6.10 Opening a saved line topology

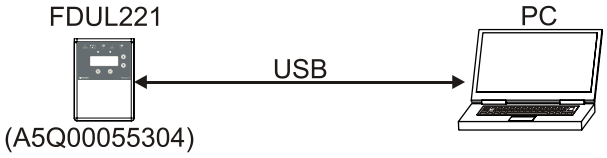
In 'EL' operation mode, saved line topologies can be opened using the 'PC Linetester Tool FXS2017' software.

6.11 Operating the line tester with a PC

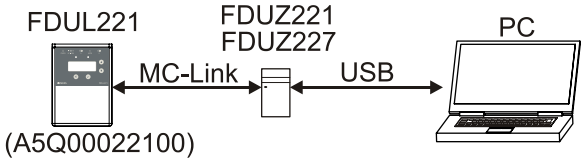
The FDUL221 line tester can be controlled via a connected PC. The 'PC Linetester Tool FXS2017' software is supplied with the FDUL221 line tester on CD or can be downloaded from the **C**ustomer **S**upport **C**enter[1].

Depending on the variant of the FDUL221 line tester, there are various options for connecting the line tester to the PC:

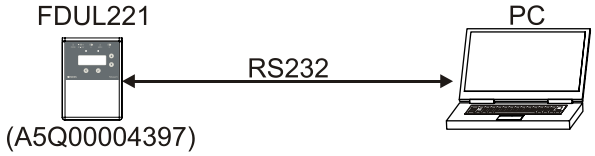
Variant 3: Direct connection to USB interface



Variant 2: Connection via FDUZ221/FDUZ227



Variant 1: Connection via RS232 interface



To commission, proceed as follows:

▷ The PC and the 'PC Linetester Tool FXS2017' software are available.

▷ The components for linking the FDUL221 and PC are present.

1. Install the 'PC Linetester Tool FXS2017' software on the PC.

2. Connect the FDUL221 line tester to the PC.

- For variant 3, use a USB cable.
- For variant 2 use the FDUZ221 MCL-USB adapter or the MCL-USB adapter (radio) FDUZ227. Use the supplied cable (MC link and USB) for the connection.
- For variant 1, use the RS232 PC cable. The RS232 connection is in the battery compartment.

3. Connect the FDUL221 line tester to the power supply and switch it on.
   - Ensure that the power supply and the USB connection are not interrupted during an upload or download.
4. Start the 'PC Linetester Tool FXS2017' software on the PC.
5. In the 'Read in' menu, select the 'Start reading in' sub menu.

⇨ The line tester can be operated from the PC using the 'PC Linetester Tool FXS2017' software.

You can delete all the files on the FDUL221 line tester with the 'PC Linetester Tool FXS2017' software.

The USB connection can be affected in areas where there is a high level of EMC interference. In such cases, use the FDUL221 line tester without the 'PC Linetester Tool FXS2017' software.

If you have any questions, please contact the **C**ustomer **S**upport **C**enter[1].

[1] **C**ustomer **S**upport **C**enter/PSP Product Support Platform CSC address: https://intranet.sbt.siemens.com/fs/CSC/

See also

Overview [➞ 20]

6.12 Transferring a saved line topology to a PC

▷ The FDUL221 line tester is in 'EL' operation mode.

▷ The 'PC Linetester Tool FXS2017' software is installed on the PC.

▷ The PC is connected to the FDUL221 line tester by cable.

1. Start the 'PC Linetester Tool FXS2017' software.
2. Select 'FDUL221'.
3. Wait until the data has loaded.
4. Select the 'FDUL221-EL' menu and the 'Upload saved topology' sub menu.
5. Select the storage location.
6. Define the file name.
7. Save the file with 'Save Topology'.

⇨ The file is saved.

You can delete all the files on the FDUL221 line tester with the 'PC Linetester Tool FXS2017' software.

6.13 Table of faults

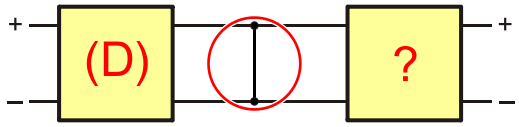
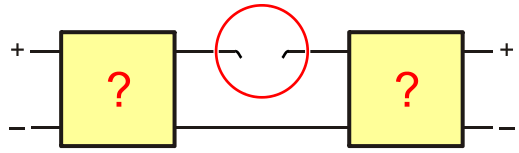
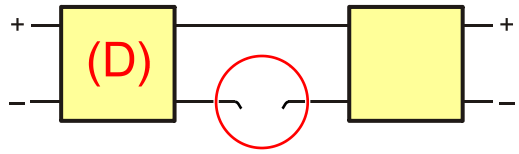
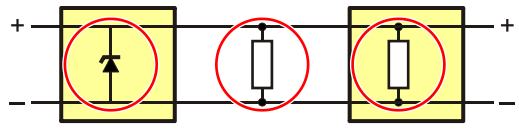
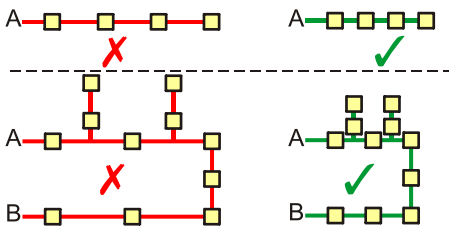
Below you will find an overview of the errors displayed by the FDUL221 line tester as well as possible causes and remedies for the errors.

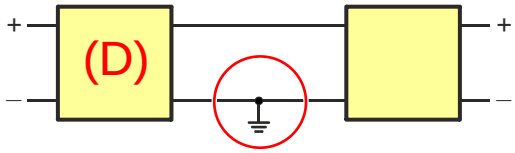
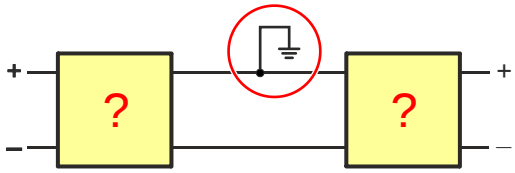
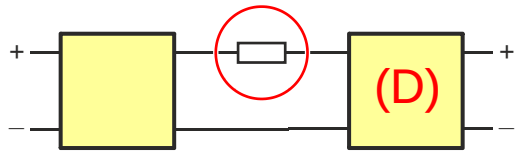
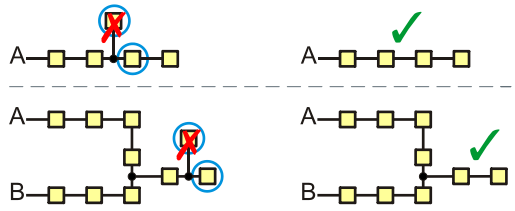
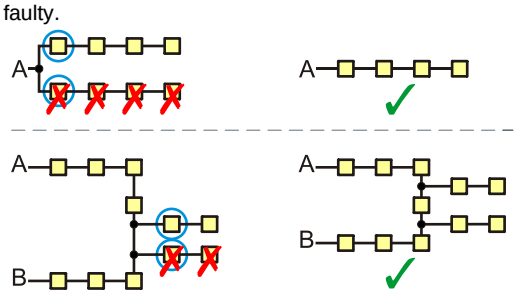
Line device

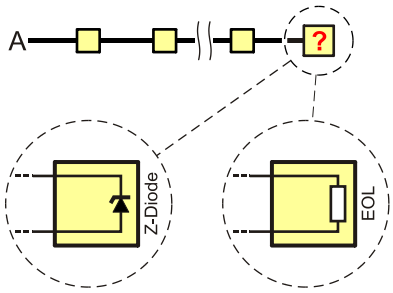
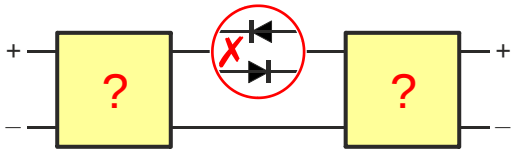
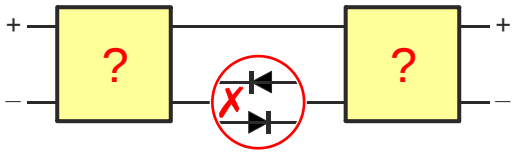
(D) Line device is shown on the display, the internal and external alarm indicators flash

? Position of the line device not detected

Line device is shown on the display with an error

Error display	Possible cause	Remedy
E01 Short	Short-circuit on the detector line. The line separator is open for the line device shown on the display. 	Locate the short-circuit by checking the cable section behind the line device shown on the display. In the case of a loop, the location is also shown as an 'open line'.
E02 Open (+)	Open line on the ⊕ line The exact position of the open line cannot be identified by the FDUL221 line tester. 	Check the cable. Search for the faulty location by disconnecting the detector line and re-checking the cable connection. Disconnect the return line and restart the detector line. The open line is located behind the last line device shown on the display.
E03 Open (-)	Open line on the ⊖ line 	Open the loop at one end and restart the detector line. The open line is located behind the last line device shown on the display.
E04 Hi leak	High leakage current  The typical leakage current is approx. 300 µA (base current) and approx. 3 µA per line device.	Check the cable insulation. In the case of migrated detector lines: ● Check whether old line devices are still installed on the detector line. ● Check whether EOL elements, e.g. resistors, are still installed on the detector line.
E05 High cap	a) High line capacity 	Line too long. Reduce the length of the loops or stubs, e.g. through division. The maximum line length is 3.3 km for FS20/FS720, 2.5 km for SIGMASYS and also depends on the line type. R_{lmax} = 240 Ω, C_{lmax} = 750 nF
	b) Error during migration, e.g. due to forgotten line device	Replace the affected line device.

Error display	Possible cause	Remedy
E06 (-) -> EARTH	a) ⊖ line is grounded b) The connection for the external AI is grounded 	Search for the ground fault. In particular, note connections for line devices with grounded components, shielded cables, etc.
E07 (+) -> EARTH	⊕ line is grounded. The exact position of the error cannot be identified by the FDUL221 line tester. 	Find the faulty location by separating the parts of the detector line and checking the separated line parts (e.g. ½, ¼, ⅛). Also refer to the tips on 'Error search' [➞ 61].
E08 series R	High resistance 	Resistance in the detector line is too high. Check the lines and the connection points (terminals). Ensure that the line is not too long. Limit values: See error E05 Use the 'Measure Device' menu item.
E09 More err	The error list is limited to a maximum number of error messages that can be displayed. However, more errors are available than can be currently displayed.	Rectify the errors displayed and then read in the detector line again. The errors that were not originally displayed will then be shown.
E10 >252 dev	There are too many devices on the detector line that has been read-in. A maximum of 252 devices may be installed on a FDnet/C-NET detector line.	The read-in loop or stub must be divided into several loops or stubs with less line devices.
E11 bad TTap	A sub-stub is not permitted in this location. Note: This error number indicates several line devices as faulty. 	A branch is not allowed. Change the wiring. Ensure that a 'sub-stub on stub' topology has not been wired. Only one or several individual sub-stubs can branch from a loop.
E12 >2 TTap	Several sub-stubs directly after one another without a line separator in between are not permitted. Note: This error number indicates several line devices as faulty. 	Ensure that there is a line device, e.g. a line separator, between two sub-stubs branching off from the loop. Only one sub-stub may branch off from a loop between two line devices on the detector line.

Error display	Possible cause	Remedy
E13 bad EOS	Error on the last line device of a stub: In the case of a closed line separator, an increased load current is detected on this line device. 	In the case of migrated lines: Check whether a resistor or a Z diode is still installed on the line device. Remove the resistor or the Z diode.
E14 Diode (+)	Diode on the ⊕ line 	The wire was incorrectly connected to the terminal for the external alarm indicator instead of the terminal for the detector line. Also observe the notices in the 'Error search using the 'measure line device' method [→ 62]' section.
E15 Diode (-)	Diode on the ⊖ line 	The wire was incorrectly connected to the terminal for the external alarm indicator instead of the terminal for the detector line. Also observe the notices in the 'Error search using the 'measure line device' method [→ 62]' section.
E16 Alarm	An alarm has been triggered on the line device.	E.g. in the case of a manual call point, replace the defective glass insert and close the door.
E17 Defect	The line device is defective.	Replace the line device.

6.14 Tips for troubleshooting on the detector line

Once the detector line has been read in, the FDUL221 line tester detects the following detector line errors:

- Open line
- Ground fault
- Short-circuit
- Shield fault
- Shield permeability
- Shield ground fault

If a single line device is selected with the FDUL221 line tester, its internal or external alarm indicator will flash.

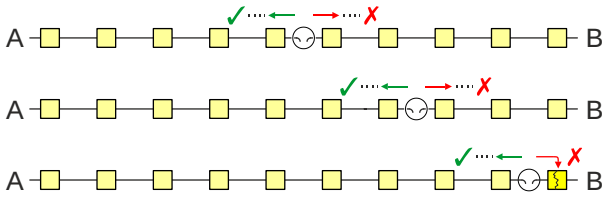
If the 'All ON' is selected in the 'Locate devices' menu, the internal/external alarm indicators of all line devices detected by the FDUL221 line tester flash. In this way, you can detect line devices that were not detected by the FDUL221 line tester.

6.14.1 Error search using the 'bisection' method

▷ The FDUL221 line tester is ready for operation.

1. Separate the lines on a line device in the center of the loop or stub and create two stubs.
2. Measure each stub.
   ⇨ You will detect the stub with the error.
   ⇨ Divide the faulty stub in the center and connect the previously separated points.
3. Measure each stub.
   ⇨ This will enable you to identify the area with the error.
4. Proceed as described with the division until you have located the error.

⇨ The increasingly smaller sections will enable you to rapidly locate the error.



Error search using the 'bisection' method

6.14.2 Error search using the 'measure line device' method

Recommended for errors E02, E14, E15. Using the measured value you can determine whether the error lies upstream or downstream of the selected line device. The location of the error can be rapidly determined through the selection of line devices.

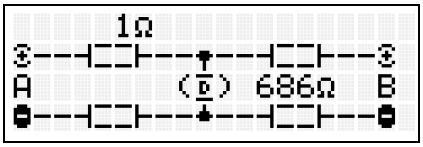
Proceed as follows:

1. Restart the detector line.
2. Navigate to the desired line device in the line tester display.
3. Press the ⓥ button.
4. Select the 'Measure Device' menu item.
5. Perform steps 1 to 4 for more devices if required.

Measure the terminal resistances of the line device in the 'Measurements' menu. The values displayed are totals. The total value is affected by line resistance and diodes (e. g. external alarm indicators). Take this into account when analyzing the measurement.

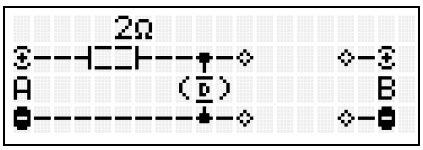
Loop

- Plus and minus lines are measured separately
- Cable from 'A' and 'B' separated
- Diodes are detected and localized (wire 'A' or 'B' and ⊕ ⊖)



Stub

- Only the total resistance is measured
- Only used for stub and sub-stub



6.14.3 Explanation of ground fault measurement (for FDUL221 variant 3 only)

Once you have started up the line, you can identify the ground fault resistance between **(+)** and ground as well as **(-)** and ground using the 'Measurements' menu.

The table below shows three examples:

Ground fault measurement display	Interpretation
Measurements ⇕→⏚ ∞Ω OK ●⇕→⏚ ∞Ω OK ⇕→⇕ >10kΩ	Line ok
Measurements ⇕→⏚ 149kΩ leak ●⇕→⏚ 50.6kΩ leak ⇕→⇕ >10kΩ	Fault at connection with low measured value for **(-)**
Measurements ⇕→⏚ 49.6kΩ fault ●⇕→⏚ 145kΩ leak ⇕→⇕ >10kΩ	Fault at connection with low measured value for **(+)**

- The line is ok if the value '∞ Ω **OK**' is displayed with '**(+)**→⏚' and '**(-)**→⏚'.
- If 'leak' or 'fault' is displayed, there is a ground fault at the connection with the lower resistance value to ground. This resistance corresponds to the actual ground fault resistance.
- The resistance at the other connection (the higher value) cannot be interpreted directly, as it is usually 100 kΩ on account of the internal circuit.
- A resistance to ground that exceeds 500 kΩ can no longer be reliably detected.

If the line is measured manually using a multimeter, the line must be disconnected from the FDUL221 line tester.

7 Maintenance / Repair

7.1 Testing the line tester

The FDUL221 line tester is set in the factory. This setting cannot be changed by the user.

During the selftest the settings are tested automatically, by electronically connecting and measuring reference resistances in the different configuration. Calibration may also be checked manually.

7.1.1 Selftest

The selftest is not possible in 'EL' operation mode. In this case, change the operation mode. See chapter: 'Firmware update [→ 69]'.

▷ A measuring cable is required for testing.

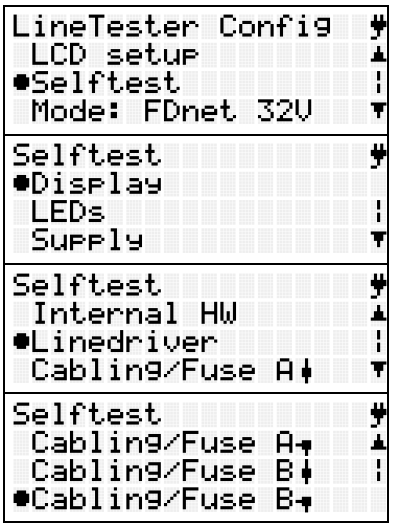
▷ The FDUL221 line tester is connected to a power supply.

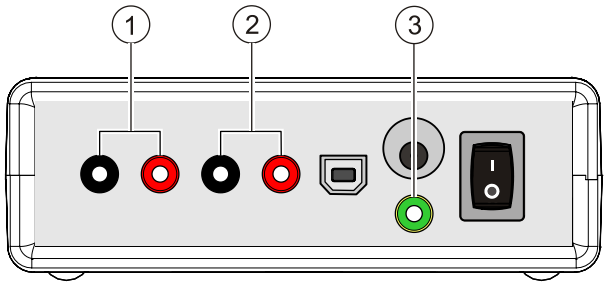
1. Press the ⊗ button and switch the FDUL221 line tester on at the same time.
   ⇨ The display shows 'LineTester Config'.
2. Navigate to the 'Selftest' sub menu.
3. Perform the tests according to the information in the display.
   ⇨ The corresponding test result is displayed.
4. To acknowledge a successful test, press the ✓ button 'PASS'.
   ⇨ You are taken to the next test.
5. If the test is not successful, press the ⊗ button 'FAIL'.
   ⇨ You are taken to the previous test.
6. Connect the cable according to the instructions during testing. The connections for the detector lines and ground wire/shielding are labeled accordingly.
7. Rectify the faults displayed.
8. If the fault 'Cablin/Fuse' is displayed, check the cable. If the fuse is the cause of the error, send the FDUL221 line tester for repair.

Testing procedure

- Display
  - 'Test Display'
  - 'Black lines OK?'
- LEDs
  - 'Test LEDs'
  - 'Red LED steady on?
  - 'Green LED blinking?'
- Supply
  - 'Test Supply'
  - 'Vbatt= .....mV'
  - 'UL=.....mV'

- Internal HW
  - 'Test Hardware'
- Linedriver
  - 'Test Linedriver A(+)'
- Cablin/Fuse A(+)
  - 'Connect EARTH to A(+)'
- Cablin/Fuse A(-)
  - 'Connect EARTH to A(-)'
- Cablin/Fuse B(+)
  - 'Connect EARTH to B(+)'
- Cablin/Fuse B(-)
  - 'Connect EARTH to B(-)'
- 'Selftest COMPLETE'
- 'Exit ⊗





Measurement connections

1 Line B (sockets B+ and B-)
2 Line A (sockets A+ and A-)
3 Earth (socket)

See also

Power supply [→ 37]

7.1.2 Testing calibration

If testing manually, use a digital voltmeter with 'True RMS'.

The table below shows the nominal measured value as a function of the configured control unit.

Control panel	Mode	Nominal measured value
● FS20 ● FS720 ● CS114x	FDnet 32 V	DC 28 V ± 5 % AC 10 V ± 10 %
● SIGMASYS	FDnet SIGMA	DC 24 V ± 5 % AC 8 V ± 10 %

7.2 Replacing batteries

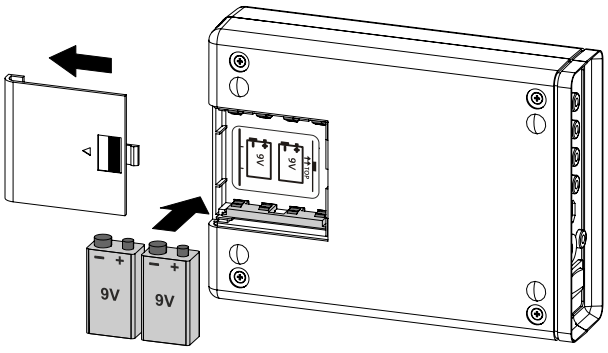
The charge state of the batteries is indicated on the right of the FDUL221 line tester's display. To ensure the faultless functionality of the FDUL221 line tester, weak batteries must be replaced by new ones.

	⚠ WARNING
	Short-circuit as a result of incorrectly inserting batteries Warming of batteries and risk of fire • When inserting battery, note polarity.

▷ Two new, undamaged batteries, order number A5Q00004142, are available.

1. Switch off the FDUL221 line tester.
2. Disconnect the FDUL221 line tester from the detector line.
3. Open the battery compartment on the back of the FDUL221 line tester.
   - Slide the cover out of the catch.
   - Remove the cover.
4. Remove the batteries.
5. Move the pin cover from the new batteries to the old ones.
6. Insert two new batteries into the battery compartment and ensure they are inserted correctly. The batteries must have a space between them so that the battery terminals make reliable contact with the FDUL221 line tester.
7. Close the battery compartment.

Dispose of batteries in an environmentally friendly manner and observe national guidelines and regulations.



Battery compartment for two batteries with sign for correct insertion

See also

9 V lithium manganese dioxide battery [→ 36]

7.2.1 Service life of the batteries

The service life strongly depends on the line allocation, the display light and the operating temperature.

Operation mode	Service life at room temperature	
	Lighting **ON**	Lighting **OFF**
Normal operation (quiescent condition)	Approx. 19 hours	Approx. 51 hours
Line operation with 126 detectors	Approx. 7 hours	Approx. 10 hours

See also

9 V lithium manganese dioxide battery [→ 36]

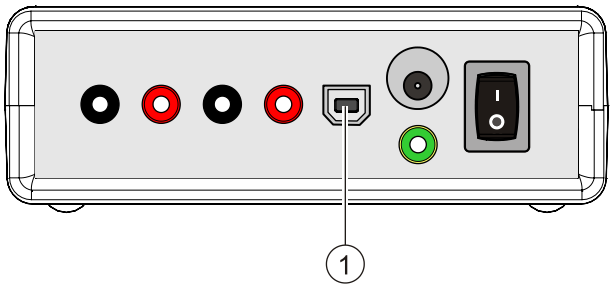
7.3 Firmware update

A firmware update enables the following:

- Installation of a new firmware version
- Change to or from 'EL' operation mode
- Change the user language

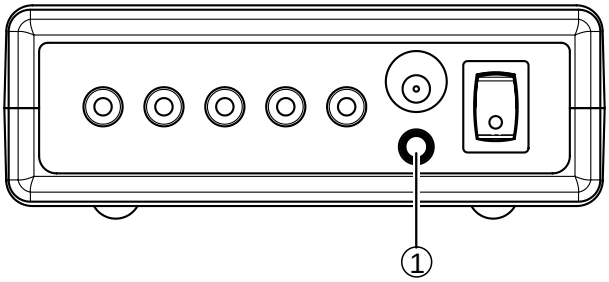
When a firmware update is carried out, the new firmware overwrites the old firmware. To carry out a firmware update, the components for connecting the PC with the FDUL221 line tester must be available. You will find more information in chapter 'Operating the line tester with a PC [→ 56]'.

Variant 3: Connection to the PC via USB cable



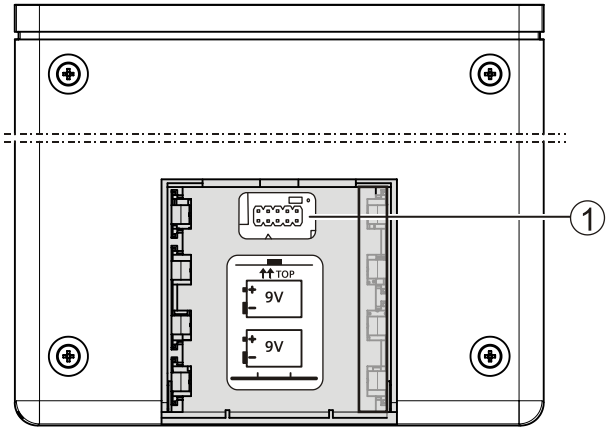
1 Connection on the front for variant 3 (USB)

Variant 2: Connection to PC via MC link socket



1 Connection on front for version 2 (MC link)

Variant 1: Connection to PC via serial RS232 interface



1 Connection in battery compartment for variant 1 (RS232)

Firmware update by PC

▷ Permanent and safe power supply to the FDUL221 line tester is available while the update is taking place.

▷ The file required for the firmware update is available. You will find the file on the CD included in the set or on the Intranet in the Customer Support Center[1].

1. Load the firmware update on the PC.
2. Connect the FDUL221 line tester to the PC.
3. Connect the FDUL221 line tester to the mains and switch it on.
4. On the PC, open the directory in which the firmware is located.
5. Select the required firmware version.
6. Start the download by double-clicking on the file *.exe'.
7. Follow the instructions indicated on the PC screen.
8. In the case of initial installation, select the available connection variant.
9. Follow the prompt to press the ▲▼✓✗ buttons on the FDUL221 line tester.
10. Hold the buttons down and follow the instructions.
    ⇨ The update has been successfully installed.
11. Disconnect the FDUL221 line tester from the PC.
12. Configure the FDUL221 line tester and save the configuration. [→ 50]
13. Switch off the FDUL221 line tester.

⇨ The update is complete.

[1] obtain from: Customer Support Center/PSP Product Support Platform CSC address: https://intranet.sbt.siemens.com/fs/CSC/

Firmware update with FS20/Cerberus PRO FS720 fire detection system

In the Sinteso FS20/Cerberus PRO FS720 fire detection system, the firmware update can also be performed with the FXS2007 engineering tool or with the FXS2008 periphery update tool.

You will find detailed information about firmware updates for the FS20 fire detection system in document 009052 and for the FS720 fire detection system in document A6V10210416.

See also

Operating the line tester with a PC [→ 56]
Applicable documents [→ 7]

8 Specifications

8.1 Technical data

The following data only applies to the FDUL221 line tester, variant 3.

Power supply	Operating voltage:	DC 10…30 V
	Battery	2 x lithium manganese dioxide type U9VL Li/MnO2 9 V, 1 Ah 25 x 48 x 16 mm
	Network adapter	AC 240 V / DC 24 V / 625 mA
	Operating current	
	In quiescent condition with LCD backlight	Max. 30 mA
	Depends on the number of line device on the detector line and the function performed	Max. 550 mA
Line voltage	FDnet (FS20, CS114x)	DC 32 V
	C-NET (FS720)	DC 32 V
	FDnet SIGMA (SIGMASYS)	DC 28 V
Fuses	Line A (+)	Internal fuse
	Line A (–)	Internal fuse
	Line B (+)	Internal fuse
	Line B (–)	Internal fuse
Interfaces	Line	FDnet/C-NET
	PC	Via USB interface
Maximum detector key figures (MK) per line	With network adapter	Min. 550
	With battery	Min. 150
Connections	Line	4 sockets for lab cable with crocodile clips/connector
	Earth	Sockets for lab cable with crocodile clips/connector
	Mains	Socket for power unit kit FDUL221-B
	PC	USB-B socket for USB cable

Mechanical data

Line tester FDUL221	Dimensions (L x W x H)	190 x 135 x 45 mm
	Color	~RAL 9002 gray white
	Housing material	ABS
Case	Dimensions (L x W x H)	340 x 275 x 90 mm
	Housing material	PP
Weights	Line tester FDUL221	0.44 kg
	Line connection set	0.10 kg
	Power unit set	0.25 kg

Ambient conditions

	Operating temperature	-25…+40 °C (LCD 0…+40 °C)
	Storage temperature without battery	-30…+75 °C
	Storage temperature with battery	-25…+60 °C
	Air humidity (non-condensing)	≤95 % rel.
	Protection category for FDUL221	IP30
	Protection category for network adapter	IP41
	Test class	4 kV

Standards

	European standards	• EN 60601
	International standards	• IEC 601 Protection category II • ISO 9001 • ISO 14001
	Siemens standards	SN 36350

Approvals

	EC Certificate of Conformity	CE

8.2 Environmental compatibility and disposal

This device is manufactured using materials and procedures which comply with current environmental protection standards as best as possible. More specifically, the following measures have been undertaken:

- Use of reusable materials
- Use of halogen-free plastics
- Electronic parts and synthetic materials can be separated

Larger plastic parts are labeled according to ISO 11469 and ISO 1043. The plastics can be separated and recycled on this basis.

Electronic parts and batteries must not be disposed of with domestic waste.

- Take electronic parts and batteries to local collection points or recycling centers.
- Contact local authorities for more information.
- Observe national requirements for disposing of electronic parts and batteries.

Index

B

Battery
- Battery compartment, 35
- Display charge state, 30
- Power supply with battery, 37
- Replacing batteries, 67
- Service life of the batteries, 68

C

Connections
- Bushes, 28

Control panel
- Configure on control panel, 50

Customer Support Center
- Address: https://intranet.sbt.siemens.com/fs/CSC/, 23, 24

D

Detector lines
- Topologies, 17

Display, 29
- Display for 'device' function, 45
- LCD setup, 42, 43, 43, 50
- Symbols, 30

Disposal, 73

E

Environmental compatibility, 73

ES
- Product version, 27
- Product version ES≥10, 25

F

Faults
- Error search using 'bisection', 61
- Error search using 'measure line device', 62
- Remedies, 58
- Replacing batteries, 67
- Tips for troubleshooting on the detector line, 61

FDCL221 line separator, 19

FDUZ221/FDUZ227
- Connect to PC and FDUL221, 56

Firmware update, 69

Fuses
- Selftest for fuses, 65

L

Line separation functions, 19

Line separator, 17

Line topology
- Opening a line topology, 56
- Reading in line topology, 51
- Saving a line topology, 55
- Starting up a line, 54
- Transferring a line topology to a PC, 57
- Viewing line topology, 51

Loop
- Connections, 32, 47
- Read in, 51
- Topology, 17
- Viewing loop, 52

M

MC link, 5

Menu
- Menu buttons, 31
- Menu tree, 40

Menu tree
- Configuration, 42, 43
- 'EL' operation mode, 43
- Topology, 40, 43

O

Operation mode
Changing the operation mode, 38
'EL' operation mode, 24

P

Packaging label
Product version, 27
Product label
Product version, 27

R

Recycling, 73
RS232
Cables, 26
Product version, 5

S

Selftest, 64
Stub
Connections, 32, 47
Read in, 51
Topology, 17
Viewing stub, 52
Sub-stub
Impermissible sub-stubs, 54
Topology, 17
Viewing sub-stub on loop, 53
Symbols, 30

T

Topology, 17
Type plate
Product version, 27

U

USB interface, 5

V

Variant 1
RS232 interface, 5, 22, 56, 69
Variant 2
FDUZ221/FDUZ227 interface, 5, 22, 56, 69
Variant 3
USB interface, 5, 22, 56, 69

Issued by
Siemens Switzerland Ltd
Infrastructure & Cities Sector
Building Technologies Division
International Headquarters
Gubelstrasse 22
CH-6301 Zug
Tel. +41 41-724 24 24
www.siemens.com/buildingtechnologies

© 2005-2013 Copyright Siemens Switzerland Ltd
Technical specifications and availability subject to change without notice.