

SITRANS L

DRAFT

Radar level transmitters SITRANS LR500 series with mA/ HART

Operating Instructions

Getting started	1
Introduction	2
Safety notes	3
Description	4
Installing/mounting	5
Connecting	6
Commissioning	7
Operating	8
Parameter assignment	9
Service and maintenance	10
Diagnostics and troubleshooting	11
Technical specifications	12
Dimension drawings	13
Product documentation and support	A
Technical reference	B
HART communication	C
Remote operation	D
HMI menu structure	E
Abbreviations	F

Legal information

Warning notice system

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

WARNING

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

Trademarks

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

Disclaimer of Liability

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

Table of contents

1	Getting started	11
1.1	Getting started	11
2	Introduction	13
2.1	Purpose of this documentation	13
2.2	Document history	13
2.3	FW revision history.....	13
2.4	Product compatibility	14
2.5	Designated use	14
2.6	Checking the consignment.....	14
2.7	Items supplied	14
2.8	Industrial use note	15
2.9	Security information	15
2.10	Security note	16
2.11	Transportation and storage	17
2.12	Notes on warranty	17
3	Safety notes	19
3.1	Preconditions for use	19
3.1.1	Warning symbols on the device	19
3.1.2	Laws and directives	19
3.1.3	Conformity with European directives	20
3.1.4	Conformity with UK regulations	20
3.1.5	Improper device modifications.....	21
3.1.6	Radar frequencies for worldwide use	21
3.2	Requirements for special applications.....	22
3.3	Use in hazardous areas.....	22
3.4	Proper use	23
3.5	Local governing regulations	23
3.6	Radio equipment compliance (Europe)	23
3.7	Information for radio approval FCC and ISSED.....	24
4	Description.....	29
4.1	Description	29
4.2	Applications.....	29
4.3	System configuration	30

4.4	Communication	30
5	Installing/mounting	33
5.1	Basic safety notes.....	33
5.1.1	Handling the device	33
5.1.2	Pressure Equipment Directive (PED) 2014/68/EU	33
5.1.3	Installation location requirements	35
5.1.3.1	Direct sunlight	36
5.1.4	Proper mounting.....	36
5.1.5	Incorrect disassembly.....	37
5.2	Proper materials.....	37
5.3	Sensor reference point	38
5.4	Nozzle mounting	38
5.4.1	Nozzle mounting	40
5.4.2	Thread sealing	41
5.5	LR550 polymeric horn, liquids and solids	42
5.5.1	Mounting bracket	43
5.6	Sunshield.....	46
6	Connecting	47
6.1	Basic safety notes.....	47
6.1.1	Missing PE/ground connection	47
6.1.2	Connecting or disconnecting in explosive environments	48
6.1.3	Improvement of interference immunity	50
6.2	Connecting SITRANS LR500 series	50
6.2.1	Wiring instructions.....	50
6.2.2	Input supply cable note	51
6.2.3	Connecting field device and SITRANS AW050 Bluetooth adapter	52
6.2.3.1	Installing or replacing Bluetooth adapter	53
6.3	Hazardous area installations.....	54
6.3.1	Nameplates for hazardous area installation	54
6.3.1.1	Intrinsic safety wiring	54
6.3.1.2	Non-incendive wiring.....	56
6.3.2	Further information related to hazardous area installations.....	56
6.3.3	Instructions specific to hazardous area installation	56
6.3.3.1	Special conditions for safe use.....	56
6.3.3.2	Instructions specific to hazardous area installations (in accordance with IEC 60079-0:2011 clause 30).....	56
7	Commissioning	59
7.1	Basic safety notes.....	59
7.2	Local commissioning.....	60
7.2.1	Activating SITRANS LR500 series.....	61
7.2.2	Local HMI	61
7.2.2.1	The LCD display.....	62
7.2.3	Programming.....	63
7.2.4	Wizards.....	64
7.2.4.1	Quick commissioning	64

7.2.4.2	Demo wizard	76
7.2.4.3	AFES wizard	77
7.2.5	Requesting an echo profile	78
7.2.6	Device address	78
7.2.7	Testing the configuration	79
7.3	Application examples	79
8	Operating	81
8.1	Starting measurement	81
8.2	Measurement conditions_response rate	81
8.3	Measurement conditions_dimensions and fail-safe	82
8.4	mA control.....	82
8.5	Characterization chart.....	83
8.6	Vessel shape and dimensions	85
8.7	Simulation	86
8.7.1	Simulation - general (Operating chapter).....	86
8.7.2	Simulation - Current output (Operating chapter).....	86
8.7.3	Simulation - Process value (Operating chapter)	87
8.7.4	Simulation - Application test (Operating chapter)	89
8.7.5	Simulation - Diagnostic (Operating chapter)	89
9	Parameter assignment	91
9.1	Quick start (1)	91
9.1.1	Quick commissioning (1.1)	91
9.1.2	Demo wizard (1.2)	92
9.1.3	AFES wizard (1.3)	92
9.2	Setup (2)	92
9.2.1	Select output (2.1).....	92
9.2.1.1	Operation_Level and Volume illustration	92
9.2.1.2	PV selection (2.1.1).....	92
9.2.1.3	SV selection (2.1.2).....	94
9.2.1.4	TV selection (2.1.3)	94
9.2.1.5	QV selection (2.1.4)	94
9.2.1.6	Linearization type (2.1.5).....	94
9.2.2	Sensor (2.2).....	95
9.2.2.1	Units (2.2.1)	95
9.2.2.2	Temperature units (2.2.2)	96
9.2.2.3	Fill rate limit (2.2.3)	96
9.2.2.4	Empty rate limit (2.2.4).....	96
9.2.3	Calibration (2.3)	97
9.2.3.1	Lower calibration point (2.3.1).....	97
9.2.3.2	Upper calibration point (2.3.2).....	97
9.2.3.3	Lower level point (2.3.3)	97
9.2.3.4	Upper level point (2.3.4)	97
9.2.3.5	Sensor offset (2.3.5)	97
9.2.3.6	Low-level cutoff (2.3.6)	97
9.2.3.7	Propagation factor (2.3.7)	98
9.2.3.8	Antenna offset (2.3.8).....	98

9.2.4	Current output (2.4)	98
9.2.4.1	Loop current mode (2.4.1)	98
9.2.4.2	Loop current value in multidrop mode (2.4.2)	98
9.2.4.3	Damping value (2.4.3)	99
9.2.4.4	Lower range value (2.4.4)	99
9.2.4.5	Upper range value (2.4.5)	99
9.2.4.6	Lower saturation limit (2.4.6)	100
9.2.4.7	Upper saturation limit (2.4.7)	101
9.2.4.8	Lower fault current (2.4.8)	101
9.2.4.9	Upper fault current (2.4.9)	101
9.2.4.10	Fault current (2.4.10)	101
9.2.4.11	Fail-safe loss of echo (2.4.11)	101
9.2.4.12	Fail-safe LOE timer (2.4.12)	102
9.2.5	Volume (2.5)	102
9.2.5.1	Vessel shape (2.5.1)	102
9.2.5.2	Vessel dimension A (2.5.2)	104
9.2.5.3	Vessel dimension L (2.5.3)	104
9.2.5.4	Volume units (2.5.4)	104
9.2.5.5	Upper scaling point (2.5.5)	104
9.2.6	Custom (2.6)	105
9.2.6.1	Upper scaling point (2.6.1)	105
9.2.6.2	Customized characteristic curve (2.6.2)	105
9.2.7	Local display (2.7)	106
9.2.7.1	Start view (2.7.1)	106
9.2.7.2	Contrast (2.7.2)	107
9.3	Maintenance and diagnostics (3)	107
9.3.1	Identification (3.1)	108
9.3.1.1	Tag (3.1.1)	108
9.3.1.2	Long tag (3.1.2)	108
9.3.1.3	Descriptor (3.1.3)	108
9.3.1.4	Message (3.1.4)	108
9.3.1.5	Device (3.1.5)	108
9.3.1.6	Local display (3.1.6)	109
9.3.2	Diagnostics (3.2)	109
9.3.3	Signal (3.3)	109
9.3.3.1	Signal quality (3.3.1)	109
9.3.3.2	Echo configuration (3.3.2)	110
9.3.3.3	Echo select (3.3.3)	110
9.3.3.4	Filtering (3.3.4)	111
9.3.3.5	Sampling (3.3.5)	113
9.3.3.6	TVT configuration (3.3.6)	113
9.3.4	Peak values (3.4)	117
9.3.4.1	Minimum electronics temperature (3.4.1)	117
9.3.4.2	Maximum electronics temperature (3.4.2)	117
9.3.4.3	Minimum distance (3.4.3)	117
9.3.4.4	Maximum distance (3.4.4)	117
9.3.4.5	Minimum echo signal strength (3.4.5)	117
9.3.4.6	Maximum echo signal strength (3.4.6)	117
9.3.4.7	Minimum confidence (3.4.7)	117
9.3.4.8	Maximum confidence (3.4.8)	117
9.3.5	Non-resettable peak values (3.5)	117
9.3.5.1	Minimum electronics temperature (3.5.1)	117

9.3.5.2	Maximum electronics temperature (3.5.2).....	118
9.3.5.3	Minimum terminal voltage (3.5.3)	118
9.3.5.4	Maximum terminal voltage (3.5.4)	118
9.3.6	Trend log settings (3.6)	118
9.3.6.1	Number of logging values (3.6.1).....	118
9.3.6.2	Number of logged points (3.6.2)	118
9.3.6.3	Logging interval (3.6.3)	118
9.3.6.4	Logging behavior (3.6.4)	119
9.3.6.5	Logging value 1 (3.6.5) ... Logging value 8 (3.6.12)	119
9.3.7	Simulation (3.7).....	120
9.3.7.1	Simulation mode (3.7.1)	120
9.3.7.2	Simulation value (3.7.2).....	120
9.3.7.3	PV status (3.7.3)	120
9.3.7.4	Ramp end (3.7.4).....	121
9.3.7.5	Ramp steps (3.7.5).....	121
9.3.7.6	Ramp duration (3.7.6.).....	121
9.3.8	Current loop (3.8)	121
9.3.8.1	Loop test (3.8.1)	121
9.3.8.2	Terminal voltage (3.8.2).....	122
9.3.9	Resets (3.9)	122
9.3.9.1	Device restart (3.9.1)	122
9.3.9.2	Resets (3.9.2)	122
9.3.9.3	Reset peak values (3.9.3)	123
9.3.10	Frequency (3.10)	124
9.3.11	Audit trail (3.11)	124
9.3.11.1	Configuration change counter (3.11.1).....	124
9.4	Communication (4).....	124
9.4.1	Polling address (4.1)	124
9.4.2	Identify the device (4.2).....	125
9.5	Security (5).....	125
9.5.1	Change user PIN (5.1)	125
9.5.2	Recovery ID (5.2)	125
9.5.3	PIN recovery (5.3)	126
9.5.4	User PIN (5.4)	126
9.5.5	Button lock (5.5).....	127
9.6	Language (6)	127
10	Service and maintenance	129
10.1	Basic safety notes.....	129
10.1.1	Maintenance.....	129
10.2	Cleaning	130
10.3	Maintenance and repair work.....	130
10.3.1	Enclosure open	131
10.4	Replacing the HMI.....	132
10.4.1	Remove existing HMI	132
10.4.2	Install a new HMI	132
10.5	Return procedure	133
10.6	Disposal.....	134

11	Diagnostics and troubleshooting.....	135
11.1	Device status symbols	135
11.2	Communication troubleshooting.....	135
11.3	Device status symbols	136
11.3.1	Device status symbols (chart).....	136
11.4	Device information symbols	138
11.4.1	Device information symbols	138
11.5	Fault codes and corrective actions	138
11.6	Operation troubleshooting	145
11.6.1	Common problems	145
11.6.1.1	Communication troubleshooting.....	145
11.6.2	Measurement difficulties	146
11.6.2.1	Adjusting aiming	146
11.6.2.2	Fixed reading	146
11.6.2.3	Obstructions in the beam	147
11.6.2.4	Set the device to ignore the false echo	147
11.6.3	Wrong reading	147
11.6.4	Echo profile display and trend display	148
12	Technical specifications	149
12.1	Power	149
12.2	Performance	149
12.3	Near range	151
12.4	Interface.....	151
12.5	Outputs	151
12.6	Construction	151
12.7	Operating conditions	152
12.7.1	Second line of defence (SLOD)	152
12.7.2	Environmental	152
12.7.3	Process conditions	153
12.7.4	Vessel pressure	153
12.7.5	Mechanical stress.....	153
12.7.6	Air purging system.....	153
12.8	Process	155
12.9	Certificates and approvals.....	155
12.10	Communication	156
12.11	Derating curves	157
12.11.1	Temperature derating curves.....	157
12.11.2	Temperature vs pressure derating curves.....	159
13	Dimension drawings	165
13.1	LR510 threaded lens antenna.....	165
13.2	LR530 flanged encapsulated antenna	167

13.3	LR550 polymeric horn antenna	170
13.4	LR580 flanged lens antenna	174
A	Product documentation and support	179
A.1	Product documentation	179
A.2	Technical support.....	180
B	Technical reference.....	181
B.1	Principles of operation	181
B.2	Echo processing	181
B.2.1	Echo processing	181
B.2.2	Echo selection	182
B.2.2.1	Echo selection algorithms	182
B.3	Loop power	183
B.3.1	Loop power	183
C	HART communication	185
C.1	HART communications	185
C.2	HART communication protocol	185
C.3	SIMATIC PDM	185
C.4	HART Electronic Device Description (EDD).....	185
D	Remote operation	187
D.1	SIMATIC PDM	187
D.1.1	Simulation (under PDM appendix)	187
D.1.2	Overview SIMATIC PDM	187
D.1.3	Check SIMATIC PDM version	188
D.1.4	Updating the Electronic Device Description (EDD) or Field Device Integration (FDI).....	188
D.2	Bluetooth.....	188
D.2.1	Scope of delivery of SITRANS AW050 Bluetooth adapter kit	188
D.2.2	Connecting field device and SITRANS AW050 Bluetooth adapter	189
D.2.2.1	Connecting field device when Bluetooth adapter installed	189
D.2.2.2	Installing or replacing Bluetooth adapter	190
D.2.3	Connecting field device with SITRANS mobile IQ app.....	191
D.2.4	Default password	192
D.2.5	Reset Password	192
D.2.6	Technical data: SITRANS AW050 Bluetooth adapter	193
D.2.7	Technical data: SITRANS mobile IQ	193
D.2.8	Dimensions SITRANS AW050 Bluetooth adapter	194
D.2.9	Information for radio approval FCC and IC	194
D.3	HART	195
D.3.1	HART communication	195
D.3.2	Communication (HART)	195
D.3.3	Communication connections.....	196
D.3.4	Configuring communication ports	197
D.3.5	Communication troubleshooting	197

E HMI menu structure..... 199

F Abbreviations..... 205

 Glossary 207

 Index 209

Getting started

1.1 Getting started

Condition

You have read the following safety instructions:

- General safety information (Page 19)
- Basic safety information: Installing/mounting (Page 33)
- Basic safety information: Connecting (Page 47)
- Basic safety information: Commissioning (Page 59)

Read the entire document in order to achieve the optimum performance of the device.

Procedure

1. **Install/mount the device.**
Installing/mounting (Page 33)
2. **Connect the device.**
Connecting (Page 47)
3. **Power up the device.**
Activating SITRANS LR500 series (Page 61)
4. **Configure the device via quick commissioning wizard:**
Quick commissioning (Page 64)

You can find additional functions in the section Parameter assignment. (Page 91)

See also

Nozzle mounting (Page 38)

Connecting SITRANS LR500 series (Page 50)

Introduction

2.1 Purpose of this documentation

These instructions contain all information required to commission and use the device. Read the instructions carefully prior to installation and commissioning. In order to use the device correctly, first review its principle of operation.

The instructions are aimed at persons mechanically installing, connecting and commissioning the device, as well as service and maintenance engineers.

See also

Product documentation and support (Page 179)

2.2 Document history

The following table shows major changes in the documentation compared to the previous edition.

Edition	Remark
11/2023	First edition

2.3 FW revision history

Sensor

Firmware revision	PDM EDD revision	Date	Changes
1.00.00	1.00.00	November 2023	• Initial release

HMI

Firmware revision	Date	Changes
1.00.00	November 2023	• Initial release

2.4 Product compatibility

The following table describes compatibility between manual edition, device revision, engineering system and associated Electronic Device Description (EDD).

Manual edition	Remarks	Device revision	Compatible version of device integration package	
11/2023	First edition	HART FW: 1.00.00 or later HW: 1.00.00 or later Device revision 1 or later	SIMATIC PDM V9.1	EDD: 1.00.00 or later

2.5 Designated use

Use the device in accordance with the information on the nameplate and in the Technical specifications (Page 149).

2.6 Checking the consignment

1. Check the packaging and the delivered items for visible damages.
2. Report any claims for damages immediately to the shipping company.
3. Retain damaged parts for clarification.
4. Check the scope of delivery by comparing your order to the shipping documents for correctness and completeness.



WARNING

Using a damaged or incomplete device

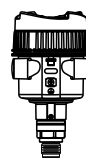
Risk of explosion in hazardous areas.

- Do not use damaged or incomplete devices.

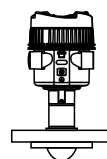
2.7 Items supplied

- SITRANS LR500 series radar level transmitter

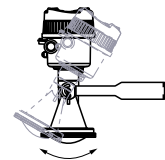
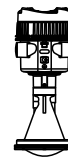
LR510 threaded lens antenna



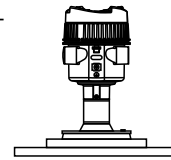
LR530 Flanged encapsulated antenna



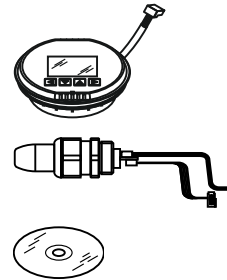
LR550 polymeric
horn antenna
With mounting
bracket (optional)



LR580 flange lens an-
tenna



- HMI display (optional)
- AW050 Bluetooth module (optional)
- Siemens Process Instrumentation documentation disk containing certificates, and manuals for ATEX approved devices



Note

Scope of delivery may vary, depending on version and add-ons. Make sure the scope of delivery and the information on the nameplate correspond to your order and the delivery note.

2.8 Industrial use note

NOTICE

Use in a domestic environment

This Class A Group 1 equipment is intended for use in industrial areas.

In a domestic environment this device may cause radio interference.

2.9 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
<https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
<https://www.siemens.com/cert>.

2.10 Security note

NOTICE
Unauthorized product information or software
Use only authorized Siemens websites when accessing any product information or software, including firmware updates, device integration files (EDD, for example), as well as other product documentation. Using unauthorized product information or software could result in a security incident, such as breach of confidentiality, or loss of integrity and availability of the system.
For more information, see Product documentation and support (Page 179).

2.11 Transportation and storage

To guarantee sufficient protection during transport and storage, observe the following:

- Keep the original packaging for subsequent transportation.
- Devices/replacement parts should be returned in their original packaging.
- If the original packaging is no longer available, ensure that all shipments are properly packaged to provide sufficient protection during transport. Siemens cannot assume liability for any costs associated with transportation damages.

NOTICE
Insufficient protection during storage
The packaging only provides limited protection against moisture and infiltration.
• Provide additional packaging as necessary.

Special conditions for storage and transportation of the device are listed in Technical specifications (Page 149).

2.12 Notes on warranty

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. The sales contract contains all obligations on the part of Siemens as well as the complete and solely applicable warranty conditions. Any statements regarding device versions described in the manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of publishing. Siemens reserves the right to make technical changes in the course of further development.

Safety notes

3.1 Preconditions for use

This device left the factory in good working condition. In order to maintain this status and to ensure safe operation of the device, observe these instructions and all the specifications relevant to safety.

Observe the information and symbols on the device. Do not remove any information or symbols from the device. Always keep the information and symbols in a completely legible state.

3.1.1 Warning symbols on the device

Symbol	Explanation
	Consult operating instructions
	Dispose of in an environmentally safe manner, and according to local regulations.

3.1.2 Laws and directives

Observe the safety rules, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC Part I) (Canada)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EU and UK)

3.1.3 Conformity with European directives

The product described in this document is in conformity with the relevant harmonization legislation, and its amendments, of the European Union.

Electromagnetic compatibility directive EMC 2014/30/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to electromagnetic compatibility
Low voltage directive LVD 2014/35/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits
Explosive atmospheres directive ATEX 2014/34/EU	Directive of the European Parliament and the Council on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres
Pressure equipment directive PED 2014/68/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment
Radio equipment directive RED 2014/53/EU	Directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC
Measuring instruments directive MID 2014/32/EU	Directive of the European Parliament and the Council on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments
Non-automatic weighing instruments directive NAWI 2014/31/EU	Directive of the European Parliament and the Council on the harmonisation of the laws of the Member States relating to the making available on the market of non-automatic weighing instruments
Restriction of hazardous substances directive RoHS 2011/65/EU	Directive of the European Parliament and the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment

The applicable directives can be found in the EU Declaration of Conformity of the specific device.

3.1.4 Conformity with UK regulations

The UKCA marking on the device symbolizes the conformity with the following UK regulations:

Electromagnetic compatibility SI 2016/1091	Electromagnetic Compatibility Regulations 2016
Low Voltage SI 2016/1101	Electrical Equipment (Safety) Regulations 2016
Explosive atmosphere SI 2016/1107	Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016
Pressure equipment SI 2016/1105	Pressure Equipment (Safety) Regulations 2016

Radio equipment SI 2017/1206
Restrictions of hazardous substances SI
2012/3032

Radio Equipment Regulations 2017
The Restriction of the Use of Certain Hazardous
Substances in Electrical and Electronic Equip-
ment Regulations 2012

The applicable regulations can be found in the UKCA declaration of conformity of the specific device.

3.1.5 Improper device modifications

WARNING

Improper device modifications

Risk to personnel, system, and environment can result from modifications to the device, particularly in hazardous areas.

- Only carry out modifications that are described in the instructions for the device. Failure to observe this requirement cancels the manufacturer's warranty and the product approvals. Do not operate the device after unauthorized modifications.

3.1.6 Radar frequencies for worldwide use

Country specific settings for the radar signals are determined via the frequency. The operating mode must be set in the operating menu via the respective adjustment tool at the beginning of the setup. For more information, see Parameter assignment (Page 91)

WARNING

Selecting the frequency for your country group

Operating the device without selecting the frequency for the appropriate country group constitutes a violation of the regulations of the radio approvals of the respective country.

3.2 Requirements for special applications

Due to the large number of possible applications, each detail of the described device versions for each possible scenario during commissioning, operation, maintenance or operation in systems cannot be considered in the instructions. If you need additional information not covered by these instructions, contact your local Siemens office or company representative.

Note

Operation under special ambient conditions

We highly recommend that you contact your Siemens representative or our application department before you operate the device under special ambient conditions as can be encountered in nuclear power plants or when the device is used for research and development purposes.

3.3 Use in hazardous areas

Qualified personnel for hazardous area applications

Persons who install, connect, commission, operate, and service the device in a hazardous area must have the following specific qualifications:

- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures, aggressive, and hazardous media.
- They are authorized, trained, or instructed in carrying out work on electrical circuits for hazardous systems.
- They are trained or instructed in maintenance and use of appropriate safety equipment according to the pertinent safety regulations.

WARNING
Use in hazardous area Risk of explosion. • Only use equipment that is approved for use in the intended hazardous area and labeled accordingly. • Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate.

3.4 Proper use

NOTICE
Protection from the device may become impaired
The equipment is to be used only in the manner outlined in this manual, otherwise protection provided by the device may be impaired.

3.5 Local governing regulations

NOTICE
Installation regulations
Installation shall only be performed by qualified personnel and in accordance with local governing regulations.

3.6 Radio equipment compliance (Europe)

Hereby, Siemens declares that the SITRANS LR500 series is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EC. The declaration of conformity may be consulted at AUTOHOTSPOT .

Standards

The instrument was tested according to the latest issue of the following harmonized standards:

- EN 302372 - Tank Level Probing Radar
- EN 302729 - Level Probing Radar

Receiver test

For the receiver test, which covers the influence of an interfering signal on the device, the performance criterion has at least the following performance level according to ETSI TS 103 361 [6]:

- Performance criterion: Variation of the measured value during distance measurement under interference conditions
- Performance level: $\Delta d \leq \pm 50 \text{ mm}$

Operating conditions

For operation inside of closed vessels, points a to f in annex E of EN 302372 must be fulfilled.

3.7 Information for radio approval FCC and ISED

For operation outside of closed vessels, the following conditions must be fulfilled:

- The instrument must be stationary mounted and the antenna directed vertically downward
- The mounting location must be at least 4 km away from radio astronomy stations, unless special permission was granted by the responsible national approval authority
- When installed within 4 to 40 km of a radio astronomy station, the instrument must not be mounted higher than 15 m above the ground

Radio astronomy stations

The following table shows the geographic position of the radio astronomy stations in Europe:

Country	Name of the Station	Latitude	Longitude
Finland	Metsähovi	60°13'04" N	24°23'37" E
France	Plateau de Bure	44°38'01" N	05°54'26" E
Germany	Effelsberg	50°31'32" N	06°53'00" E
Italy	Sardinia	39°29'50" N	09°14'40" E
Spain	Yebes	40°31'27" N	03°05'22" W
	Pico Veleta	37°03'58" N	03°23'34" W
Sweden	Onsala	57°23'45" N	11°55'35" E

RF exposure guidance

RF Exposure guidance to the user on what separation distance to the body/limbs the SITRANS LR500 must be operated in order to comply with RED Directive RF Exposure requirements.

For example, if the device is operated near the body of a human and the SITRANS LR500 has undergone RF Exposure/MPE assessment at a user-device separation distance of 20 cm, then the following guidance can be provided:

- This device must be installed to provide a separation distance of at least 20 cm from people to ensure compliance with the RF exposure requirements.

3.7 Information for radio approval FCC and ISED

Canada Regulatory Information

Fulfilled standards/Normes respectées

This device complies with part 15 of the FCC Rules and Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Canada Class B statement

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

RF Exposure Requirements/Déclaration d'exposition aux radiations

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

Operating conditions/Conditions d'exploitation

This device has been approved for both closed containers and openair environments with the following limitations:

- Closed Containers: For installations utilizing a tilt during installation: This device is limited to installation in a completely enclosed container made of metal, reinforced fiberglass or concrete to prevent RF emissions, which can otherwise interfere with aeronautical navigation
- Open Air Environment: For operation outside of closed vessels, the following condition must be fulfilled: This device shall be installed and maintained to ensure a vertically downward orientation of the transmit antenna's main beam. Furthermore, the use of any mechanism that does not allow the main beam of the transmitter to be mounted vertically downward is prohibited
- The installation of the LPR/TLPR device shall be done by trained installers, in strict compliance with the manufacturer's instructions.
- This device shall be installed only at fixed locations. The LPR device shall not operate while being moved or while inside a moving container
- Hand-held applications are prohibited.
- Marketing to residential consumers is prohibited.
- The use of this device is on a "no-interference, no-protection" basis. That is, the user shall accept operations of high-powered radar in the same frequency band which may interfere with or damage this device

3.7 Information for radio approval FCC and ISSED

- However, devices found to interfere with primary licensing operations will be required to be removed at the user's expense
- The installer/user of this device shall ensure that it is at least 10 km from the Dominion Astrophysical Radio Observatory (DRAO) near Penticton, British Columbia. The coordinates of the DRAO are latitude 49°19'15" N and longitude 119°37'12" W. For devices not meeting this 10 km separation (e.g., those in the Okanagan Valley, British Columbia,) the installer/user must coordinate with, and obtain the written concurrence of, the Director of the DRAO before the equipment can be installed or operated. The Director of the DRAO may be contacted at 250-497-2300 (tel.) or 250-497-2355 (fax). (Alternatively, the Manager, Regulatory Standards, Industry Canada, may be contacted.)

Cet appareil est homologué pour une utilisation dans les cuves fermées et les environnements ouverts avec les restrictions suivantes:

- Cuves fermées : Pour les installations impliquant une inclinaison lors de l'installation : cet appareil ne doit être installé que dans une cuve totalement fermée en métal ou en béton, pour empêcher les émissions RF susceptibles d'interférer avec la navigation aéronautique
- Environnement ouvert : Pour l'utilisation hors des cuves fermées, la condition suivante doit être remplie : L'appareil doit être installé et entretenu de manière à garantir une orientation verticale vers le bas du faisceau principal de l'antenne émettrice. De plus, l'utilisation de tout mécanisme ne permettant pas l'orientation verticale vers le bas du faisceau principal de l'émetteur est interdite
- L'installation d'un dispositif LPR ou TLPR doit être effectuée par des installateurs qualifiés, en pleine conformité avec les instructions du fabricant
- Cet appareil ne doit être installé qu'à des emplacements fixes. L'appareil LPR ne doit pas être utilisé pendant qu'il est en train d'être déplacé ou se trouve dans un conteneur en mouvement
- Les applications portables sont interdites
- La vente à des particuliers est interdite
- Ce dispositif ne peut être exploité qu'en régime de non-brouillage et de non-protection, c'est-à-dire que l'utilisateur doit accepter que des radars de haute puissance de la même bande de fréquences puissent brouiller ce dispositif ou même l'endommager

- D'autre part, les capteurs de niveau qui perturbent une exploitation autorisée par licence de fonctionnement principal doivent être enlevés aux frais de leur utilisateur
- La personne qui installe/utilise ce capteur de niveau doit s'assurer qu'il se trouve à au moins 10 km de l'Observatoire fédéral de radioastrophysique (OFR) de Penticton en Colombie-Britannique. Les coordonnées de l'OFR sont : latitude N 49° 19' 15", longitude O 119° 37' 12". La personne qui installe/utilise un dispositif ne pouvant respecter cette distance de 10 km (p. ex. dans la vallée de l'Okanagan [Colombie-Britannique]) doit se concerter avec le directeur de l'OFR afin d'obtenir de sa part une autorisation écrite avant que l'équipement ne puisse être installé ou mis en marche. Le directeur de l'OFR peut être contacté au 250-497-2300 (tél.) ou au 250-497-2355 (fax). (Le Directeur des Normes réglementaires d'Industrie Canada peut également être contacté).

USA Regulatory Information

Fulfilled standards

FCC 15.19 Labelling requirements

This device complies with part 15 of the FCC Rules and Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation

FCC 15.21 Information to user

"Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment."

FCC 15.105 statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and

3.7 Information for radio approval FCC and ISED

on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

FCC 15.256 statement

This device is approved for unrestricted use only inside closed, stationary vessels made of metal, reinforced fiberglass or concrete.

For operation outside of closed vessels, the following conditions must be fulfilled:

- This device shall be installed and maintained to ensure a vertically downward orientation of the transmit antenna's main beam. Furthermore, the use of any mechanism that does not allow the main beam of the transmitter to be mounted vertically downward is prohibited
- This device shall be installed only at fixed locations. The LPR device shall not operate while being moved or while inside a moving container
- Hand-held applications are prohibited
- Marketing to residential consumers is prohibited

RF Exposure Requirements

To comply with FCC RF exposure compliance requirements, the device must be installed to provide a separation distance of at least 20 cm from all persons.

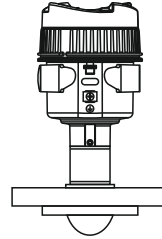
Description

4.1 Description

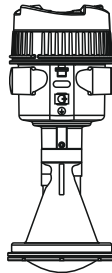
SITRANS LR500 series radar level transmitter with HART, 4 to 20 mA is ideal for level and volume measurements. It is suitable for liquids, slurries, and bulk solids.



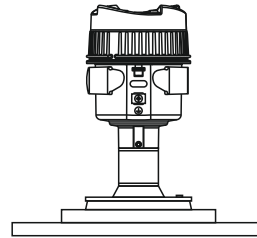
LR510 threaded lens antenna



LR530 flanged encapsulated antenna

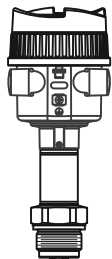


LR550 polymeric horn antenna



LR580 flanged lens antenna

A thermal extension part is supplied between the housing and the process connection, yielding extended process temperature capability. See image below of LR510 with extension as a reference.



4.2 Applications

SITRANS LR500 series is a 80 GHz advanced radar level device designed to measure **liquids, slurries and solids** in a variety of applications:

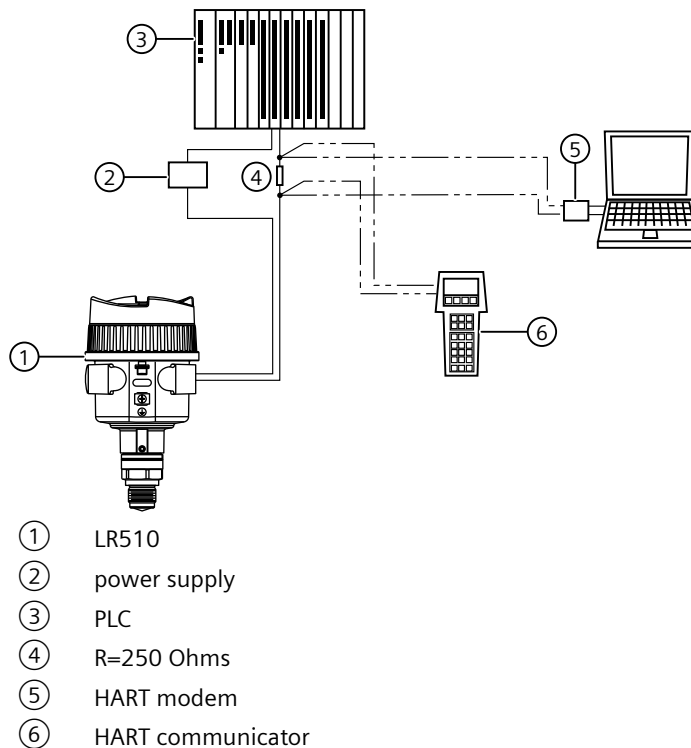
Liquids

- Storage: Device is optimized for inventory measurement of liquid bulk storage vessels. Slow filling and emptying cycles, calm surfaces.
- Process: Device is optimized for process control measurement of liquid applications. Fast filling and/or emptying cycles, turbulent surfaces including agitation.
- Open air: Device is optimized for open applications, for example river levels.

Solids

- Storage: Device is optimized for inventory measurement of large solid bulk storage silos. Slow filling and emptying cycles, calm surfaces.
- Process: Device is optimized for fast moving solid applications. Typically short range fast filling and/or emptying cycles, for example crusher level control or surge bin.
- Open air: Device is optimized for open applications, for example aggregate material piles or bunker bins.

4.3 System configuration



4.4 Communication

This device supports various communication protocols. For more information, see AUTOHOTPOT.

Hart communication

Applications using HART communications in a harsh EMC environment should use shielded cable. For more information, see AUTOHOTSPOT

Installing/mounting

5.1 Basic safety notes

5.1.1 Handling the device

 CAUTION

Do not lift a heavy device by the housing

If your device comes with a heavy flange, do not lift it by the housing. Instead, lift the device by the neck of the antenna or the flange itself.

 CAUTION

Damage to antenna surface

Take special care when handling the threaded and Flanged encapsulated antennas. Any damage to the antenna surface, particularly to the tip/lens, could affect performance. (For example, do not sit device on its lens antenna.)

 CAUTION

Handle by enclosure

Handle the device using the enclosure, not the process connection or tag, to avoid damage.

5.1.2 Pressure Equipment Directive (PED) 2014/68/EU

Note

Pressure Equipment Directive (PED) 2014/68/EU

Siemens Level Transmitters with flanged, threaded, or sanitary clamp type process mounts have no pressure-bearing housing of their own and, therefore, do not come under the Pressure Equipment Directive as pressure or safety accessories (see EU Commission Guideline A-08 and A-20).

 DANGER

Pressure applications

Danger to personnel, system and environment will result from improper disassembly.

- Never attempt to loosen, remove, or disassemble process connection while vessel contents are under pressure.

 WARNING

Wetted parts unsuitable for the process media

Risk of injury or damage to device.

Hot, toxic and corrosive media could be released if the wetted parts are unsuitable for the process medium.

- Ensure that the material of the device parts wetted by the process medium is suitable for the medium. Refer to the information in Technical specifications (Page 149).

Note

Material compatibility

Siemens can provide you with support concerning selection of parts wetted by process media. However, you are responsible for the selection of parts. Siemens accepts no liability for faults or failures resulting from incompatible materials.

 WARNING

Unsuitable connecting parts

Risk of injury or poisoning.

In case of improper mounting, hot, toxic, and corrosive process media could be released at the connections.

- Ensure that connecting parts (such as flange gaskets and bolts) are suitable for connection and process media.

 WARNING

Exceeded maximum permissible operating pressure

Risk of injury or poisoning.

The maximum permissible operating pressure depends on the device version, pressure limit and temperature rating. The device can be damaged if the operating pressure is exceeded. Hot, toxic and corrosive process media could be released.

Ensure that maximum permissible operating pressure of the device is not exceeded. Refer to the information on the nameplate and/or in Technical specifications (Page 149).

⚠ CAUTION**Hot surfaces resulting from hot process media**

Risk of burns resulting from surface temperatures above 65 °C (149 °F).

- Take appropriate protective measures, for example contact protection.
- Make sure that protective measures do not cause the maximum permissible ambient temperature to be exceeded. Refer to the information in Technical specifications (Page 149).

⚠ CAUTION**External stresses and loads**

Damage to device by severe external stresses and loads (e.g. thermal expansion or pipe tension). Process media can be released.

- Prevent severe external stresses and loads from acting on the device.

NOTICE**Installation regulations**

Installation shall only be performed by qualified personnel and in accordance with local governing regulations.

5.1.3 Installation location requirements

⚠ WARNING**Insufficient air supply**

The device may overheat if there is an insufficient supply of air.

- Install the device so that there is sufficient air supply in the room.
- Observe the maximum permissible ambient temperature. Refer to the information in the section Technical specifications (Page 149).

NOTICE**Aggressive atmospheres**

Damage to device through penetration of aggressive vapors.

- Ensure that the device is suitable for the application.

5.1.3.1 Direct sunlight

NOTICE
Direct sunlight Damage to device. The device can overheat or materials can deteriorate due to UV exposure. • Protect the device from direct sunlight. Consider use of optional sunshield. • Make sure that the maximum permissible ambient temperature is not exceeded. Refer to the information in Technical specifications (Page 149).

NOTICE
Direct sunlight Damage to device. The device can overheat or materials become brittle due to UV exposure. • Protect the device from direct sunlight. • Make sure that the maximum permissible ambient temperature is not exceeded. Refer to the information in Technical specifications (Page 149).

NOTICE
Strong vibrations Damage to device. • In installations with strong vibrations, mount the device in a low vibration environment.

5.1.4 Proper mounting

 WARNING
Incorrect mounting at Zone 0 Risk of explosion in hazardous areas. • Ensure sufficient tightness at the process connection. • Observe the standard IEC/EN 60079-14.

NOTICE**Incorrect mounting**

The device can be damaged, destroyed, or its functionality impaired through improper mounting.

- Before installing ensure there is no visible damage to the device.
- Make sure that process connectors are clean, and suitable gaskets and glands are used.
- Mount the device using suitable tools. Refer to the information in Technical specifications (Page 149).

5.1.5 Incorrect disassembly

**WARNING****Incorrect disassembly**

The following risks may result from incorrect disassembly:

- Risk through emerging media when connected to the process
- Risk of explosion in hazardous area

In order to disassemble correctly, observe the following:

- Before starting work, make sure that you have switched off all physical variables such as pressure, temperature, electricity etc. or that they have a harmless value.
- If the device contains hazardous media, it must be emptied prior to disassembly. Make sure that no environmentally hazardous media are released.
- Secure the remaining connections so that no damage can result if the process is started unintentionally.

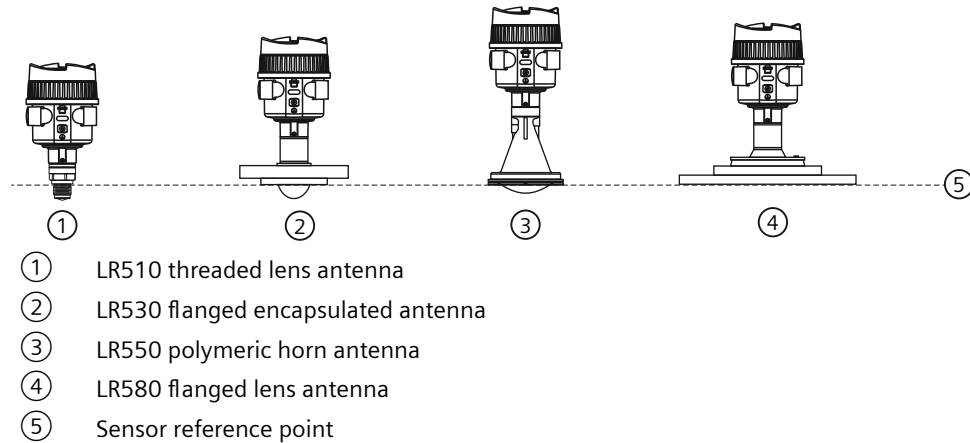
5.2 Proper materials

NOTICE**Proper materials**

The user is responsible for the selection of bolting and gasket materials (except for Flanged encapsulated antenna) which will fall within the limits of the process connection and its intended use, and which are suitable for the service conditions.

5.3 Sensor reference point

The measuring range of LR500 series devices begins at the end of the sensor reference point. The reference point is different depending on the sensor version.

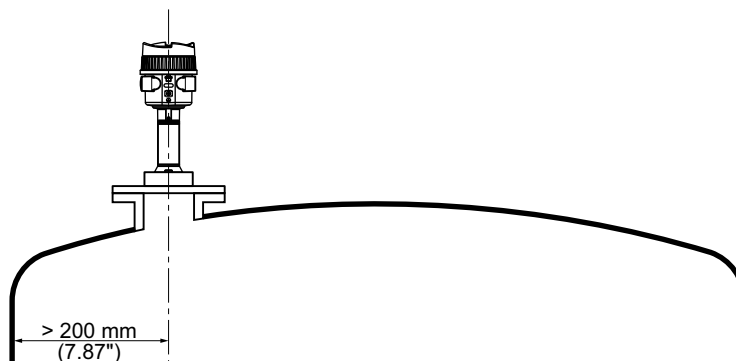


5.4 Nozzle mounting

Nozzle location

- Avoid central locations on tall, narrow vessels
- Nozzle must be vertical and clear of imperfections

The mounting location of the radar sensor should be a place where no other equipment or fixtures cross the path of the radar signals. Vessel installations, such as e.g. ladders, limit switches, heating spirals, struts, etc., can cause false echoes and impair the material echo. Make sure when planning your measuring point that the radar sensor has a "clear view" to the measured product. In case of existing vessel installations, a auto false echo suppression should be carried out during setup when the vessel is empty.



Beam angle

Note

- Beam width depends on antenna size and is approximate: see below.
- For details on avoiding false echoes, see Auto False Echo Suppression (Page 238).

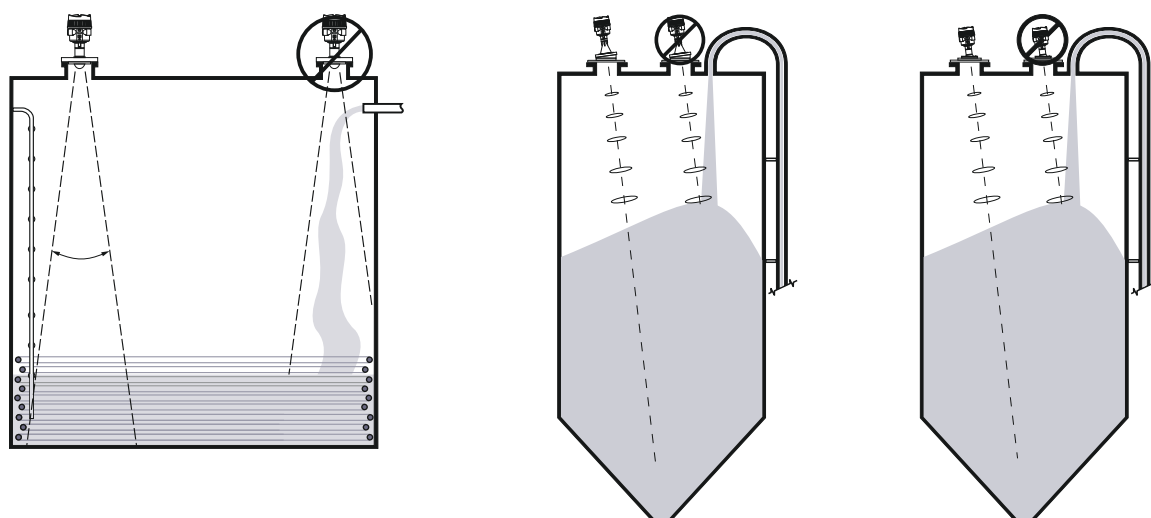
Beam angle is the width of the cone where the energy density is half of the peak energy density.

The peak energy density is directly in front of and in line with the antenna.

There is a signal transmitted outside the beam angle, therefore false targets may be detected.

Inflowing medium

The instrument should not be mounted too close to the inflowing medium, as the radar signal could be disrupted.



Silo with filling from top

The optimal mounting position is opposite the filling point. To avoid heavy soiling, the distance to any filter or dust collector should be as far as possible.

Version	Size	Beam angle
LR510	G $\frac{3}{4}$, $\frac{3}{4}$ NPT	14°
	G1, 1 NPT	10°
	G1½, 1½ NPT (250 °C)	10°
	G1½, 1½ NPT (150/200 °C)	7°
LR550		3°
LR530	≥ DN 25	10°
	≥ DN 50, 2"	6°
	≥ DN 80, 3"	3°

Version	Size	Beam angle
LR580	DN 80, 3"	3°
	DN 100, 4"	
	DN 150, 6"	

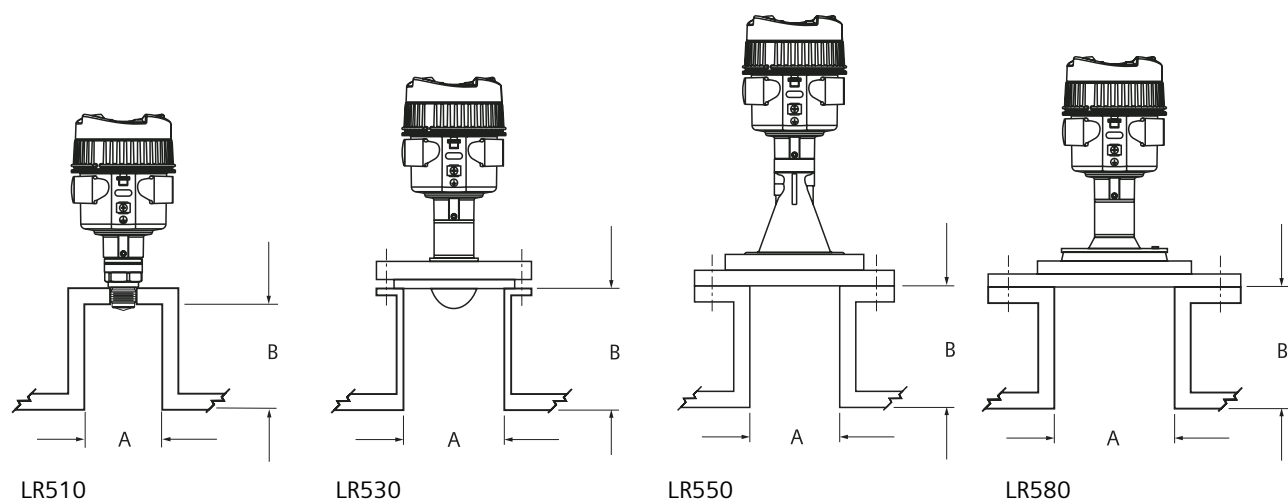
5.4.1 Nozzle mounting

For nozzle mounting, the nozzle should be as short as possible and its end rounded. This reduces false reflections from the nozzle.

With threaded connection, the antenna end should protrude at least 5 mm (0.2 in) out of the nozzle.

If the reflective properties of the medium are good, you can mount the device on nozzles longer than the antenna. The nozzle end should be smooth and burr-free, if possible also rounded.

When mounting on longer nozzles, we recommend carrying out an auto false echo suppression. You will find recommended values for nozzle heights in the following illustration or the tables. The values come from typical applications. Deviating from the proposed dimensions, also longer nozzles are possible, however the local conditions must be taken into account.



LR510 threaded connection

Nozzle diameter "A"		Nozzle height "B"	
40 mm	1 1/2"	≤ 150 mm	≤ 5.9"
50 mm	2"	≤ 200 mm	≤ 7.9"
80 mm	3"	≤ 300 mm	≤ 11.8"
100 mm	4"	≤ 400 mm	≤ 15.8"
150 mm	6"	≤ 600 mm	≤ 23.6"

LR530 flanged encapsulated PTFE antenna

Nozzle diameter "A"		Nozzle height "B"	
50 mm	2"	≤ 200 mm	≤ 7.9"
80 mm	3"	≤ 400 mm	≤ 15.8"
100 mm	4"	≤ 500 mm	≤ 19.7"
150 mm	6"	≤ 800 mm	≤ 31.5"

LR550 polymeric horn antenna

Nozzle diameter "A"		Nozzle height "B"	
80 mm	3"	≤400 mm	≤15.8"
100 mm	4"	≤500 mm	≤19.7"
150 mm	6"	≤800 mm	≤31.5"

LR580 lens antenna, aimer flange

Nozzle diameter "A"		Nozzle height "B"	
80 mm	3"	≤400 mm	≤15.8"
100 mm	4"	≤500 mm	≤ 19.7"
150 mm	6"	≤800 mm	≤ 31.5"

5.4.2 Thread sealing**WARNING****Thread sealing**

It may be necessary to use PTFE tape or other appropriate thread sealing compound, and to tighten the process connection beyond hand-tight. (The maximum recommended torque for Threaded versions is 40 N-m (30 ft.lbs.)

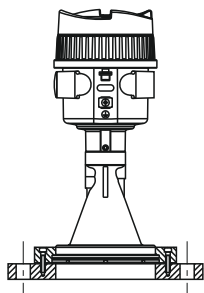
Note**G thread types**

G thread types are supplied with a Klingersil flat seal.

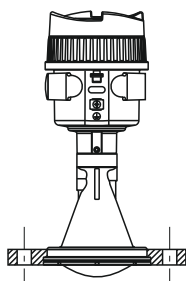
5.5 LR550 polymeric horn, liquids and solids

LR550 design

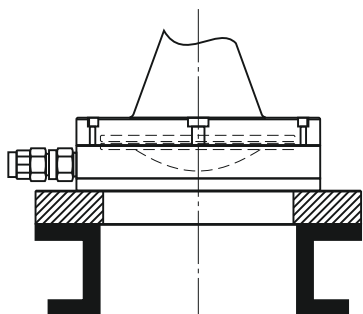
LR550 with adapter flange



LR550 with DN80/3" Universal flange



LR550 purging connection with adaptor flange, mounted on a nozzle

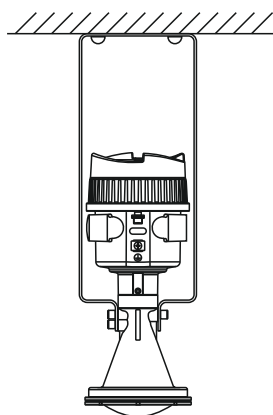


5.5.1 Mounting bracket

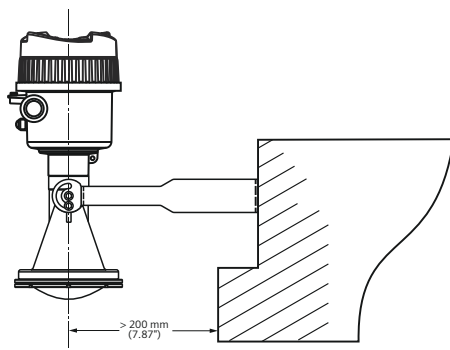
Mounting bracket

The optional mounting bracket allows simple mounting of the LR550 on a wall or ceiling. Especially in the case of open vessels, this is a simple and effective way to align the sensor to the surface of the bulk solid material.

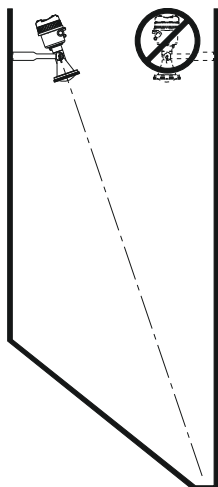
Ceiling mounting



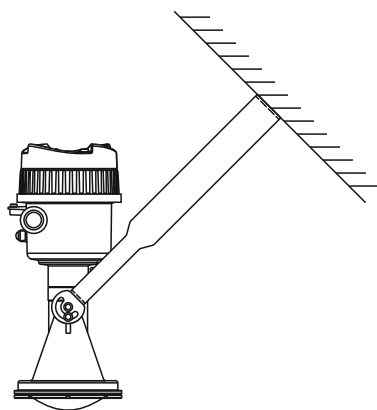
Wall mounting



Mounted at the largest possible distance from separating wall



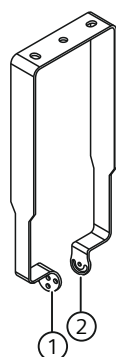
Inclined wall mounting



Mounting preparation

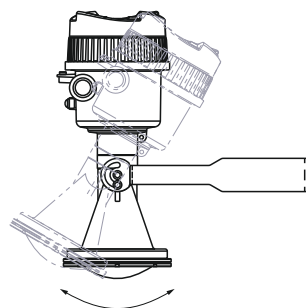
The mounting bracket is supplied unassembled (optionally) and must be screwed to the sensor before setup.

Required tools: Allen wrench size 4. There are two different ways of screwing the bracket to the sensor, see following illustration:



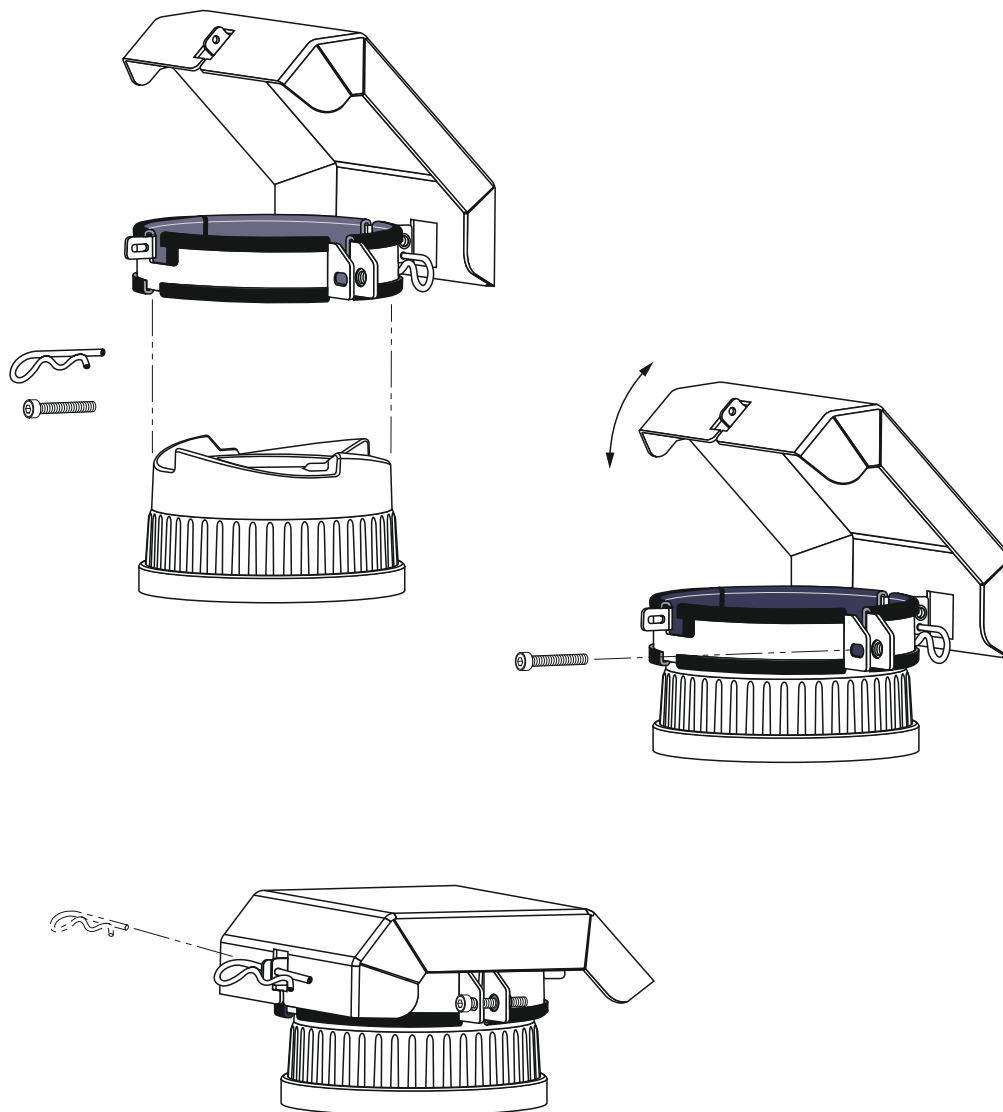
- ① For angle of inclination, in steps
- ② For angle of inclination, infinitely variable

Mounting bracket aiming



5.6 Sunshield

There is an optional sunshield to protect the display if the device is mounted in direct sunlight.



Connecting

6.1 Basic safety notes

 WARNING
Unsuitable cables, cable glands and/or plugs Risk of explosion in hazardous areas. • Use only cable glands/plugs that comply with the requirements for the relevant type of protection. • Tighten the cable glands in accordance with the torques specified in Technical specifications (Page 149). • Close unused cable inlets for the electrical connections. • When replacing cable glands, only use cable glands of the same type. • After installation, check that the cables are seated firmly.

 WARNING
Incorrect conduit system Risk of explosion in hazardous areas as result of open cable inlet or incorrect conduit system. • In the case of a conduit system, mount a spark barrier at a defined distance from the device input. Observe national regulations and the requirements stated in the relevant approvals.

6.1.1 Missing PE/ground connection

 WARNING
Missing PE/ground connection Risk of explosion in hazardous area Depending on the device version, connect the power supply as follows: • Connecting terminals: Connect the terminals according to the terminal connection diagram. First connect the PE/ground conductor.

! WARNING**Unprotected cable ends**

Risk of explosion through unprotected cable ends in hazardous areas.

- Protect unused cable ends in accordance with IEC/EN 60079-14.

! WARNING**Insufficient isolation of intrinsically safe and non-intrinsically safe circuits**

Risk of explosion in hazardous areas.

- When connecting intrinsically safe and non-intrinsically safe circuits ensure that isolation is carried out properly in accordance with local regulations for example IEC 60079-14.
- Ensure that you observe the device approvals applicable in your country.

6.1.2 Connecting or disconnecting in explosive environments

! WARNING**Connecting or disconnecting in explosive environments**

Connecting or disconnecting a powered device in explosive environments can lead to an explosion.

- Connect and disconnect in **non**-explosive environments.
- or -
- Remove power to the device before connecting or disconnecting in explosive atmosphere.

! WARNING**Connecting or disconnecting device in energized state**

Risk of explosion in hazardous areas.

- Connect or disconnect devices in hazardous areas only in a de-energized state.
- Install a suitable switch-off device.

Exceptions:

- Devices having the type of protection "Intrinsic safety Ex i" may also be connected in energized state in hazardous areas.



WARNING

Incorrect selection of type of protection

Risk of explosion in areas subject to explosion hazard.

This device is approved for several types of protection.

1. Decide in favor of one type of protection.
2. Connect the device in accordance with the selected type of protection.
3. In order to avoid incorrect use at a later point, make the types of protection that are not used permanently unrecognizable on the nameplate.

NOTICE

Ambient temperature too high

Damage to cable sheath.

- At an ambient temperature $\geq 60\text{ °C}$ (140 °F), use heat-resistant cables suitable for an ambient temperature at least 20 °C (36 °F) higher.

NOTICE

Condensation in the device

Damage to device through formation of condensation if the temperature difference between transportation or storage and the mounting location exceeds 20 °C (36 °F).

- Before taking the device into operation, let the device adapt for several hours in the new environment.

Note

Electromagnetic compatibility (EMC)

You can use this device in industrial environments, households and small businesses.

Metal enclosures ensure improved electromagnetic protection from high frequency radiation. This protection can be increased by grounding the enclosure.

6.1.3 Improvement of interference immunity

Note

Improvement of interference immunity

- Lay signal cables separate from cables with voltages > 60 V.
 - Use cables with twisted wires.
 - Keep device and cables at a distance from strong electromagnetic fields.
 - Take account of the conditions for communication specified in the Technical specifications (Page 149).
-

Note

Conduit seals

Use appropriate conduit seals to maintain applicable IP and NEMA ratings.

Note

DC input terminals

The DC input terminals shall be supplied from a source providing electrical isolation between the input and output, in order to meet the applicable safety requirements of IEC 61010-1. For example, SELV source.

Note

All field wiring must have insulation suitable for rated voltages.

6.2 Connecting SITRANS LR500 series

6.2.1 Wiring instructions

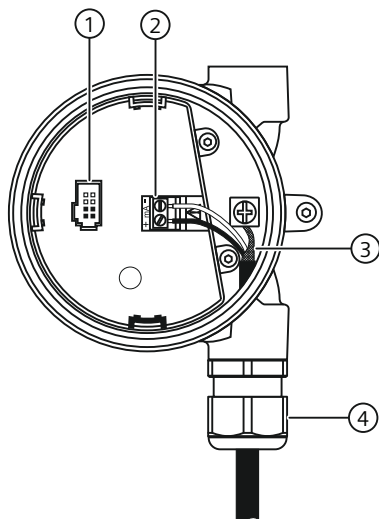
Note

Initial connection when display ordered separately from the device

Only follow the display wiring instructions if the display is ordered separately from the device. The display is connected when ordered at the same time as the device.

1. Turn lid by hand in a counter-clockwise direction to remove it from device.
2. Strip cable jacket for approximately 70 mm (2.75 inch) from end of cable, and thread wires through gland.

3. Connect wires to terminals as shown below: polarity is identified on terminal block.



- ① HMI connection
- ② Instrument connection
- ③ Cable shield loop power
- ④ Cable gland (or NPT cable entry)

4. Tighten gland to form a good seal.
5. Press female end of cable from optional display onto male four-pin connector.
6. Set optional HMI into enclosure. Buttons on HMI should sit over terminal block. Gently turn HMI a quarter turn clockwise to secure the HMI in the enclosure.
7. Replace device lid. Thread onto enclosure, turning clockwise. Hand tighten until mechanical stop is reached.

See also

Replacing the HMI (Page 132)

6.2.2 Input supply cable note

Note

Insulation thickness

The input supply cable should have an insulation thickness of at least 0.5 mm.

6.2.3 Connecting field device and SITRANS AW050 Bluetooth adapter

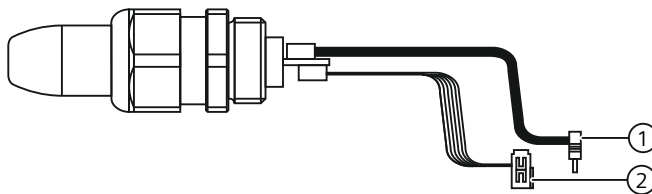
Procedure

NOTICE**General purpose use**

SITRANS AW050 Bluetooth module is only approved for use with general purpose non-hazardous devices

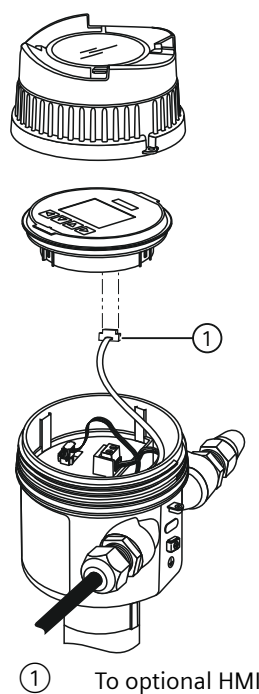
When the HMI adapter is already installed, follow these steps to connect the field device:

1. Remove the current HMI cable.
2. Connect the blue cable to the HMI display.
3. Connect the red cable to the device.



- ① to the optional HMI
- ② to the electronics

The cables are best run separately inside the enclosure as shown in the figure following. Care must be taken when installing the display to be sure that the ribbon cables are not pinched or torn. Excessive force should not be necessary for installation of the display mounting.



Use of the display while the AW050 is installed

When power is applied to the device, the display will activate for approximately 15 seconds, and then deactivate for 5 seconds as the AW050 integrates.

When the AW050 connection is made through SITRANS mobile IQ, the display will not be accessible. When the AW050 Bluetooth connection is disconnected, the display will activate again.

Note

Connecting a SITRANS LR500 series display after a connected and functioning AW050 will require a power cycle of the LR500 series for the display to function properly.

6.2.3.1 Installing or replacing Bluetooth adapter

Procedure

Follow these steps to install or replace the Bluetooth adapter. For more information, refer to illustrations in Connecting field device and SITRANS AW050 Bluetooth adapter (Page 52).

1. Run both cables through conduit entry where Bluetooth adaptor will be installed.
2. Install cable gland and tighten against enclosure. Ensure the adapter cables are not pinched inside the housing.
3. Install the O-ring onto the adapter against the step of the shaft.

6.3 Hazardous area installations

4. Connect wires to adapter as shown in the illustration above. Note that the spacing of the connectors on the adapter is offset. To connect the wires to the adapter, first connect the red wire to the connector closest to the edge of the circuit board. Next, connect the blue wire to the connector that is furthest from the edge of the circuit board.
5. Slide the adapter into the gland against the O-ring.
6. Tighten the gland to the adapter, without twisting the cables.
7. Plug the cables into the display and electronics.

6.3 Hazardous area installations



WARNING

Improper power supply

Risk of explosion in hazardous areas as result of incorrect power supply.

- Connect the device in accordance with the specified power supply and signal circuits. The relevant specifications can be found in the certificates, in Technical specifications (Page 149) or on the nameplate.

6.3.1 Nameplates for hazardous area installation

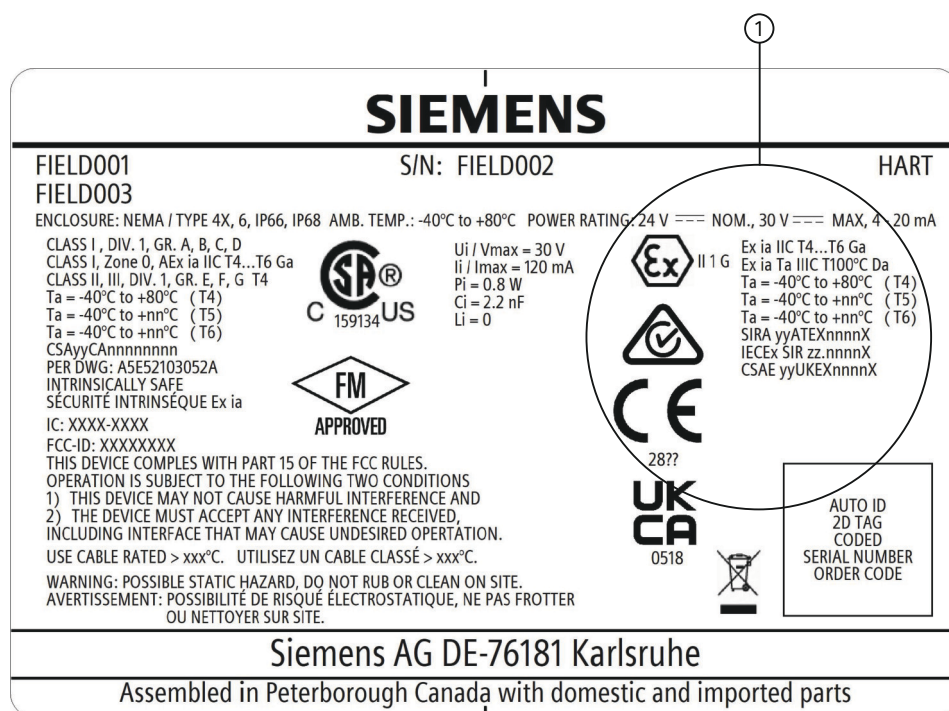
6.3.1.1 Intrinsic safety wiring

Device nameplate

Note

Sample nameplate

This nameplate is given as an example only.



① ATEX and UKEX certificates

The ATEX certificate number (CSAne 23ATEX1113X) listed on the nameplate can be downloaded from our website:

AUTOHOTSPOT

The UKEX certificate number (CSAE 23UKEX1087X) listed on the nameplate can be downloaded from our website:

Product page

Go to **Support > Approvals/Certificates**.

The IECEx certificate listed on the nameplate can be viewed on the IECEx website:

AUTOHOTSPOT

Under the "Certified Equipment" tab in the "Certificate/ExTR/QAR number" field, enter the IECEx CSA number: 23.0025X.

For more information on hazardous area installations, refer to AUTOHOTSPOT.

Connection drawing (FM/CSA)

The FM/CSA_{US} connection drawing number (A5E52103052A) listed on the device nameplate can be downloaded from our website:

AUTOHOTSPOT

Go to **Technical Info > Images, graphics, drawings**.

6.3.1.2 Non-incendive wiring

Connection drawing (FM)

The FM connection drawing number (A5E52277176) listed on the device nameplate can be downloaded from our website:

AUTOHOTSPOT

Go to **Technical info > Images, graphics, drawings**.

6.3.2 Further information related to hazardous area installations

- For power demands see AUTOHOTSPOT.
- For wiring requirements follow local regulations.
- Use approved cable gland/conduit seal to maintain Type 4X, Type 6, IP66, IP68 ratings.
- For hazardous area approvals, see AUTOHOTSPOT.

6.3.3 Instructions specific to hazardous area installation

6.3.3.1 Special conditions for safe use

Parts of the enclosure are non-conducting and may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charge on non-conducting surfaces.

6.3.3.2 Instructions specific to hazardous area installations (in accordance with IEC 60079-0:2011 clause 30)

The following instructions relevant to safe use in a hazardous area apply to equipment covered by certificate numbers CSANe 23ATEX1113X, CSAE 23UKEX1087X, IECEx CSA 23.0025X.

1. The certification marking is as follows:

Certificate number:	CSANe 23ATEX1113X	CSAE 23UKEX1087X	IECEx CSA 23.0025X
Certification code:	Ex ia IIC T4...T6 Ga	Ex ia IIC T4...T6 Ga	Ex ia IIC T4...T6 Ga
Other marking:		 	

2. The equipment may be used in zones 0, 1 & 2 with flammable gases and vapours with apparatus groups IIA, IIB & IIC and with temperature classes T4...T6.
3. Installation shall be carried out in accordance with the applicable code of practice by suitably-trained personnel.

4. There are no special checking or maintenance conditions other than a periodic check.
5. With regard to explosion safety, it is not necessary to check for correct operation.
6. The equipment contains no user-replaceable parts and is not intended to be repaired by the user. Repair of the equipment is to be carried out by the manufacturer, or their approved agents, in accordance with the applicable code of practice.
7. Repair of this equipment shall be carried out in accordance with the applicable code of practice.
8. If the equipment is likely to come into contact with aggressive substances, e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected thus ensuring that the type of protection is not compromised.
9. The certificate number has an 'X' suffix which indicates that special conditions of installation and use apply. Those installing or inspecting this equipment must have access to the contents of the certificate or these instructions. The conditions listed in the certificate are reproduced below:
 - Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces.
 - In addition, the equipment shall only be cleaned with a damp cloth. This is particularly important if the equipment is installed in a zone 0 location.

See also

Product documentation (Page 179)

Technical support (Page 180)

Commissioning

7.1 Basic safety notes

DANGER

Toxic gases and liquids

Danger of poisoning when venting the device: if toxic process media are measured, toxic gases and liquids can be released.

- Before venting ensure that there are no toxic gases or liquids in the device, or take the appropriate safety measures.

WARNING

Improper commissioning in hazardous areas

Device failure or risk of explosion in hazardous areas.

- Do not commission the device until it has been mounted completely and connected in accordance with the information in Technical specifications (Page 149).
- Before commissioning take the effect on other devices in the system into account.

WARNING

Commissioning and operation with error message

If an error message displays, correct operation is no longer guaranteed.

- Check the severity of the error.
- Correct the error.
- If the error still exists:
 - Take the device out of operation.
 - Do not restart the device.

The same risk continues to apply when error messages are switched off or disabled.

WARNING

Hot surfaces

Risk of burns resulting from hot surfaces.

- Take corresponding protective measures, for example by wearing protective gloves.

! WARNING**Loss of explosion protection**

Risk of explosion in hazardous areas if the device is open or not properly closed.

- Close the device as described in Installing/mounting (Page 33).

! WARNING**Opening device in energized state**

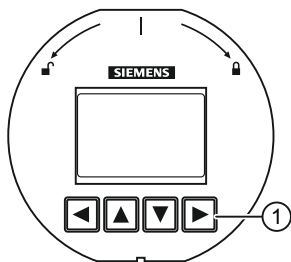
Risk of explosion in hazardous areas

- Only open the device in a de-energized state.
- Check prior to commissioning that the cover, cover locks, and cable inlets are assembled in accordance with the directives.

Exception: Devices having the type of protection "Intrinsic safety Ex i" may also be opened in energized state in hazardous areas.

7.2 Local commissioning

SITRANS LR500 series can be quickly commissioned using wizards, and menu driven parameters. The parameters can be modified locally using the device display and buttons, also known as the Human Machine Interface (HMI).



① Local device buttons

The quick start wizards provide an easy step-by-step procedure to help you configure the device for a simple application. We recommend that you configure your application in the following order:

- First, run the "Quick commissioning wizard" for your application.
- Next, if there are known false echoes present, run the "Auto false echo suppression wizard" (optional) to prevent false echo detection when the vessel is empty or below the false echo level.
- After completing the wizards, configure any custom parameters via the parameter menus.
- Lastly, if desired, configure alarms and warnings using "Limit monitoring and event counter" via a remote engineering system.

You can access the quick commissioning wizards:

- Locally via HMI
- From a remote location via mobile IQ, App with AW050 module or SIMATIC PDM EDD

See also

Quick commissioning (Page 64)

Application examples (Page 79)

Parameter assignment (Page 91)

7.2.1 Activating SITRANS LR500 series

Power up the device.

SITRANS LR500 series runs through an initialization routine for approximately 30 seconds or less. Next, the device name and then firmware revision appear. The display goes into **measurement view** (measured process values show as "- - - -" before the first measurement is completed). The "Distance" measurement (displayed in meters) appears first by default. Press ▼ button to scroll through other values in **measurement view**.

The device is now ready for operation.

7.2.2 Local HMI

Note

Low temperature affects local display

The operating temperature of the display is -40 °C to +80 °C; -40 °C to -25 °C with reduced readability.

Note

Backlight is always on

The SITRANS LR500 series has a backlight which is always on to assist viewing in very low light conditions. This backlight will switch off if the voltage is less than 14v

Note

Show menu numbers on local display

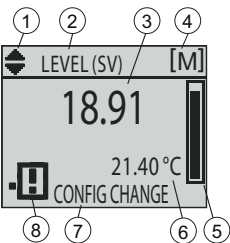
To view menu numbers on the device, parameter "Service view" must be enabled. (Go to menu "Setup > Local display".)

- The item number of the current selection appears in the **info field**.
- The menu number in which the current selection resides, appears on the **title line** (thus no menu numbers appear for top-level menu items, such as "QUICK START", "SETUP", etc.).

Refer to full device menu in **HMI menu structure**.

7.2.2.1 The LCD display

Measurement mode display¹⁾²⁾: Normal operation



- | | |
|---|--|
| ① Toggle indicator ¹⁾ for PV or SV (primary or secondary values) | ⑦ Text area displays status messages |
| ② Selected operation: level, space, or distance | ⑦ Text area displays a fault code and an error message |
| ③ Measured value (level, space, or distance) | ⑧ Device status indicator |
| ④ Units | ⑧ Service required icon appears |
| ⑤ Bar graph indicates level | |
| ⑥ Secondary region indicates on request ²⁾ electronics temperature, echo confidence, loop current, or distance | |

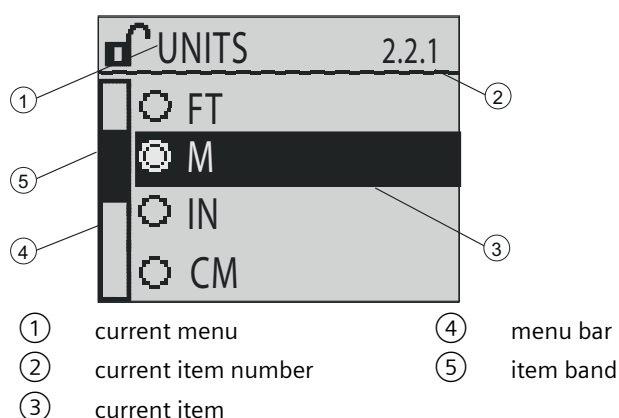
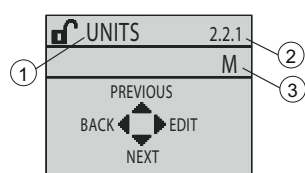
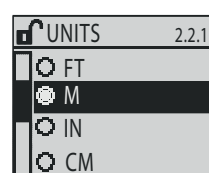
Fault present:
S: 0 LOE



PROGRAM mode display

Navigation view

- A visible menu bar indicates the menu list is too long to display all items.
- The depth of the item band on the menu bar indicates the length of the menu list: a deeper band indicates fewer items.
- The position of the item band indicates the approximate position of the current item in the list. A band halfway down the menu bar indicates the current item is halfway down the list.

**Parameter view****Edit view**

- ① parameter name
 ② parameter number
 ③ parameter value/selection

1) Press UP or DOWN arrow to switch

2) In response to a key press request. For details, see AUTOHOTSPOT.

7.2.3**Programming**

From **measurement view**, press ► button to enter **parameter view** and open the first menu level **M 01**.

To select a listed option:

1. Navigate to the desired parameter.
2. Press ► button to open **edit view**. The current selection is highlighted.
3. Scroll to a new selection using ▲ and ▼ buttons.
4. Press ► button to accept it. The display returns to **parameter view** and shows the new selection.

To change a numeric value:

1. Navigate to the desired parameter.
2. When selected, the current value is displayed.
3. Press ► button to configure it. The "EDIT" symbol is flashing.
4. Use ▲ and ▼ buttons to increase or decrease the value. Press and hold button to increase scrolling speed.

5. To escape without saving your changes, press ◀ button to return to **parameter view**.
6. Press ▶ button to accept the new value. The display returns to **parameter view** ("EDIT" symbol is no longer flashing) and shows the new selection. Review for accuracy.

Button functions for editing

Button	Name		Function
	UP or DOWN arrow	Selecting parameter settings	Scrolls to item
		Alpha-numeric editing	Increases or decreases value. Pressing and holding will increase scrolling speed through values.
	RIGHT arrow	Selecting parameters	Accepts the data (writes the parameter setting)
	LEFT arrow	Selecting parameter settings	Cancels edit view without changing the parameter setting.

7.2.4 Wizards

7.2.4.1 Quick commissioning

Quick commissioning wizards

A wizard provides an easy step-by-step procedure that configures the device for a simple application. To configure the device for applications of level, space, distance, or volume, use the "Quick commissioning wizard" via HMI. It is possible to configure custom applications employing more complex vessel shapes via the HMI, but we suggest using a remote engineering system, such as SIMATIC PDM.

Quick commissioning wizards are also available remotely using various software packages:

- SIMATIC PDM

Quick commissioning wizard

This device provides a single quick commissioning wizard that can be used for various applications.

The initial wizard steps are common for all application types. Subsequent wizard parameters will vary depending on the application you choose. For the purpose of documenting, two

separate lists follow. These lists include the wizard parameters available to commission each application type (see links below).

1. From **measurement view**, press  button to enter **parameter view**. The first level menu (Quick start) will display. Press  button to enter this menu.
2. Press  button again to enter "Quick commissioning wizard" (Commission). In the wizard, it is not necessary to press  button to navigate to the next step. In each step, you are taken directly to **edit view**.
3. Set "Operation", "Material type", and "Application type". Subsequent wizard parameters will vary depending on the application you choose. See links below to step you through the wizard appropriate to your application.
4. Select "Yes" to confirm all parameter changes as the final step in the quick commissioning wizard, and return to **parameter view**. "DONE" will appear on the main line of the display.
5. Press  button three times to return to **measurement view**.

Note

Important information regarding the use of commissioning wizard

- A reset to factory defaults should be performed before running "Quick commissioning wizard" if the device has been used in a previous application. See AUTOHOTSPOT.
 - Settings for quick commissioning wizard are inter-related and changes apply only after "Confirm" is set to 'Yes' in final step.
 - Do not use quick commissioning wizard to modify individual parameters. (See instead chapter AUTOHOTSPOT.)
Perform customization for your application only *after* "Quick commissioning wizard" has been completed.
-

Note

Commissioning wizard may fail due to invalid configuration

Device may show "ERROR" if the commissioning wizard completes with some invalid configurations. Invalid value(s) may be stored in the parameter(s).

- Review application parameters, then perform a "Factory reset" or re-run the "Quick commissioning wizard" with proper values to clear the invalid configuration.
-

Note

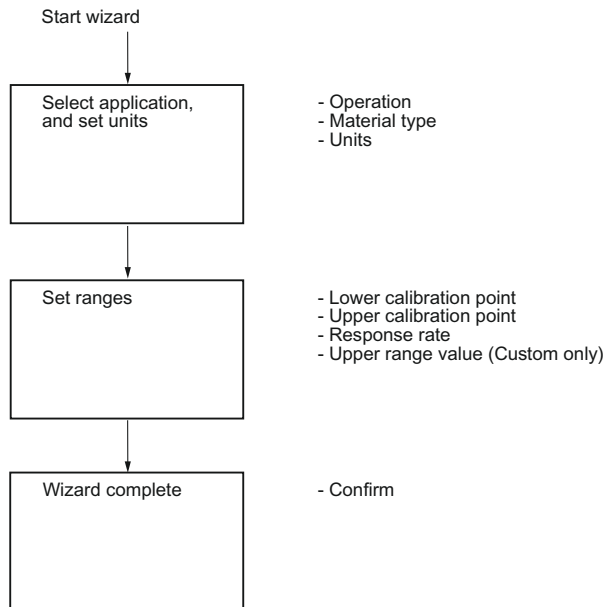
Update of process value on display when commissioning wizard run via EDD

Process values shown in **measurement view** on local display will not automatically update to reflect a change made remotely via "Wizard - Quick start...".

- To have device process values update when configured remotely, use local buttons to take device in and out of **measurement view** (i.e. go to **parameter view** then back to **measurement view**).
-

Quick commissioning: Level/Space/Distance/Custom

<< Revise graphic to include 'Application type', 'Custom units' ? >>

**Note****Distance and Custom applications**

- When "Operation" is set to "Distance", setting the upper calibration point is not required (will not appear in the wizard).
- Only when "Operation" is set to "Custom", is the upper range value required (will appear in the wizard).

Note**Output remains active**

While the device is being configured, the output remains active and continues to respond to changes in the process.

Note**Parameter options**

In the following wizard steps, a full list of options for each parameter is shown. However, some options may not appear on the device, based on the application selected.

Operation

Sets operation mode which defines output and local display.

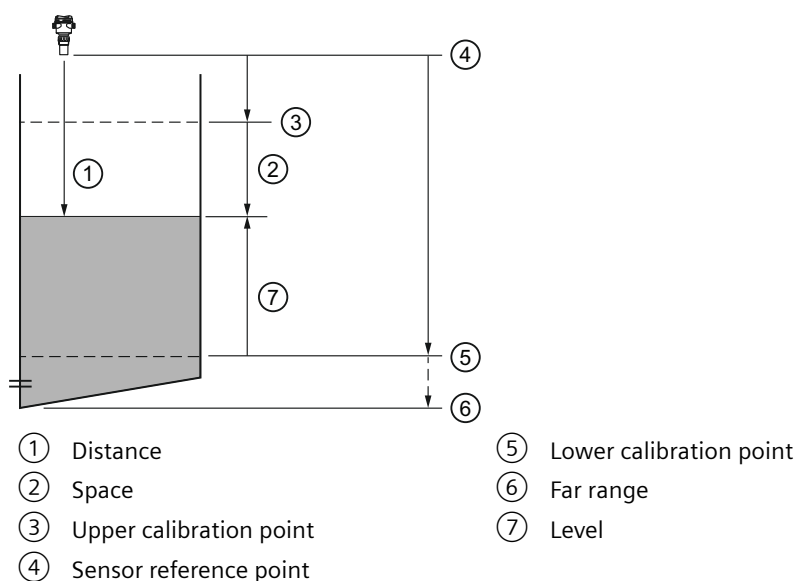
Setting	Level
	Space
	Distance
	Volume
	Custom
Default	Level

<< See if 'custom setup_note' that follows this topic is applicable to Level/Custom and/or Volume wizard >>

Note

Completing a Custom setup

For a custom application ("Operation" set to "Custom"), at least one pair of input and output breakpoints (parameters "X-value" and "Y-value") must be defined, *after* the wizard is complete. See AUTOHOTSPOT.



Setting	Description	Reference point
Level	Height of material	Lower calibration point (process empty level)
Space	Distance to material surface	Upper calibration point (process full level)
Distance		Sensor reference point
Custom	Linearization table (level/volume breakpoints)	Lower calibration point

Material type

Used to optimize performance based on material type.

Setting	Liquid
	Solid
Default	Liquid

Application type

Used to optimize performance based on application type.

Setting	Storage
	Process
	Open
Default	Storage

Units

Sets units used by the device.

			Default
Setting	Meters	m	3 decimal places
	Centimeters	cm	1 decimal place
	Millimeters	mm	0 decimal places
	Feet	Ft	3 decimal places
	Inches	in	2 decimal places
Default	Meters	m	3 decimal places

<< Check if reused topics below (re decimal places and hash marks) are applicable to LR5xx, AND if "Custom units" parameter should be added to wizard (were only settable via remote operation in LU240). >>

Note**Dynamic decimal places**

Each setting for parameter "Units" has a default number of decimal places used to show the process value on the local display. However, if the value is too large to show on the segment display, the decimal places will be automatically adjusted to show the process value.

Note**Process value too large to display**

In some cases, even with dynamic decimal places, it is possible that the process value be too large to show on the local display, "#####" will show instead.

If this occurs in a typical application:

- Adjust parameter "Units" so that a smaller value can be shown, e.g. use meters instead of millimeters.

If this occurs in a custom application:

- Adjust parameter "Custom units" so that a smaller value can be shown, e.g. use tons instead of pounds.
- Note that a change to custom units also requires a scaling adjustment (see AUTOHOTSPOT).

Lower calibration point

Sets distance from sensor reference point to lower calibration point: usually process empty level.

<< remove LU240 versions and add LR5xx setting/default. Confirm same values used in wizard and Calibration menu. >>

Setting	• 0 to 3 m (3 m version) • 0 to 6 m (6 m version) • 0 to 12 m (12 m version)
Default	• 3 m (3 m device) • 6 m (6 m version) • 12 m (12 m version)

Defined in parameter "Units".

Upper calibration point

Sets distance from sensor reference point to upper calibration point: usually process full level.

<< remove LU240 versions and add LR5xx setting/default. Confirm same values used in wizard and Calibration menu. >>

Setting	• 0 to 3 m (3 m version) • 0 to 6 m (6 m version) • 0 to 12 m (12 m version)
Default	0 m

Defined in parameter "Units".

Response rate

Sets reaction speed of device to measurement changes in target range.

Use a setting just faster than the maximum filling or emptying rate (whichever is faster).

<< Check that m/min numbers are correct/have not changed >>

Setting	Slow	0.1 m/min (fill/empty rate limit)
	Medium	1.0 m/min (fill/empty rate limit)
	Fast	10.0 m/min (fill/empty rate limit)
Default	Slow	

Custom units

Sets unit text to display, in a custom application. Limited to 16 characters.

<< Is this true for LR5xx, and is location of parameter Custom units correct in wizard? >>

The text entered is simply for display purposes. No unit conversion occurs.

<< Verify that parameter names are correct, and decide if 'Damping value' be changed to 'Sensor damping value' or removed from list if SDV is affected but not visible to user in LR5xx. Any changes to the following note must be corrected in "Empty rate limit - settings" topic. >>

Note

Rate parameters

The rate parameters "Fill rate limit", "Empty rate limit", and "Damping value" work in conjunction, and are affected by parameter "Response rate" (set in the "Quick commissioning" wizard). The rate parameters automatically adjust when parameter "Response rate" is altered, but any changes made to the rate parameters following the completion of the wizard will supersede the response rate setting.

<< Include only if explained further in TechRef chapter (as per LU240) >>

Further information can be found in AUTOHOTSPOT.

Upper range value

Sets the maximum value that corresponds to level "full".

Setting	0 to 9999999
Default	100 <Custom units>

<< Check if following note (re "Upper scaling point") should be used in LR5xx >>

Note

"Upper range value" (URV) versus "Upper scaling point"

- When parameter "Upper range value" is set within the "Quick commissioning wizard", the parameter "Upper scaling point" is automatically adjusted to the same value.
- Setting a value for either parameter *outside* of the wizard will not automatically adjust the other value.

<< Check if following note (re "Upper scaling point") should be used in LR5xx >>

Note

Changing custom units

If a change is made to custom units, be sure to rescale the output, as rescaling for custom units is not handled automatically by the device.

- Use parameters "Upper range value" and "Upper scaling point" to rescale output.

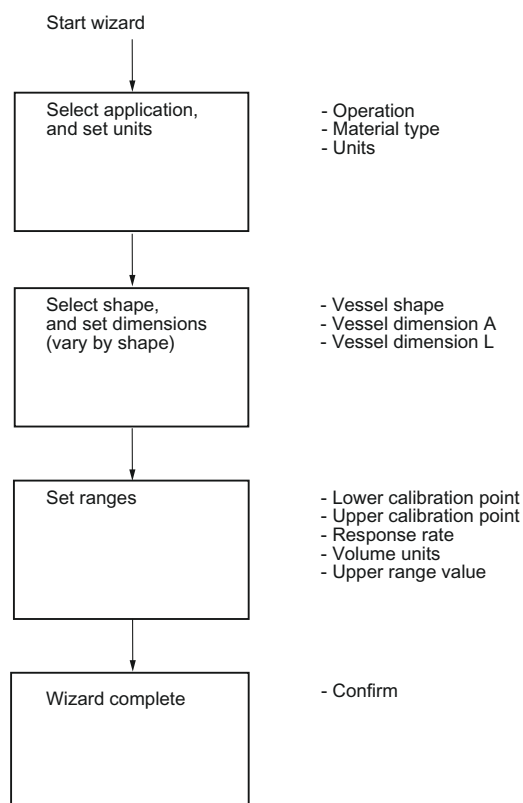
Confirm

Applies settings as last step in wizard.

Setting	Yes	Wizard completes and settings are applied.
	No	Returned to start of wizard. (Settings are saved to perform wizard again, but not applied until "Confirm" set to "Yes".)
Default	No	

Quick commissioning: Volume

<< Revise graphic to include 'Application type', and 'Custom units' ? >>



Note**Output remains active**

While the device is being configured, the output remains active and continues to respond to changes in the process.

Note**Parameter options**

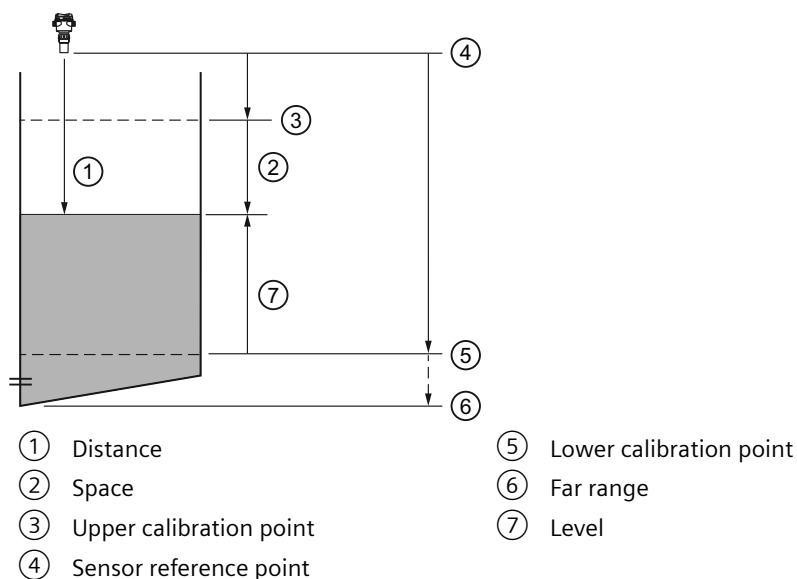
In the following wizard steps, a full list of options for each parameter is shown. However, some options may not appear on the device, based on the application selected.

Operation

Sets operation mode which defines output and local display.

Setting	Level
	Space
	Distance
	Volume
	Custom
Default	Level

<< See if 'custom setup_note' that follows this topic is applicable to Level/Custom and/or Volume wizard >>



Setting	Description	Reference point
Volume	Volume of material in Volume units (based on level)	Lower calibration point

Material type

Used to optimize performance based on material type.

Setting	Liquid
	Solid
Default	Liquid

Application type

Used to optimize performance based on application type.

Setting	Storage
	Process
	Open
Default	Storage

Units

Sets units used by the device.

			Default
Setting	Meters	m	3 decimal places
	Centimeters	cm	1 decimal place
	Millimeters	mm	0 decimal places
	Feet	Ft	3 decimal places
	Inches	in	2 decimal places
Default	Meters	m	3 decimal places

<< Check if reused topics below (re decimal places and hash marks) are applicable to LR5xx, AND if "Custom units" parameter should be added to wizard (were only settable via remote operation in LU240). >>

Note

Dynamic decimal places

Each setting for parameter "Units" has a default number of decimal places used to show the process value on the local display. However, if the value is too large to show on the segment display, the decimal places will be automatically adjusted to show the process value.

Note**Process value too large to display**

In some cases, even with dynamic decimal places, it is possible that the process value be too large to show on the local display, "#####" will show instead.

If this occurs in a typical application:

- Adjust parameter "Units" so that a smaller value can be shown, e.g. use meters instead of millimeters.

If this occurs in a custom application:

- Adjust parameter "Custom units" so that a smaller value can be shown, e.g. use tons instead of pounds.
- Note that a change to custom units also requires a scaling adjustment (see AUTOHOTSPOT).

Vessel shape

Sets vessel shape, and allows device to calculate volume in addition to level.

Settings	Linear vessel
	Conical bottom vessel
	Parabolic bottom vessel
	Half sphere bottom vessel
	Flat sloped bottom vessel
	Cylinder vessel
	Parabolic ends vessel
	Sphere vessel
Default	Linear vessel

Vessel dimension A

Sets height of vessel bottom when bottom is conical, parabolic, half spherical, or flat sloped. If horizontal parabolic ends vessel, sets depth of end.

Setting	0 to 99.999 m
Default	0

See AUTOHOTSPOT for illustration.

Vessel dimension L

Sets length of cylindrical section of horizontal parabolic ends vessel.

Setting	0 to 99.999 m
Default	0

See AUTOHOTSPOT for illustration.

Lower calibration point

Sets distance from sensor reference point to lower calibration point: usually process empty level.

Upper calibration point

Sets distance from sensor reference point to upper calibration point: usually process full level.

Response rate

Sets reaction speed of device to measurement changes in target range.

Use a setting just faster than the maximum filling or emptying rate (whichever is faster).

<< Check that m/min numbers are correct/have not changed >>

Setting	Slow	0.1 m/min (fill/empty rate limit)
	Medium	1.0 m/min (fill/empty rate limit)
	Fast	10.0 m/min (fill/empty rate limit)
Default	Slow	

<< Verify that parameter names are correct, and decide if 'Damping value' be changed to 'Sensor damping value' or removed from list if SDV is affected but not visible to user in LR5xx. Any changes to the following note must be corrected in "Empty rate limit - settings" topic. >>

Note**Rate parameters**

The rate parameters "Fill rate limit", "Empty rate limit", and "Damping value" work in conjunction, and are affected by parameter "Response rate" (set in the "Quick commissioning" wizard). The rate parameters automatically adjust when parameter "Response rate" is altered, but any changes made to the rate parameters following the completion of the wizard will supersede the response rate setting.

<< Include only if explained further in TechRef chapter (as per LU240) >>

Further information can be found in AUTOHOTSPOT.

Volume units

Sets volume measurement units.

Custom units

Sets unit text to display, in a custom application. Limited to 16 characters.

<< Is this true for LR5xx, and is location of parameter Custom units correct in wizard? >>

The text entered is simply for display purposes. No unit conversion occurs.

Upper range value

Sets the maximum value that corresponds to level "full".

Setting	0 to 9999999
Default	100 liters

<< Check if following note (re "Upper scaling point") should be used in LR5xx >>

Note

"Upper range value" (URV) versus "Upper scaling point"

- When parameter "Upper range value" is set within the "Quick commissioning wizard", it automatically sets the "Upper scaling point" to the same value.
- Setting a value for either parameter *outside* of the wizard, will not automatically adjust the other value.

<< Check if following note (re "Upper scaling point") should be used in LR5xx >>

Note

Changing custom units

If a change is made to custom units, be sure to rescale the output, as rescaling for custom units is not handled automatically by the device.

- Use parameters "Upper range value" and "Upper scaling point" to rescale output.

Confirm

Applies settings as last step in wizard.

Setting	Yes	Wizard completes and settings are applied.
	No	Returned to start of wizard. (Settings are saved to perform wizard again, but not applied until "Confirm" set to "Yes".)
Default	No	

7.2.4.2 Demo wizard

Used to optimize the device for demonstration purposes, increasing measurement response time.

Units

Sets units used by the device.

			Default
Setting	Meters	m	3 decimal places
	Centimeters	cm	1 decimal place
	Millimeters	mm	0 decimal places
	Feet	Ft	3 decimal places
	Inches	in	2 decimal places
Default	Meters	m	3 decimal places

<< Check if reused topics below (re decimal places and hash marks) are applicable to LR5xx, AND if "Custom units" parameter should be added to wizard (were only settable via remote operation in LU240). >>

Lower calibration point

Sets distance from sensor reference point to lower calibration point: usually process empty level.

Confirm

Applies settings as last step in wizard.

Setting	Yes	Wizard completes and settings are applied.
	No	Returned to start of wizard. (Settings are saved to perform wizard again, but not applied until "Confirm" set to "Yes".)
Default	No	

7.2.4.3 AFES wizard

Used to prevent false echo detection over a specified range.

Use AFES wizard if there are known obstructions in the application and if false echoes are anticipated. Perform the AFES wizard when the material level is low.

To run the wizard, enter the auto false echo suppression range.

Auto false echo suppression range

Sets end point of the learned TVT distance.

To calculate value

1. Determine the auto false echo suppression range by measuring the actual distance from the sensor reference point to the material surface using a rope or tape measure.
2. Subtract 0.5 m (20") from this distance and use the resulting value.

Note**For best results with AFES**

- Set up auto false echo suppression during commissioning if possible, by running "Auto false echo suppression wizard".
 - Ensure material level is below all known obstructions at the moment when "Auto false echo suppression wizard" learns the TVT. Ideally the vessel should be empty or almost empty.
 - Use auto false echo suppression only if target is greater than one meter from transmitter face (sensor reference point)
 - Note the distance to material level when learning the echo profile, and set value in parameter "Auto false echo suppression range" to a shorter distance to avoid the material echo being screened out.
 - If the vessel contains an agitator, it should be running.
-

Once the wizard completes successfully, parameter "Auto false echo suppression" is set to "Enabled" and the learned TVT will be used.

For more information about auto false echo suppression, see AUTOHOTSPOT.

Confirm

Applies settings as last step in wizard.

Confirm - settings

Setting	Yes	Wizard completes and settings are applied.
	No	Returned to start of wizard. (Settings are saved to perform wizard again, but not applied until "Confirm" set to "Yes".)
Default	No	

7.2.5 Requesting an echo profile

After commissioning the device, an echo profile may be viewed on the HMI or using a remote engineering system, such as SIMATIC PDM.

For details, see SIMATIC PDM (Page 187).

7.2.6 Device address

Setting a device address is not necessary for local operation, but must be set if configuring the device for use on a HART network. See AUTOHOTSPOT.

7.2.7 Testing the configuration

After configuring the device, it is recommended that you test the device to ensure that it performs to your specifications. This test can be run in simulation mode or by varying the actual process value in the application. The latter is preferred, as it more accurately represents operating conditions. However, if it is not possible to do a physical test, a simulation will ensure that control programming is correct. For more details, see AUTOHOTSPOT.

7.3 Application examples

This chapter provides details on the general operation and functionality of the SITRANS LR500 series. For instructions on the use of the device local display HMI, refer to Local HMI (Page 61).

For a complete list of parameters, see Parameter assignment (Page 91) or Parameter assignment (Page 91).

8.1 Starting measurement

After startup, the **measurement view** reports a list of measurement values in the order shown below.

Process value	Text as shown in measurement view of device
Level	LEVEL
Space	SPACE
Distance	DISTANCE
Volume*	VOLUME
Custom*	CUSTOM
Loop current**	LOOP CURRENT
Primary variable**	PV
% of range**	% OF RANGE
Sensor temperature	SENSOR TEMP

* "Volume" and "Custom" are not visible until configured.

** Measurements based on primary variable (PV) selection. Default PV is set to "Distance" at startup. (See "Operation" in quick commissioning wizard, or parameter "PV selection" in menu "Setup > Select output" to change this default.)

8.2 Measurement conditions_response rate

The following information will help you configure your device for optimal performance and reliability.

Response Rate

The response rate of the device influences the measurement reliability. Use the slowest rate possible with the application requirements.

8.3 Measurement conditions_dimensions and fail-safe

Dimensions

Dimensions of the vessel, wet well, or reservoir (other than lower and upper calibration points) are only important if you require volume readings. In this case, all dimensions are used to calculate the volume value in terms of level.

Fail-safe

The fail-safe parameters ensure that the device defaults to an appropriate state when a valid level reading is not available. (See AUTOHOTSPOT for a list of fault codes related to fail-safe.)

- Parameter "Fault current" defines the behavior (mA output value to report) when an error condition, such as loss of echo, is detected.
- A fail-safe timer also activates when an error condition is detected. "Fail-safe LOE timer" sets the amount of time the loss of echo will persist before device enters fail-safe mode.
- Upon expiration of the timer, and if device is still in an error condition, the mA output value reported is based on value set in parameter "Fail-safe loss of echo".

If fail-safe operation activates frequently, see Diagnostics and troubleshooting (Page 135).

8.4 mA control

Note

Default mA values

If default values (4 and 20 mA) are used for the upper and lower saturation limits, the mA output (shown under "Loop current" in **measurement view** of device) will remain at the set mA limit, even if the level reading falls below/rises above the lower and upper range values.

Parameter	Sample value	Description
Lower saturation limit	3.55	Set lower limit for saturation range, past which the loop current cannot decrease.
Upper saturation limit	22.8	Set upper limit for saturation range, past which the loop current cannot increase.

Verifying the mA range

Check that the external device can track the entire 4 to 20 mA range sent by the device. Follow the steps below if actual mA readings differ between the device (shown under "Loop current" in **measurement view** of device) and an external device (such as a PLC).

1. To test the loop current, run the "Loop test wizard". Select a constant mA value to use in the test from a list of mA values, or set a custom mA value by selecting option "User", then set a value.
2. Check that the external device displays the same mA reading as the mA value set above.
3. If external device reading differs from the value manually set on the device, adjust the reading on the external device to match the reading on the device.

8.5 Characterization chart

If you wish to measure volume and you cannot use a pre-defined vessel (AUTOHOTSPOT) or PMD (AUTOHOTSPOT), you must configure a custom application.

Configure a custom application by setting parameter "Operation" (in quick commissioning wizard), or "PV selection" (in **navigation view**) to option "Custom", then define your vessel/PMD using AUTOHOTSPOT.

Up to 32 breakpoints, each consisting of an input and output value (X- and Y-value), are available to define your vessel shape/PMD.

- For a custom volume characteristic curve, X-values refer to level, Y-values refer to volume.
1. Plot a chart. Usually a vessel supplier will provide this chart. However, if you have a custom-built vessel/PMD, then you will need access to complete drawings, or accurate measurements.
 2. Enter the curve values from this chart using "X-value n", "Y-value n" breakpoints, where 'n' is the breakpoint number 1 to 32.

Note

If breakpoints are entered via local display, then an upload is performed via SIMATIC PDM, a second upload via PDM may be necessary to transfer the breakpoint values.

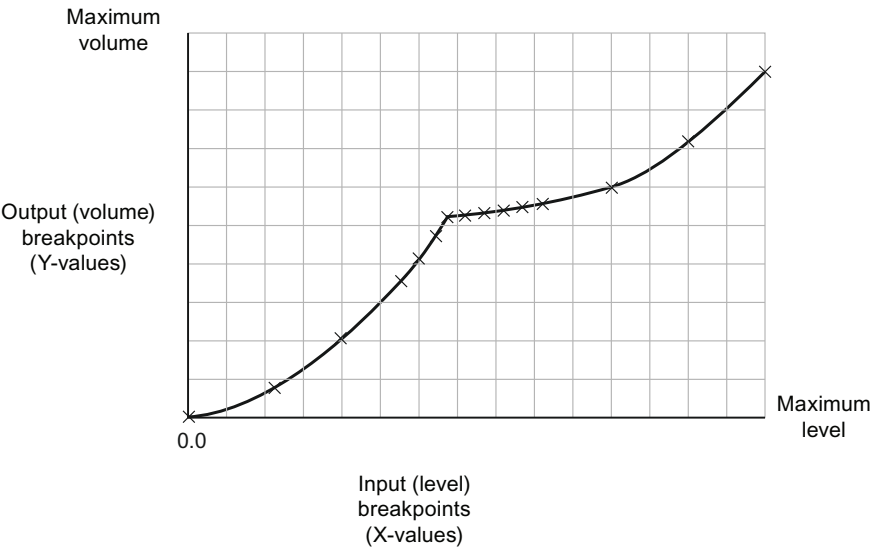
3. Ensure extra points are added around sharp transitions in the vessel/PMD (e.g: steps in a vessel wall).

Note

The end points in the curve are 0,0 (fixed), and the point defined by parameter "Upper scaling point" for maximum volume or maximum flow. ("Upper scaling point" is set by parameter "Upper range value" in "Quick commissioning wizard".)

Example chart for custom volume characterization (with 15 of possible 32 breakpoints defined):

8.5 Characterization chart



Parameter	Value	Description
X-value 1	0.0	Determines the level breakpoints at which the volume breakpoints are known.
X-value 2	0.8	
X-value 3	2.0	
X-value 4	3.5	
X-value 5	4.1	
X-value 6	4.7	
X-value 7	5.1	
X-value 8	5.2	
X-value 9	5.3	
X-value 10	5.4	
X-value 11	5.5	
X-value 12	5.6	
X-value 13	6.0	
X-value 14	7.2	
X-value 15	9.0	

Parameter	Value	Description
Y-value 1	0.0	Determines the volume break-points which correspond to the level breakpoints.
Y-value 2	2.1	
Y-value 3	4.0	
Y-value 4	5.6	
Y-value 5	5.9	
Y-value 6	6.3	
Y-value 7	6.7	
Y-value 8	7.1	
Y-value 9	7.8	
Y-value 10	8.2	
Y-value 11	8.8	
Y-value 12	9.2	
Y-value 13	10.9	
Y-value 14	13.0	
Y-value 15	15.0	

For more details regarding characterization, refer to AUTOHOTSPOT.

8.6 Vessel shape and dimensions

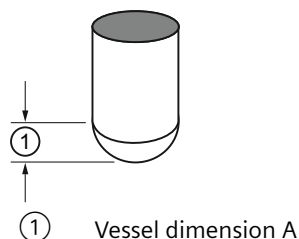
The device can be configured to suit many common vessel shapes. See AUTOHOTSPOT. Whenever possible, use one of the pre-defined selections. If one of the pre-defined selections is not applicable, a custom volume calculation can be used. (Configure a custom application by setting parameter "Operation" or "PV selection" to option "Custom", then define your vessel shape using AUTOHOTSPOT.) For more details, see AUTOHOTSPOT.

Each vessel shape uses the empty distance value in its calculations of volume. See AUTOHOTSPOT for an illustration.

Some vessel shapes also require extra dimensions to calculate the volume. Do not estimate these values as they must be exact to ensure the accuracy of your volume calculations.

Example:

To configure volume for a vessel with a half-sphere bottom, set the following:



Parameter	Sample value	Description
Vessel shape	Half sphere bottom vessel	Sets correct vessel shape
Upper scaling point	100	Sets upper scaling at 100 (defined in "Volume units")
Vessel dimension A	1.3	Sets dimension A to 1.3 m

Note**Example outcome**

- The default reading changes to a range from 0 to 100, which is the value in parameter AUTOHOTSPOT.
 - The process empty value is still measured to the bottom of the vessel (value in parameter "Lower calibration point"), not the top of dimension A.
-

8.7 Simulation

8.7.1 Simulation - general (Operating chapter)

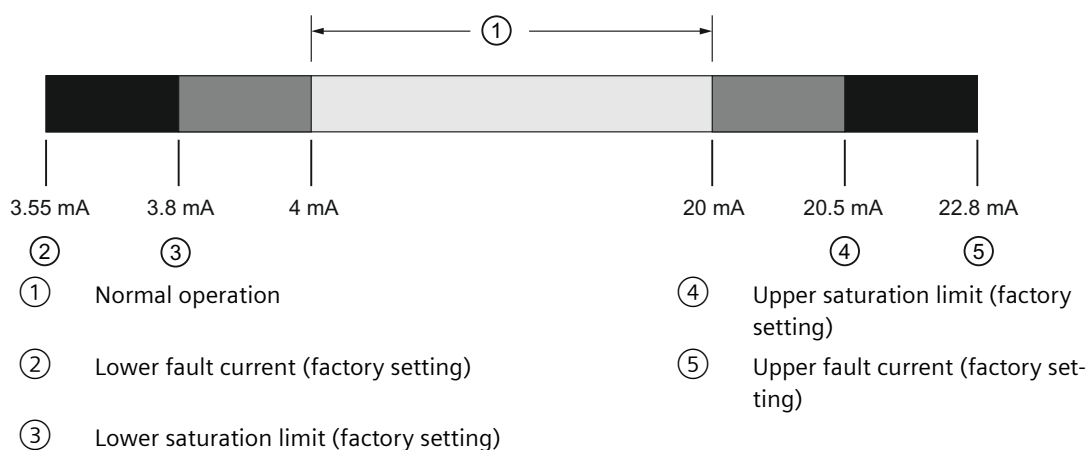
Process values, loop current, and diagnostics can be simulated with this device. Loop current can be simulated via the HMI, or via an engineering system such as SIMATIC PDM. Process values and diagnostics can be simulated via a remote engineering system.

8.7.2 Simulation - Current output (Operating chapter)

Current output simulation

The current output can also be simulated using AUTOHOTSPOT.

A simulated value (from a preset selection, or a value set by customer) can be set to test the functioning of the mA connections during commissioning or maintenance of the device. The range is 3.55 mA to 22.8 mA.



Note

Simulated current output

The simulated current output value influences output to the control system.

In general, to simulate current output:

1. Run the "Loop test wizard" from the menu "Maintenance and diagnostics > Loop test" on the device (or from the **Device** menu in SIMATIC PDM).
 - Select a preset mA value, or enter a custom value. (Custom value can be entered by selecting "User" option on device, or "Other" option in PDM.)
2. Start the loop test.
3. When you are ready to end the simulation, stop the loop test by exiting the wizard. The device returns to the actual output value.

8.7.3 Simulation - Process value (Operating chapter)

Process value simulation

Process value simulation is an iterative process whereby parameters are adjusted and corresponding results are displayed. Process values can only be simulated using a remote engineering system, but when a simulation is active, it will be represented by the fault code "Cb" and corresponding symbol appearing on the device display.

Note

Simulation enabled

- Simulation fault code "Cb" will show on local display even if other faults are present.
- Simulation fault code and corresponding symbol are shown with a cyan background in the EDD.

When Simulation is enabled, some of the device's configured functionality will respond to the simulated value, including:

- **Limit monitoring:** Any warnings and process alarms that have been configured, will activate based on the simulated value.
- **Logging:** Log files will reflect the simulated values.
- **Milliamp output:** The loop current output will also track the corresponding process value it has been configured to read.

The following function will not respond to the simulated value when simulation is enabled:

- **Fault conditions:** The device will never enter the fail-safe state when in simulation mode. Faults that would normally cause a fail-safe condition (such as a broken cable) may still occur, but a fail-safe condition will not be reported on the device during simulation.

In general, to simulate a process value via PDM:

1. Go to the **Device** menu in PDM, and choose "**Simulation > Process values**". (For parameter details, see AUTOHOTSPOT).
2. Set a simulation mode.
3. Set simulation value, and any parameters for a ramp simulation.
4. Start simulation (click "Transfer" button).

(The status of the simulation can be monitored in the PDM menu "**View > Process values**".)

To stop simulation at any time, change parameter "Simulation mode" to "Disabled".

Simulating a fixed process value

1. Set parameter "Simulation mode" to "Enabled" to simulate a **fixed** process value.
2. Set parameter "Simulation value" to the desired fixed value for the simulation.
3. Set parameter "PV status" to the status to simulate.
4. Click "Transfer" button to start the simulation.
5. Set parameter "Simulation mode" to "Disabled" to stop the simulation.

Simulating a changing process value

1. Set parameter "Simulation mode" to "Ramp" to simulate a changing process value.
2. Set parameter "Simulation value" to the desired starting value for the simulation.
3. Set parameter "PV status" to the status to simulate.
4. Set parameter "Ramp end" to stop the simulation when the process value reaches the ramp end value.
5. Set parameter "Ramp steps" to set the number of steps in the ramp simulation.
6. Set parameter "Ramp duration" to set the time interval (in seconds) for each step in the simulation.
7. Click button "Transfer" to start the simulation.

The simulated level will initially begin ramping up from the simulation value. When the process value rises to 100% or falls to 0%, it reverses direction at the same rate. The

simulation will stop based on the ramp end value, but ensure parameter "Simulation mode" is set to "Disabled" before the current output is returned to automatic control.

8.7.4 Simulation - Application test (Operating chapter)

Application test

You can test the application by varying the actual process value (the preferred test method), or by simulating changes to the process value.

When simulating a changing process value, run a complete cycle to verify that device operates as expected. Monitor system performance carefully, under all anticipated operating conditions.

1. When the device performs exactly as required, programming is complete.
2. If alternate measurement units, or fail-safe action is desired, update the parameters for the new functionality.
3. If you experience problems with system performance, see AUTOHOTSPOT.

If you cannot observe all possible operating conditions by varying the process value, use the simulation process above to verify programming.

Retest the system each time you adjust any parameters.

8.7.5 Simulation - Diagnostic (Operating chapter)

Diagnostic simulation

Diagnostics can be simulated via a remote engineering system. Diagnostics related to "Device status", "Limit monitoring and event counter", and "HART status" can be chosen from a select list to simulate.

In general, to simulate diagnostics via PDM:

1. Go to the menu "Device" in PDM and choose "Simulation > Diagnostics".
2. On the tab "Diagnostics simulation", click button "Enable" (button toggles between "Enable" and "Disable") to put the device in simulation mode.
3. Select the diagnostics to simulate from the drop-down list provided for the "Diagnostics" field.
4. For each diagnostic selected, set the "Action" to be simulated: "On" or "Off".
5. Start simulation (click "Transfer" button).

The status of the simulation for each diagnostic selected, can be seen on the remaining tabs in the dialogue window. The diagnostic being simulated will show a checked box.

End simulation on the tab "Diagnostics simulation":

- To end simulation of a specific diagnostic, click the button "Enable/Disable Simulation" (below the "Action" field).
- To stop device simulation at any time, click the toggle button at the top of the window from "Enable" to "Disable".

Parameter assignment

This chapter includes all parameters accessible via local operation.

Parameters are identified by name (followed by parameter number in parenthesis), and organized into function groups within a menu structure.

See AUTOHOTSPOT for a list of abbreviated parameter names, as they appear on the device.

Note

- In Navigation view, local buttons (▲▼▶◀) navigate in the direction of the arrow.
 - Press ▶ button to open **Edit Mode**, or to save a modification.
-

<< Check arrow graphics - up arrow appears to be different size than the rest, and new compendium has new size for inline graphics >>

<< Revise next sentence for applicable engineering systems >>

For other parameters accessible only via an engineering system (such as SIMATIC PDM, or AMS Device Manager), see AUTOHOTSPOT.

9.1 Quick start (1)

<< Review first sentence to ensure steps (button presses) are correct, and add hotspots based on applicable chapters. >>

From **measurement view**, press ▶ button to enter **parameter view**, then press ▼ button to select the "Quick commissioning wizard". Press ▶ button to open the first step, and follow the instructions.

Note

Do not use a quick commissioning wizard to modify individual parameters. (Perform customization for your application only *after* "Quick commissioning wizard" has been completed).

- See Quick commissioning via HMI.
- See Quick commissioning via SIMATIC PDM.

9.1.1 Quick commissioning (1.1)

Provides step-by-step procedure to set up common applications easily.

9.2 Setup (2)

9.1.2 Demo wizard (1.2)

Used to optimize the device for demonstration purposes, increasing measurement response time.

9.1.3 AFES wizard (1.3)

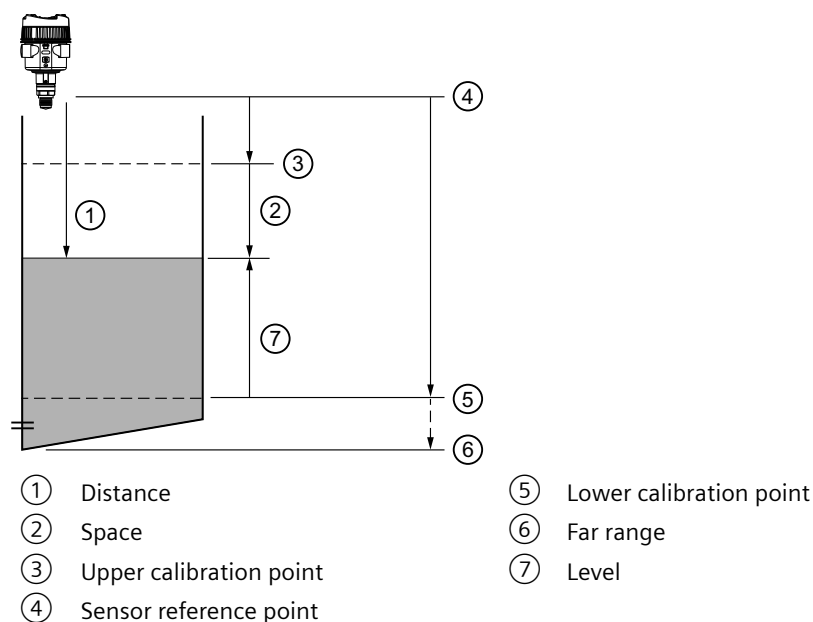
Used to prevent false echo detection over a specified range.

9.2 Setup (2)

The following parameters relate to device setup.

9.2.1 Select output (2.1)

9.2.1.1 Operation_Level and Volume illustration



9.2.1.2 PV selection (2.1.1)

Sets the primary variable by selecting a process value that corresponds to the loop current.

Setting	Level
	Space
	Distance
	Volume
	Custom
Default	Distance

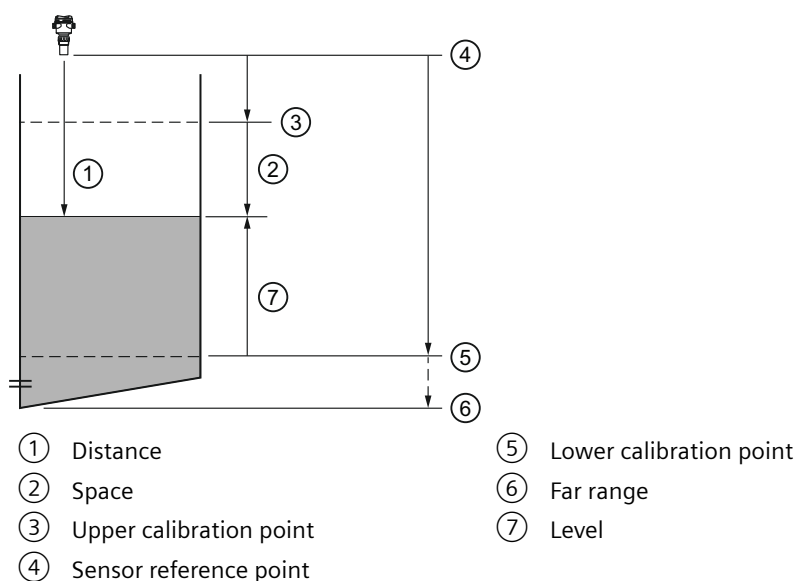
<< Check that third bullet is accurate for LR5xx. "Volume flow" (from LU240) has been removed here. >>

Note

Start view set automatically by wizard

The process value to display on device after power on is set automatically by the "Quick commissioning wizard".

- When parameter "Operation" is set in the wizard, the value is written to parameter "Start view".
- If a change is made to parameter "Start view" or parameter "PV selection" after running the wizard, the last one set will apply.
- Options "Volume" and "Custom" are not visible in **measurement view** until configured. If one of these unconfigured options is selected in parameter "Start view", **measurement view** will show the next visible process value.



Option	Description	Reference point
Level	Distance to material surface	Lower calibration point (process empty level)
Space	Distance to material surface	Upper calibration point (process full level)
Distance	Distance to material surface	Sensor reference point
Volume	Volume of material in Volume units (based on level)	Lower calibration point

9.2 Setup (2)

9.2.1.3 SV selection (2.1.2)

Sets the secondary variable by selecting a process value that corresponds to the loop current.

Setting	Level
	Space
	Distance
	Echo signal strength
	Confidence
	Volume
	Custom
	Electronics temperature
Default	Electronics temperature

9.2.1.4 TV selection (2.1.3)

Sets the tertiary variable by selecting a process value that corresponds to the loop current.

Setting	Level
	Space
	Distance
	Echo signal strength
	Confidence
	Volume
	Custom
	Electronics temperature
Default	

9.2.1.5 QV selection (2.1.4)

Sets the quaternary variable by selecting a process value that corresponds to the loop current.

Setting	Level
	Space
	Distance
	Echo signal strength
	Confidence
	Volume
	Custom
	Electronics temperature
Default	

9.2.1.6 Linearization type (2.1.5)

Sets type of linearization used to calculate volume.

Setting	None
	Volume
	Custom
Default	None

9.2.2 Sensor (2.2)

9.2.2.1 Units (2.2.1)

Sets units used by the device.

			Default
Setting	Meters	m	3 decimal places
	Centimeters	cm	1 decimal place
	Millimeters	mm	0 decimal places
	Feet	Ft	3 decimal places
	Inches	in	2 decimal places
Default	Meters	m	3 decimal places

<< Check if reused topics below (re decimal places and hash marks) are applicable to LR5xx, AND if "Custom units" parameter should be added to wizard (were only settable via remote operation in LU240). >>

Note

Dynamic decimal places

Each setting for parameter "Units" has a default number of decimal places used to show the process value on the local display. However, if the value is too large to show on the segment display, the decimal places will be automatically adjusted to show the process value.

Note

Process value too large to display

In some cases, even with dynamic decimal places, it is possible that the process value be too large to show on the local display, "#####" will show instead.

If this occurs in a typical application:

- Adjust parameter "Units" so that a smaller value can be shown, e.g. use meters instead of millimeters.

If this occurs in a custom application:

- Adjust parameter "Custom units" so that a smaller value can be shown, e.g. use tons instead of pounds.
- Note that a change to custom units also requires a scaling adjustment (see AUTOHOTSPOT).

9.2 Setup (2)

9.2.2.2 Temperature units (2.2.2)

Sets temperature units used by the device.

Setting	• °C (degrees Celcius) • °F (degrees Fahrenheit) • K (Kelvin)
Default	°C (degrees Celcius)

9.2.2.3 Fill rate limit (2.2.3)

Sets the maximum fill rate the device can track.

Setting	0 to 99999
Default	0.1 m/min

<< Verify that parameter names are correct, and decide if 'Damping value' be changed to 'Sensor damping value' or removed from list if SDV is affected but not visible to user in LR5xx. Any changes to the following note must be corrected in "Empty rate limit - settings" topic. >>

Note**Rate parameters**

The rate parameters "Fill rate limit", "Empty rate limit", and "Damping value" work in conjunction, and are affected by parameter "Response rate" (set in the "Quick commissioning" wizard). The rate parameters automatically adjust when parameter "Response rate" is altered, but any changes made to the rate parameters following the completion of the wizard will supersede the response rate setting.

9.2.2.4 Empty rate limit (2.2.4)

Sets the maximum empty rate the device can track.

Setting	0 to 99999
Default	0.1 m/min

Note**Rate parameters**

The rate parameters "Fill rate limit", "Empty rate limit", and "Damping value" work in conjunction, and are affected by parameter "Response rate" (set in the "Quick commissioning" wizard). The rate parameters automatically adjust when parameter "Response rate" is altered, but any changes made to the rate parameters following the completion of the wizard will supersede the response rate setting.

9.2.3 Calibration (2.3)

9.2.3.1 Lower calibration point (2.3.1)

Sets distance from sensor reference point to lower calibration point: usually process empty level.

9.2.3.2 Upper calibration point (2.3.2)

Sets distance from sensor reference point to upper calibration point: usually process full level.

9.2.3.3 Lower level point (2.3.3)

Sets level value when material is at lower calibration point.

Setting	-99999 to 99999 m
Default	0

9.2.3.4 Upper level point (2.3.4)

Sets level value when material is at upper calibration point.

Setting	-99999 to 99999 m
Default	• 3 m (3 m version) • 6 m (6 m version) • 12 m (12 m version)

9.2.3.5 Sensor offset (2.3.5)

Sets offset to compensate for changes in sensor reference point.

Changes to sensor reference point may result from adding a thicker gasket or reducing the standoff/nozzle height.

Setting	-99.999 to 99.999 m
Default	0

If amount of parameter "Sensor offset" is known, enter the constant that can be added to or subtracted from sensor value¹⁾ to compensate if the sensor reference point has shifted.

¹⁾ The value produced by the echo processing which represents the distance from sensor reference point to the target

9.2.3.6 Low-level cutoff (2.3.6)

Sets lower limit on measured value (before any offset applied).

For example, set value to zero to prevent a negative level measurement.

9.2 Setup (2)

Setting	-999 to 0 m
Default	-999 m

Note**Default value disables parameter**

By using the default value of -999 m, or a lower value, the parameter "Low-level cutoff" is disabled.

To enable "Low-level cutoff", set a value greater than the default, e.g. -998 or higher.

9.2.3.7 Propagation factor (2.3.7)

Sets value that represents reduction in propagation velocity as a result of the wave travelling through a pipe or medium.

Setting	
Default	

9.2.3.8 Antenna offset (2.3.8)

Sets offset required if antenna type is changed.

This parameter is not reset when factory reset performed.

Setting	
Default	

9.2.4 Current output (2.4)**9.2.4.1 Loop current mode (2.4.1)**

Sets operation of Loop current for HART multidrop mode.

Setting	Enabled
	Disabled
Default	Enabled

The device is in loop current mode by default. Disabling parameter "Loop current mode" will result in a fixed loop current setting for multidrop operation (see AUTOHOTSPOT).

9.2.4.2 Loop current value in multidrop mode (2.4.2)

Sets mA value for loop current in HART multidrop mode.

Setting	3.6 to 22.8 mA
Default	4 mA

9.2.4.3 Damping value (2.4.3)

Sets the damping (filtering) of the PV to smooth out response to sudden changes in measurement.

An increase of damping increases response time of device, and affects digital value and loop current. If output values are noisy, increase parameter "Damping value". For faster response time, decrease parameter "Damping value". Find a value that meets requirements of signal stability and response time.

Setting	0 to 100 s
Default	0 s

9.2.4.4 Lower range value (2.4.4)

Sets process value that corresponds to 4 mA loop current.

Setting	-99999 to +99999 (based on PV, setting for PV of Level shown here)
Default	0 ("Units" based on PV)

<< Notes need revising if "Lower level point" is not a user parameter in LR5xx-as noted by TimL in menu review (as it was in LU240). >>

Note

Setting for parameter "Lower range value" is based on selected PV

- PV set to Level, Space - Setting based on parameter "Lower level point"
- PV set to Distance - Setting based on parameter "Upper calibration point"
- PV set to Volume - Setting based on parameter "Upper scaling point" in "Volume" menu
- PV set to Custom - Setting based on parameter "Upper scaling point" in "Custom" menu

Note

Parameter "Lower range value" is limited when PV set to Level or Space

When PV is set to Level or Space, the setting for parameter "Lower range value" is limited by the setting for parameter "Lower level point".

- If desired setting for parameter "Lower range value" is greater than the current setting in parameter "Lower level point", it is necessary to *first* set parameter "Lower level point" to a value equal to, or greater than the desired value for parameter "Lower range value".

9.2.4.5 Upper range value (2.4.5)

Sets process value that corresponds to 20 mA loop current.

9.2 Setup (2)

Setting	-99999 to +99999 (based on PV, setting for PV of Level shown here)
Default	12 ("Units" based on PV)

<< Notes need revising if "Upper level point" is not a user parameter in LR5xx-as noted by TimL in menu review (as it was in LU240). >>

<< Verify that third note re URV vs USP works same as LU240 in LR5xx. >>

Note**Setting for parameter "Upper range value" is based on selected PV**

- PV set to Level, Space - Setting based on parameter "Upper level point"
- PV set to Distance - Setting based on parameter "Lower calibration point"
- PV set to Volume - Setting based on parameter "Upper scaling point" in "Volume" menu
- PV set to Custom - Setting based on parameter "Upper scaling point" in "Custom" menu

Note**Parameter "Upper range value" is limited when PV set to Level or Space**

When PV is set to Level or Space, the setting for parameter "Upper range value" is limited by the setting for parameter "Upper level point".

- If desired setting for parameter "Upper range value" is greater than the current setting in parameter "Upper level point", it is necessary to *first* set parameter "Upper level point" to a value equal to, or greater than the desired value for parameter "Upper range value".

Note**"Upper range value" (URV) versus "Upper scaling point"**

- When parameter "Upper range value" is set within the "Quick commissioning wizard", it automatically sets the "Upper scaling point" to the same value.
- Setting a value for either parameter *outside* of the wizard, will not automatically adjust the other value.

<< Check if following note (re "Upper scaling point") should be used in LR5xx >>

Note**Changing custom units**

If a change is made to custom units, be sure to rescale the output, as rescaling for custom units is not handled automatically by the device.

- Use parameters "Upper range value" and "Upper scaling point" to rescale output.

9.2.4.6 Lower saturation limit (2.4.6)

Sets lower limit for saturation range (4 mA to parameter "Lower saturation limit"), past which the loop current cannot decrease.

Setting	3.55 to 4 mA
Default	3.8 mA

9.2.4.7 Upper saturation limit (2.4.7)

Sets upper limit for saturation range (20 mA to parameter "Upper saturation limit"), past which the loop current cannot increase.

Setting	20 to 22.8 mA
Default	20.5 mA

9.2.4.8 Lower fault current (2.4.8)

Sets Lower fault current in Non-safety mode.

<< Is parameter/description/settings correct if LR5xx is SIL device? >>

Setting	3.55 to 4.0 mA
Default	3.55 mA

9.2.4.9 Upper fault current (2.4.9)

Sets Upper fault current in Non-safety mode.

Setting	20.0 to 22.8 mA
Default	22.8 mA

9.2.4.10 Fault current (2.4.10)

Defines behavior when Fail-safe is initiated.

Setting	Upper fault current
	Lower fault current
Default	Lower fault current

See AUTOHOTSPOT for a list of faults that initiate **Fail-safe**, causing "Fault current" setting to display.

<< Will faults initiate 'Fail-safe' (footnoted in Fault code table) same as LU240 in the LR5xx? >>

9.2.4.11 Fail-safe loss of echo (2.4.11)

Defines fail-safe behavior when fail-safe loss of echo occurs and fail-safe LOE timer expires.

Setting	Hold	Last valid reading
	Fault current	Value set in parameter "Fault current"
Default	Hold	

9.2 Setup (2)

9.2.4.12 Fail-safe LOE timer (2.4.12)

Sets amount of time loss of echo will persist before device enters fail-safe state.

Setting	0 to 720 s
Default	100 s

9.2.5 Volume (2.5)

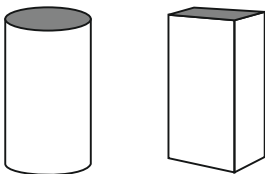
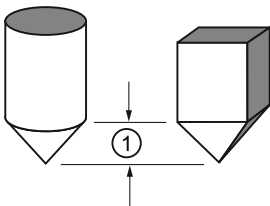
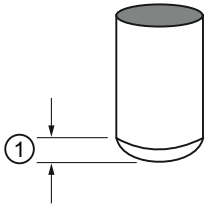
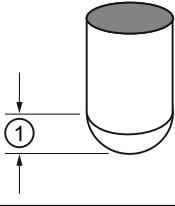
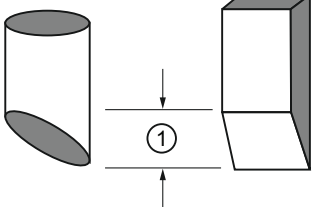
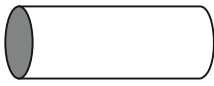
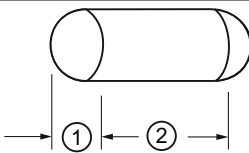
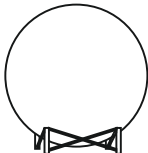
Note

Menu visibility

This menu will not appear on device unless it is configured.

9.2.5.1 Vessel shape (2.5.1)

Sets vessel shape, and allows device to calculate volume in addition to level.

	Display name/description	Vessel shape	Other parameter settings required
Setting	Linear Linear vessel		Upper scaling point
	Conical bottom Conical bottom vessel		Upper scaling point, Vessel dimension A
	Parabolic bottom Parabolic bottom vessel		Upper scaling point, Vessel dimension A
	Half sphere bottom Half sphere bottom vessel		Upper scaling point, Vessel dimension A
	Flat sloped bottom Flat sloped bottom vessel		Upper scaling point, Vessel dimension A
	Horiz. cyl. flat ends Horizontal cylinder flat ends vessel		Upper scaling point
	Horiz.cyl.parab.ends Horizontal cylinder parabolic ends vessel		Upper scaling point, Vessel dimension A, Vessel dimension L
	Sphere Sphere vessel		Upper scaling point
Default	Linear		

① Dimension A ② Dimension L

9.2 Setup (2)

9.2.5.2 Vessel dimension A (2.5.2)

Sets height of vessel bottom when bottom is conical, parabolic, half spherical, or flat sloped. If horizontal parabolic ends vessel, sets depth of end.

Setting	0 to 99.999 m
Default	0

See AUTOHOTSPOT for illustration.

9.2.5.3 Vessel dimension L (2.5.3)

Sets length of cylindrical section of horizontal parabolic ends vessel.

Setting	0 to 99.999 m
Default	0

See AUTOHOTSPOT for illustration.

9.2.5.4 Volume units (2.5.4)

Sets volume measurement units.

<< Revised list per 2W HART (same for bus and display). Need to confirm order on device and default. >>

Setting	Liters	l
	US gallons	Ga
	Imperial gallons	lGa
	Cubic meters	m ³
	Hectoliters	hl
	Cubic inches	in ³
	Cubic feet	ft ³
	Bushels	bu
	Cubic yards	yd ³
	42 US gallon barrels	bbl
	31.5 US gallon barrels	bbl (US)
	Normal liters	NI
	Normal cubic meters	Nm ³
	Standard cubic feet	SCF
Default	Cubic meters	m ³

9.2.5.5 Upper scaling point (2.5.5)

Sets maximum scaled measurement value.

Setting	0 to 9999.999 m ³
Default	0.1 m ³

<< Check if following note (re "Upper scaling point") should be used in LR5xx >>

Note

"Upper range value" (URV) versus "Upper scaling point"

- When parameter "Upper range value" is set within the "Quick commissioning wizard", it automatically sets the "Upper scaling point" to the same value.
 - Setting a value for either parameter *outside* of the wizard, will not automatically adjust the other value.
-

9.2.6 Custom (2.6)

Note

Menu visibility

This menu will not appear on device unless it is configured.

9.2.6.1 Upper scaling point (2.6.1)

Sets maximum scaled measurement value.

Setting	0 to 9999999
Default	100 <Custom units>

<< Check if following note (re "Upper scaling point") should be used in LR5xx >>

Note

"Upper range value" (URV) versus "Upper scaling point"

- When parameter "Upper range value" is set within the "Quick commissioning wizard", it automatically sets the "Upper scaling point" to the same value.
 - Setting a value for either parameter *outside* of the wizard, will not automatically adjust the other value.
-

9.2.6.2 Customized characteristic curve (2.6.2)

<< Need new help text as this menu used for Volume only in LR5xx - suggest: Used to enter Level and Output breakpoints for custom volume vessel shapes. >>

Used to enter Level and Output breakpoints for universal Primary measuring device (PMD).

9.2 Setup (2)

If the shape of vessel (volume) is more complex than any of the preconfigured shapes, you can define the shape as a series of segments. A value is assigned to each input (level) breakpoint and a corresponding value is assigned to each output (volume) breakpoint.

- Level values are defined in AUTOHOTSPOT.
- Volume values are defined in AUTOHOTSPOT.

For more information, see AUTOHOTSPOT.

X-value 1 (2.6.2.1) ... X-value 32 (2.6.2.63)

Sets level breakpoints for which output is known.

Setting	-9999999 to +9999999
Default	0

Y-value 1 (2.6.2.2)...Y-value 32 (2.6.2.64)

Sets output corresponding to each input breakpoint entered.

Setting	-9999999 to +9999999
Default	0

9.2.7 Local display (2.7)**9.2.7.1 Start view (2.7.1)**

Sets process value shown first on display after power on.

Setting	Level
	Space
	Distance
	Volume
	Custom
	Loop current
	Primary variable
	Percent of range
	Electronics temperature
Default	Distance

<< Check that third bullet is accurate for LR5xx. "Volume flow" (from LU240) has been removed here. >>

Note

Start view set automatically by wizard

The process value to display on device after power on is set automatically by the "Quick commissioning wizard".

- When parameter "Operation" is set in the wizard, the value is written to parameter "Start view".
- If a change is made to parameter "Start view" or parameter "PV selection" after running the wizard, the last one set will apply.
- Options "Volume" and "Custom" are not visible in **measurement view** until configured. If one of these unconfigured options is selected in parameter "Start view", **measurement view** will show the next visible process value.

9.2.7.2

Contrast (2.7.2)

Sets contrast level on local display.

<< Need to revise settings chart to explain 6 levels of contrast used in new 2W contrast setting VIEW >>

Setting	• 0 % • 10 % • 20 % • 30 % • 40 % • 50 % • 60 % • 70 % • 80 % • 90 % • 100 %
Default	50 %

9.3

Maintenance and diagnostics (3)

The following parameters relate to device maintenance and diagnostics.

9.3.1 Identification (3.1)

9.3.1.1 Tag (3.1.1)

Displays a unique tag name for device or measurement point. Limited to 8 characters, and can only be defined via remote operation.

9.3.1.2 Long tag (3.1.2)

Defines a unique tag name for device or measurement point. Limited to 32 characters.

9.3.1.3 Descriptor (3.1.3)

Displays a unique description for device or measurement point. Limited to 16 characters, and can only be defined via remote operation.

9.3.1.4 Message (3.1.4)

Displays a unique message for device or measurement point. Limited to 32 characters, and can only be defined via remote operation.

9.3.1.5 Device (3.1.5)

Manufacturer (3.1.5.1)

Displays manufacturer of device.

Product name (3.1.5.2)

Displays product name.

Article number (3.1.5.3)

Displays the article number (MLFB) of the device.

Serial number (3.1.5.4)

Displays unique serial number of device, set by factory.

HW version (3.1.5.5)

Displays version number corresponding to electronics hardware of device.

FW version (3.1.5.6)

Displays version number corresponding to software or firmware embedded in device.

Final assembly number (3.1.5.7)

Sets a number for user to identify the device. It is normally changed when electronics or other device components are upgraded in the field.

9.3.1.6 Local display (3.1.6)**HW version (3.1.6.1)**

Displays version number corresponding to local display of device.

FW version (3.1.6.2)

Displays version number corresponding to software or firmware embedded in local display.

9.3.2 Diagnostics (3.2)**9.3.3 Signal (3.3)****9.3.3.1 Signal quality (3.3.1)****Confidence (3.3.1.1)**

Displays echo quality: higher values represent better echo quality.

Echo signal strength (3.3.1.2)

Displays strength of selected echo, in dB.

Noise average (3.3.1.3)

Displays the average ambient noise, in dB.

9.3.3.2 Echo configuration (3.3.2)

Near range (3.3.2.1)

Sets minimum distance from sensor reference point, beyond which an echo should be considered valid.

This is sometimes referred to as blanking or a dead zone.

Setting	0 to 3 m (3 m version) 0 to 6 m (6 m version) 0 to 12 m (12 m version)
Default	0.2 m

Far range (3.3.2.2)

Sets maximum distance from sensor reference point, within which an echo should be considered valid.

Use this feature if the measured surface can drop below the lower calibration point in normal operation.

9.3.3.3 Echo select (3.3.3)

Algorithm (3.3.3.1)

Sets algorithm (applied to the echo profile) to extract the true echo.

<< Tim wants full set of options as with LR560. >>

Setting	Area largest first echo	ALF
	Echo area	A
	Largest echo	L
	First echo	F
	Largest echo area	AL
	First echo area	AF
	Largest echo at first	LF
	Best echo of the first and largest echo	BLF
	Largest echo 2	BL
	First echo 2	BF
	Last echo	LAST
	True first echo	TF
Default	First echo	F

Echo threshold (3.3.3.2)

Sets minimum echo confidence. Only echoes above this threshold are evaluated.

Setting	0 to 70
Default	5

Position detect (3.3.3.3)

Sets algorithm used to calculate the position of the echo.

Defines where on the echo the distance measurement is determined.

Setting	Rising edge percentage	Rising edge of echo (calculated using echo peak to echo floor percentage): Yields highest stability on sloped targets
	Center	Calculated center of the echo peak: Yields higher accuracy on flat, non-sloped targets
	Center 2	
	Rising 2	High accuracy rising for flat targets
Default	Rising	

Echo marker (3.3.3.4)

Used to increase or decrease the signal amplitude.

Setting	5% to 95%
Default	50 (%)

Applicable only when using "Rising" algorithm, set in parameter "Position detect".

9.3.3.4 Filtering (3.3.4)**Reform echo (3.3.4.1)**

Used to smooth jagged peaks in the echo profile. Reforms fragmented echoes into one echo.

Setting	0 to 50 intervals (greater = wider)
Default	0 (off) liquids, 20 solids

Use this feature when monitoring solids if the reported level fluctuates slightly though the monitored surface is still. Enter the amount of smoothing required to the echo profile. When a value is entered, the nearest acceptable interval value, in microseconds, is set.

Near range suppression (3.3.4.2)

Used to automatically suppress signal from sensor reference point to near range suppression distance (0 = off).

Setting	0...
Default	0

Near range suppression distance (3.3.4.3)

Sets distance for near range suppression.

<< Settings below is from 'near range' - need to add settings and default specific to Near range suppression distance >>

Setting	0 to 3 m (3 m version) 0 to 6 m (6 m version) 0 to 12 m (12 m version)
Default	0.2 m

Near range suppression distance threshold (3.3.4.4)

Sets minimum distance of selected echo for near range suppression.

<< Settings below is from 'near range' - need to add settings and default specific to Near range suppression distance threshold >>

Setting	0 to 3 m (3 m version) 0 to 6 m (6 m version) 0 to 12 m (12 m version)
Default	0.2 m

Near range suppression echo strength threshold (3.3.4.5)

Sets minimum amplitude of selected echo for near range suppression.

Setting	
Default	dB

Near range suppression expiry time (3.3.4.6)

Defines the time (in hours) to disable near range suppression, if conditions not met (0 = never).

Setting	
Default	hrs

Number of shots (3.3.4.7)

<< Help text still to be approved, and decide if used on LR5xx HMI - sent email to Tim. >>

Sets number of shots to be fired (and results averaged) per transmit pulse.

<< If this parameter used in LR5xx HMI, decide is settings correct and also the note below - all from LU240. >>

Setting	0 to 25
Default	1

A higher number of shots may result in a reduction in variation of the reported measurement value, but can increase the update time between measurements.

9.3.3.5 Sampling (3.3.5)

Echo lock (3.3.5.1)

Sets measurement verification process. When echo lock set to "Total lock", parameter "Echo lock window" is preset to 0 for automatic width and cannot be changed.

Setting	Disabled
	Maximum verification
	Material agitator
	Total lock
Default	Material agitator

Use "Material agitator" option to prevent false echoes from agitator blades.

"Maximum verification" option can be used if experiencing frequent loss of echo (LOE). However, it is recommended that you contact your Siemens representative before activating.

Echo lock window (3.3.5.2)

Sets distance window (centered on echo) used to derive reading. When new measurement is in window, window is recentered and reading is calculated.

Setting	0 to 120 m
Default	0

Gain factor (3.3.5.3)

Used to increase or decrease the signal amplitude.

Setting	0.1..50.0
Default	Liquids: 1 Solids: 10

9.3.3.6 TVT configuration (3.3.6)

Hover level (3.3.6.1)

Defines how high the TVT curve is placed above the profile, relative to the largest echo.

Setting	0 to 100%
Default	40%

Auto false echo suppression (3.3.6.2)

Used to screen out false echoes in a vessel with known obstructions.

A learned TVT (time varying threshold) replaces the default TVT over a specified range.

Setting	Enabled
	Disabled
Default	Disabled

To screen out false echoes using auto false echo suppression (AFES):

1. Determine range and enter this value in parameter "Auto false echo suppression range".
2. Run "Auto false echo suppression wizard" to "learn" the TVT.

Once the wizard completes successfully, parameter "Auto false echo suppression" is set to "Enabled" and the learned TVT will be used.

Note**TVT "Learn"**

Although the parameters "Auto false echo suppression" and "Auto false echo suppression range" may be adjusted on their own, the "Auto false echo suppression wizard" must be used to "learn" the TVT.

Note**AFES automatically disabled**

The device will automatically reset parameter "Auto false echo suppression" to "Disabled" under the following conditions:

- Parameter "Auto false echo suppression" is manually enabled, and an initial device TVT learn is *never* requested (via AFES wizard)
- Parameter "Auto false echo suppression" is enabled (either manually or automatically based on previous TVT learn using AFES wizard), and a new TVT learn request fails (for example, due to a power failure during the learn process).

To avoid situations where AFES is disabled by the device, use "Auto false echo suppression wizard" initially. The wizard will store a learned TVT and enable AFES.

If AFES is later disabled then re-enabled, the stored TVT will be used.

AFES notes

Note

For best results with AFES

- Set up auto false echo suppression during commissioning if possible, by running "Auto false echo suppression wizard".
- Ensure material level is below all known obstructions at the moment when "Auto false echo suppression wizard" learns the TVT. Ideally the vessel should be empty or almost empty.
- Use auto false echo suppression only if target is greater than one meter from transmitter face (sensor reference point)
- Note the distance to material level when learning the echo profile, and set value in parameter "Auto false echo suppression range" to a shorter distance to avoid the material echo being screened out.
- If the vessel contains an agitator, it should be running.

Note

For best results with AFES

- Set up auto false echo suppression during commissioning if possible, by running "Auto false echo suppression wizard".
- Ensure material level is below all known obstructions at the moment when "Auto false echo suppression wizard" learns the TVT. Ideally the vessel should be empty or almost empty.
- Use auto false echo suppression only if target is greater than one meter from transducer face (sensor reference point)
- Note the distance to material level when learning the echo profile, and set value in parameter "Auto false echo suppression range" to a shorter distance to avoid the material echo being screened out.
- If the vessel contains an agitator, it should be running.

Auto false echo suppression range (3.3.6.3)

Sets end point of the learned TVT distance.

To calculate value

1. Determine the auto false echo suppression range by measuring the actual distance from the sensor reference point to the material surface using a rope or tape measure.
2. Subtract 0.5 m (20") from this distance and use the resulting value.

Custom TVT shaper mode (3.3.6.4)

Sets operation mode of custom TVT shaper.

Setting	Enabled
	Disabled
Default	Disabled

The TVT breakpoints are only visible when parameter "Custom TVT shaper mode" is enabled.

Custom TVT breakpoints 1...30 (3.3.6.5)

Breakpoint 1 (3.3.6.5.1) ... Breakpoint 30 (3.3.6.5.30)

Sets TVT offset for breakpoint on TVT. Shaping points can be raised (positive number) or lowered (negative number).

Setting	Offset -50 to +50 dB
Default	0 dB

Custom TVT breakpoints 31...60 (3.3.6.6)

Breakpoint 31 (3.3.6.6.1) ... Breakpoint 60 (3.3.6.6.30)

Sets TVT offset for breakpoint on TVT. Shaping points can be raised (positive number) or lowered (negative number).

Setting	Offset -50 to +50 dB
Default	0 dB

Custom TVT breakpoints 61...90 (3.3.6.7)

Breakpoint 61 (3.3.6.7.1) ... Breakpoint 90 (3.3.6.7.30)

Sets TVT offset for breakpoint on TVT. Shaping points can be raised (positive number) or lowered (negative number).

Setting	Offset -50 to +50 dB
Default	0 dB

Custom TVT breakpoints 91...120 (3.3.6.8)

Breakpoint 91 (3.3.6.8.1) ... Breakpoint 120 (3.3.6.8.30)

Sets TVT offset for breakpoint on TVT. Shaping points can be raised (positive number) or lowered (negative number).

Setting	Offset -50 to +50 dB
Default	0 dB

9.3.4 Peak values (3.4)

Displays peak measured values.

9.3.4.1 Minimum electronics temperature (3.4.1)

Displays minimum electronics temperature value.

9.3.4.2 Maximum electronics temperature (3.4.2)

Displays maximum electronics temperature value.

9.3.4.3 Minimum distance (3.4.3)

Displays minimum distance value. Value may reset when units are changed.

9.3.4.4 Maximum distance (3.4.4)

Displays maximum distance value. Value may reset when units are changed.

9.3.4.5 Minimum echo signal strength (3.4.5)

Displays minimum echo signal strength value.

9.3.4.6 Maximum echo signal strength (3.4.6)

Displays maximum echo signal strength value.

9.3.4.7 Minimum confidence (3.4.7)

Displays minimum confidence value.

9.3.4.8 Maximum confidence (3.4.8)

Displays maximum confidence value.

9.3.5 Non-resettable peak values (3.5)

Displays statistics on non-resettable peak measured values.

9.3.5.1 Minimum electronics temperature (3.5.1)

Displays minimum electronics temperature value.

9.3.5.2 Maximum electronics temperature (3.5.2)

Displays maximum electronics temperature value.

9.3.5.3 Minimum terminal voltage (3.5.3)

Displays minimum terminal voltage value.

9.3.5.4 Maximum terminal voltage (3.5.4)

Displays maximum terminal voltage value.

9.3.6 Trend log settings (3.6)**9.3.6.1 Number of logging values (3.6.1)**

Sets number of process values to log.

Setting	Disabled
	1
	2
	3
	4
	5
	6
	7
	8
Default	Disabled

9.3.6.2 Number of logged points (3.6.2)

Sets number of data points to capture.

Setting	10 to 100000
Default	300

A minimum of 10 points must be logged. The maximum number of points that can be logged is 100000, divided by the number of inputs (parameters "Logging value 1", "Logging value 2", etc.). For example, if 4 logging values used, each can log 25000 points (100000 divided by 4).

9.3.6.3 Logging interval (3.6.3)

Sets interval in seconds between log entries.

Setting	10 to 600
Default	60

9.3.6.4 Logging behavior (3.6.4)

Defines behavior when log is full.

<< Use 2W options here. Review NOTE that correct for LR5xx >>

Setting	Overwrite oldest
	Fill and stop
Default	Overwrite oldest

Note

Log entries not immediately visible using "Overwrite oldest"

When setting "Overwrite oldest" is used, 30 log entries must be stored internally before any are visible in the Trend log.

For example, to log Level and Sensor temperature every 10 minutes, it will take 2.5 hours for the first log entries to appear.

Number of logging values = 2

Logging interval = 600

Logging behavior = Overwrite oldest

Logging value 1 = Level

Logging value 2 = Sensor temperature

The Trend log will appear empty until the first 30 entries (15 Level + 15 Sensor temperature) are stored internally, then written to the log:

- A total of 30 log entries required, divided by the Number of logging values (2), stored at a Logging interval of 600 seconds (10 minutes)
 $30/2 * 10 = 150$ minutes or 2.5 hours

9.3.6.5 Logging value 1 (3.6.5) ... Logging value 8 (3.6.12)

Sets value to log.

Setting	Level
	Space
	Distance
	Echo signal strength
	Confidence
	Volume
	Custom
	Electronics temperature
	Loop current
Default	None

To edit the logging values, trend logging must be disabled.

9.3.7 Simulation (3.7)

9.3.7.1 Simulation mode (3.7.1)

Displays status of simulation.

Setting	Disabled
	Enabled
	Ramp
Default	Disabled

Set to "Enabled" to hold the simulation at a specific value. Set to "Ramp" to have the simulation continuously sweep through the measurement range.

9.3.7.2 Simulation value (3.7.2)

Sets starting value for ramp or fixed simulation.

Setting	Not limited
Default	Not applicable

9.3.7.3 PV status (3.7.3)

Sets status of the PV to simulate.

Setting	Good
	Bad
	Uncertain
Default	Good

9.3.7.4 Ramp end (3.7.4)

Sets end value for ramp simulation.

Setting	Not limited
Default	Not applicable

9.3.7.5 Ramp steps (3.7.5)

Sets number of stair steps between ramp start (parameter "Simulation value") and end of ramp simulation.

Setting	0 to 65535
Default	10

9.3.7.6 Ramp duration (3.7.6.)

Sets total time from ramp start (parameter "Simulation value") to end of ramp simulation.

Setting	0 to 65535
Default	5

9.3.8 Current loop (3.8)**9.3.8.1 Loop test (3.8.1)**

Provides step-by-step procedure to simulate the loop current.

<< This content copied from LU240. Ensure wizard works the same way in LR5xx and settings are accurate. Keep/remove autohotspot per Operating chapter. >>

A loop test can be initiated via local operation (with any errors reported through diagnostic icons on the local display), or remotely, using an engineering system such as SIMATIC PDM.

Note**Simulated current output**

The simulated current output value influences output to the control system.

A simulated value can be set to test the functioning of the mA connections during commissioning or maintenance of the device.

Setting	3.55
	4.0
	12.0
	20.0
	22.8
	User (Set any mA value between 3.6 and 22.8)
Default	12.0 mA

Select a preset mA value, or enter a custom value (under option "User") to run the wizard.

Press ◀ button to stop and exit the loop test.

For more information, see AUTOHOTSPOT.

9.3.8.2 Terminal voltage (3.8.2)

Displays the voltage present at the device terminals.

9.3.9 Resets (3.9)

9.3.9.1 Device restart (3.9.1)

Used to restart device without disconnecting power.

Simulation will be terminated. Stored configurations are not reset.

Setting	Cancel
	Ok
Default	Cancel

9.3.9.2 Resets (3.9.2)

Used to provide various device reset options.

Setting	Factory reset
Default	Factory reset

<< Is Note and error code correct for LR5xx? >>

Note

Factory reset requires reprogramming

Following a reset to factory defaults, the device is in a "Not configured" state, and shows the fault "Configuration error" (code SC). The fault code remains until the device is reprogrammed.

<< Confirm that parameter exceptions below are correct, and only list parameters used in LR5xx. >>

Choosing option "Factory reset" will reset all parameters to factory defaults, with the following exceptions:

- "Device address" remains unchanged
- "User PIN" (write protection) value is not reset
- "Peak values" and "Operating time" are not reset
- "Long shot duration" and "Short shot duration" are not reset << Not in LR5xx ? >>
- "Auto false echo suppression" is reset to default (Disabled), but learned TVT is not lost
- "Auto false echo suppression range" is not reset
- "Custom TVT shaper mode" is reset to default (Disabled), but "Custom TVT breakpoints" are not lost

To perform a "Factory reset" via SIMATIC PDM, go to menu **"Device > Reset > Factory reset"**.

Note**Restore ordered configuration requires 22.5 mA**

Device output reads 22.5 mA while "Restore ordered configuration" is running. When restore is complete, device output returns to normal behavior.

- Restore takes approximately 20 seconds to complete.
- Following a restore to ordered configuration, the device is in a "Configured" state, and mA output is based on current measurement of restored PV.

Choosing option "Restore ordered configuration" restores device to customer-ordered default settings. The parameters not configured via the order are reset to the factory default settings.

Note**AFES disabled**

Although learned TVT is not lost, parameter "Auto false echo suppression" is reset to its default value of "Disabled" when "Restore ordered configuration" is performed.

In SIMATIC PDM, go to menu **"Device > Reset > Restore ordered configuration"**.

<< REMOVE FOLLOWING RE DAC CAL. OPTION ONCE CONFIRMED THAT THIS OPTION IS NOT IN LR5XX >>

A third option to "Restore to factory DAC calibration" is available via SIMATIC PDM. This option restores the DAC trim (digital-to-analog converter trim) to the factory setting. [The DAC trim is used to calibrate the 4 mA and 20 mA end points of the analog output with an external reference (e.g. current measurement device).]

Go to menu **"Device > Reset > Restore to factory DAC calibration"**.

9.3.9.3 Reset peak values (3.9.3)

Resets all recorded Peak values.

Setting	No
	Distance
	Electronics temperature
	Echo signal strength
	Confidence
	Peak values (Resets recorded minimum and maximum values for Distance, Electronics temperature, Echo signal strength, and Confidence.)
Default	No

9.3.10 Frequency (3.10)

Sets the country specific settings for radar signals.

Setting	• Mode 1	EU, Albania, Andorra, Azerbaijan, Australia, Belarus, Bosnia and Herzegovina, Canada, Liechtenstein, Moldavia, Monaco, Montenegro, New Zealand, Northern Macedonia, Norway, San Marino, Saudi Arabia, Serbia, Switzerland, Turkey, Ukraine, United Kingdom, USA
	• Mode 2	South Korea, Taiwan, Thailand, Japan
	• Mode 3	India
	• Mode 4	Kazakhstan
Default	Mode 1	

9.3.11 Audit trail (3.11)

9.3.11.1 Configuration change counter (3.11.1)

Displays number of times device configuration or calibration changed, locally or via engineering system.

9.4 Communication (4)

The following parameters relate to device Communication.

9.4.1 Polling address (4.1)

Sets poll ID on a HART network.

For point-to-point configurations, the standard address is zero (0). For multidrop configurations, use a non-zero HART address.

Setting	0 to 63
Default	0

9.4.2 Identify the device (4.2)

Used to arm device locally to produce a visual alert (blinking display) so device can be identified.

Setting	Enabled
	Disabled
Default	Disabled

<< Is Note wording: "command 72" and "optional display" applicable to LR5xx ? >>

Note

Optional display required

When HART command 72 is issued to the device address, a display test is run, causing the attached optional display to blink.

9.5 Security (5)

The following parameters relate to device Security.

9.5.1 Change user PIN (5.1)

Used to change PIN code that enables user access level.

Setting	0 to 65535
Default	0

9.5.2 Recovery ID (5.2)

Displays recovery ID that must be provided to Technical Support to obtain the PIN-Unlock-Key (PUK) required to recover the PIN(s).

Record the number shown in parameter "Recovery ID", and the serial number of the device. (Serial number can be found on device nameplate, or via remote operation if data was previously uploaded from device to EDD and saved in offline table, e.g. PDM **Structure view**.)

9.5 Security (5)

When you provide this information to Siemens Technical Support, a PUK (PIN Unlock Key) will be supplied to you. Enter this PUK in parameter "PIN recovery" to reset the user PIN to factory default value.

Note**Parameter visibility**

Parameter "Recovery ID" will only show on the local display if parameter "User PIN" is enabled.

9.5.3 PIN recovery (5.3)

Used to enter PIN unlock key (PUK) which resets PIN(s) to factory default value. The PUK is available from Technical Support.

For more information, see AUTOHOTSPOT.

Note**Parameter visibility**

Parameter "PIN recovery" will only show on the local display if parameter "User PIN" is enabled.

9.5.4 User PIN (5.4)

Used to enable/disable user PIN. When user PIN is enabled, changes to parameter settings require a PIN to be entered.

Note**Factory PIN**

Device is shipped unlocked. If device is locked unintentionally (user PIN enabled), enter PIN 2457 to unlock device (disabled user PIN).

Setting	Enabled
	Disabled
Default	Disabled

In **Parameter view**, the local display shows the action that can be performed:

- If display shows "Enabled", this means that security is currently disabled
- If display shows "Disabled", this means that security is currently enabled.

Note**Effectivity of change to user PIN setting**

When the setting for parameter "User PIN" is changed, it will not take effect immediately. Once setting is changed, a power cycle of the device or ten (10) minutes must pass before the change will take effect. (This delay applies only when a change is made to this parameter on the local device, not via remote operation.)

9.5.5 Button lock (5.5)

Sets access to device buttons. When lock enabled, device operation is only possible via engineering system.

To disable lock locally press right button for 5 seconds, or use engineering system to disable remotely.

Setting	Enabled	Button lock is enabled
	Disabled	Button lock is disabled
Default	Disabled	

9.6 Language (6)

Sets the language for the local display.

Setting	• English • Deutsch • Français • Italiano • Español • 汉语
Default	Based on user configuration at initial startup.

Service and maintenance

10.1 Basic safety notes

Note

The device is maintenance-free.

10.1.1 Maintenance

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover
- Reliability of power supply, lightning protection, and grounds

**WARNING****Use of a computer in a hazardous area**

If the interface to the computer is used in the hazardous area, there is a risk of explosion.

- Ensure that the atmosphere is explosion-free (hot work permit).

NOTICE**Penetration of moisture into the device**

Damage to device.

- Make sure when carrying out cleaning and maintenance work that no moisture penetrates the inside of the device.

10.2 Cleaning

Cleaning the enclosure

- Clean the outside of the enclosure with the inscriptions and the display window using a cloth moistened with water or a mild detergent.
- Do not use any aggressive cleansing agents or solvents, e.g. acetone. Plastic parts or the painted surface could be damaged. The inscriptions could become unreadable.

WARNING

Electrostatic charge

Risk of explosion in hazardous areas if electrostatic charges develop, for example, when cleaning plastic surfaces with a dry cloth.

- Prevent electrostatic charging in hazardous areas.

10.3 Maintenance and repair work

WARNING

Impermissible repair of explosion protected devices

Risk of explosion in hazardous areas

- Repair must be carried out by Siemens authorized personnel only.

WARNING

Maintenance during continued operation in a hazardous area

There is a risk of explosion when carrying out repairs and maintenance on the device in a hazardous area.

- Isolate the device from power.

- or -

- Ensure that the atmosphere is explosion-free (hot work permit).

WARNING

Impermissible accessories and spare parts

Risk of explosion in areas subject to explosion hazard.

- Only use original accessories or original spare parts.
- Observe all relevant installation and safety instructions described in the instructions for the device or enclosed with the accessory or spare part.

10.3.1 Enclosure open

** WARNING****Enclosure open**

Risk of explosion in hazardous areas.

To open the device in a hazardous area, isolate the device from power.

Exception: Devices exclusively having Intrinsic safety (Ex i) may be opened in an energized state in hazardous areas.

** WARNING****Improper connection after maintenance**

Risk of explosion in areas subject to explosion hazard.

- Connect the device correctly after maintenance.
- Close the device after maintenance work.

Refer to Connecting (Page 47).

** WARNING****Hot, toxic, or corrosive process media**

Risk of injury during maintenance work.

When working on the process connection, hot, toxic, or corrosive process media could be released.

- As long as the device is under pressure, do not loosen process connections and do not remove any parts that are pressurized.
- Before opening or removing the device ensure that process media cannot be released.

** CAUTION****Hot surfaces**

Risk of burns during maintenance work on parts having surface temperatures exceeding 70 °C (158 °F).

- Take corresponding protective measures, for example, by wearing protective gloves.
- After carrying out maintenance, remount touch protection measures.

10.4 Replacing the HMI

10.4.1 Remove existing HMI

To remove HMI for wiring or to replace a damaged display, follow steps below:

1. Turn lid by hand in a counter-clockwise direction while lifting to remove it from device.
2. Pull up to disconnect HMI cable from connector. The HMI is now free to lift out of enclosure. (Dispose of a damaged HMI according to local regulations.)

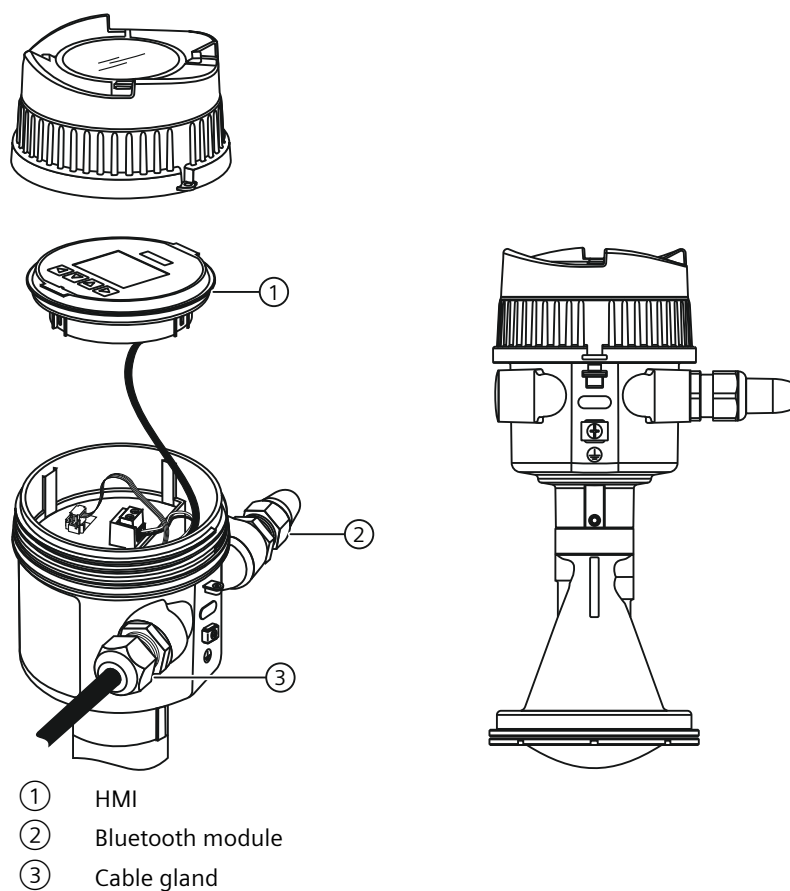
10.4.2 Install a new HMI

Note

Mounting orientation for HMI

The HMI can be rotated to any position. It will snap and hold into 90° intervals for easy viewing after installation.

1. Press the female end of cable from replacement display onto male four-pin connector.
2. Set replacement HMI into enclosure approximately one quarter turn counter-clockwise from the desired final orientation. Gently turn HMI one quarter turn clockwise to secure the HMI in the enclosure.
3. Replace device lid. Thread onto enclosure, turning clockwise. Hand tighten until mechanical stop is reached.



10.5 Return procedure

To return a product to Siemens, see AUTOHOTSPOT.

Contact your Siemens representative to clarify if a product is repairable, and how to return it. They can also help with quick repair processing, a repair cost estimate, or a repair report/cause of failure report.

NOTICE

Decontamination

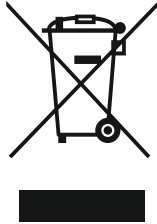
The product may have to be decontaminated before it is returned. Your Siemens contact person will let you know for which products this is required.

See also

Decontamination declaration (<https://www.siemens.com/sc/declarationofdecontamination>)

Return goods delivery note (<https://www.siemens.com/processinstrumentation/returngoodsnote>)

10.6 Disposal



Devices described in this manual should be recycled. They may not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE).

Devices can be returned to the supplier within the EC and UK, or to a locally approved disposal service for eco-friendly recycling. Observe the specific regulations valid in your country.

Further information about devices containing batteries can be found at: Information about battery / product return (WEEE) (<https://support.industry.siemens.com/cs/document/109479891/>)

Note

Special disposal required

The device includes components that require special disposal.

- Dispose of the device properly and environmentally through a local waste disposal contractor.
-

Diagnostics and troubleshooting

11.1 Device status symbols

Device status is shown using symbols on the local display. Additionally, the symbol and respective text message for each device status can be seen in remote engineering, asset management or process control systems.

Locally, alarms are shown as a symbol in the lower line of the display. If several diagnostic states are active at the same time, the symbol for the most critical state is shown.

Device status characteristics

The following table provides possible cause of device status and actions for the user or service.

The symbols used on the local display are based on NAMUR status signals, whereas symbols used in SIMATIC PDM are based on Siemens standard alarm classes.

Note

Device status priority conflict - Namur vs Siemens standard

When more than one diagnostic event is active simultaneously, a conflict in priorities may arise. In this case, the Namur symbol on the local display will differ from that shown in SIMATIC PDM.

- For example: if both diagnostic states "Maintenance demanded" and "Configuration error" are active,
 - Local display (using Namur symbols) will show "Configuration error" as higher priority.
 - SIMATIC PDM (using Siemens standard symbols) will show "Maintenance demanded" as higher priority.

Be aware of the priority for each device status, depending on the interface used.

11.2 Communication troubleshooting

Note

Understanding radar technologies

- Many parameters referenced and techniques described here require a good understanding of radar technologies and Siemens echo processing software. Use this information with caution.
 - If setup becomes too confusing, perform a device reset and start again.
 - As a further resource, "Understanding Radar Level Measurement" is available on our website. Go to:
AUTOHOTSPOT
Select "**Training center > E-Learning > epub**s".
-

11.3 Device status symbols

Generally

1. Check the following:
 - Power is available at device.
 - Optional display shows relevant data.
 - Device can be programmed using local buttons.
 - If any fault codes show on display, see AUTOHOTSPOT for a detailed list.
2. Verify that wiring connections are correct.

Specifically

1. If the device is set to communicate via a HART modem but no communication is returning to the master, check that the device address is set correctly for the HART network.
2. If a device parameter is set via remote communication, but the parameter remains unchanged, try setting the parameter using local buttons. If it cannot be set locally, ensure AUTOHOTSPOT is set to "Off", and that User PIN is deactivated.

If you continue to experience problems, go to:

Product page

Check the FAQs for this device, or contact your Siemens representative.

11.3 Device status symbols

11.3.1 Device status symbols (chart)

Device status symbols

Local display - NAMUR NE 107			SIMATIC PDM/PLC		
Symbol	Device status	Priority *	Symbol	Device status	Priority **
	Failure	1		Maintenance alarm	1
Cause: Output signal invalid due to fault in the field device or in the peripherals. Action: Maintenance is required immediately.					
	Maintenance required	4		Maintenance demanded	2
Cause: Output signal is still valid, but wear reserve is almost exhausted and/or a function will be limited soon. Action: Maintenance is strongly recommended as soon as possible.					
	Maintenance required	4		Maintenance required	3

Local display - NAMUR NE 107			SIMATIC PDM/PLC		
NAMUR - HCF					
Symbol	Device status	Priority *	Symbol	Device status	Priority **
Cause: Output signal is still valid. No functional restriction detected but end of wear reserve expected in next weeks. Action: Maintenance of device should be planned.					
	Function check	2		Manual operation	4
Cause: Output signal temporarily invalid (e.g. frozen) due to work being performed on the device. Action: Disable manual mode via HMI or engineering system.					
	Function check	2		Simulation or substitute value	5
Cause: Output signal temporarily does not represent the process because output based on a simulation value. Action: Disable simulation mode via HMI or engineering system or restart device.					
	Failure	1		Out of service	6
Cause: Output signal does not represent process value. Device mode is set to "Out of service". Action: Disable "out of service" and enable normal operation.					
	Failure	1	 (red)	Configuration error	7
Cause: Output signal invalid due to a parameter setting, connection error or a configuration error in the HW. Action: Check hardware configuration or parameter settings of the device via HMI or engineering system.					
	Out of specification	3		Process value alarm	8
Cause: Deviations from permissible ambient or process conditions detected by the device (through self-monitoring, or warnings / faults in the device) indicate that the measured value is unreliable or deviations from the set value in the actuators is most likely greater than anticipated under normal operating conditions. Process or ambient conditions will damage the device or result in unreliable output. Action: Check ambient temperature or process conditions. If possible, install device at different location.					
	Function check	2	 (yellow)	Configuration warning	9
Cause: Device can operate, but one or more parameters are incorrectly configured. Action:					
	Out of specification	3		Process value warning	10

11.5 Fault codes and corrective actions

Local display - NAMUR NE 107			SIMATIC PDM/PLC		
Symbol	Device status	Priority *	Symbol	Device status	Priority **
Cause: Deviations from permissible ambient or process conditions detected by the device (through self-monitoring, or warnings / faults in the device) indicate that the measured value is unreliable or deviations from the set value in the actuators is most likely greater than anticipated under normal operating conditions. Process or ambient conditions can damage the device or result in unreliable output. Action: Check ambient temperature or process conditions. If possible, install device at different location.					
No symbol shown				Process value tolerance	11
Cause: At least one process value has exceeded or fallen below a process tolerance limit parameter set in device. Action: Check that limit parameter settings are suitable for application.					
No symbol shown			No symbol shown	Configuration changed	12
Cause: The device configuration has changed due to a work process. Action: Reset configuration flag to clear diagnostic message.					
No symbol shown	Good - OK		No symbol shown	No assignment	13
Cause: Device status ok. No active diagnostic errors. Action: No action required.					

* Lowest priority number equals highest fault severity.

** Both the Siemens standard symbol and its corresponding Namur symbol (from device display) will be shown in SIMATIC PDM.

11.4 Device information symbols

11.4.1 Device information symbols

Information symbols

In addition to device status symbols, information symbols appear on the local display.

See AUTOHOTSPOT.

11.5 Fault codes and corrective actions

<< Once final diagnostics listed on Device (waiting for new 3.2 menu), then have RolandB check this list of diags to ensure complete and correct for LR5xx. Also want to decide if

want to include ID column (as will not show on device), and see if diags with asterisks is still applicable for LR5xx. >>

In the following table the diagnostic message IDs are listed along with possible causes and directions for corrective action.

Certain faults exist, that when triggered initiate a **Fail-safe** state. Usually this means that the mA output displays the setting in parameter "Fault current". These faults are indicated with a single asterisk (*) in the table below. For faults that display a mA output, set by something other than parameter "Fault current", refer to numbered footnotes.

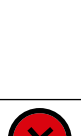
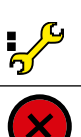
ID	Symbols	Message	Cause/action
A0*		Event counter 1 Number overruns above threshold Maintenance alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A1		Event counter 1 Number underruns above threshold Process value alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A2		Event counter 1 Number underruns above threshold Maintenance required	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A3*		Event counter 1 Number underruns above threshold Maintenance alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A4		Event counter 2 Number overruns above threshold Process value alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A6		Event counter 2 Number overruns above threshold Maintenance required	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A7*		Event counter 2 Number overruns above threshold Maintenance alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.

11.5 Fault codes and corrective actions

ID	Symbols	Message	Cause/action
A8	 	Event counter 2 Number underruns above threshold Process value alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A9	 	Event counter 2 Number underruns above threshold Maintenance required	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
AA	 	Device lifetime: maintenance demanded	Forthcoming end of configured device's lifetime. Maintenance is strongly recommended as soon as possible.
Ab	 	Device lifetime: maintenance required	Forthcoming end of configured device's lifetime. Maintenance of device should be planned.
AE	 	Service: maintenance demanded	Forthcoming end of the configured service interval. Maintenance is strongly recommended as soon as possible.
AF	 	Service: maintenance required	Forthcoming end of the configured service interval. Maintenance of device should be planned.
AG	 	Calibration: maintenance demanded	Forthcoming end of the calibration interval. Maintenance is strongly recommended as soon as possible.
AH	 	Calibration: maintenance required	Forthcoming end of the calibration interval. Maintenance of device should be planned.
AJ	 	Limit monitoring 1 Above limit Process value alarm	Monitored value is above limit (set in parameter "Upper limit").

ID	Symbols	Message	Cause/action
AL	 	Limit monitoring 1 Below limit Process value alarm	Monitored value is below limit (set in parameter "Lower limit").
An	 	Limit monitoring 2 Above limit Process value alarm	Monitored value is above limit (set in parameter "Upper limit").
Ao	 	Limit monitoring 2 Below limit Process value alarm	Monitored value is below limit (set in parameter "Lower limit").
AP	 	Limit monitoring 3 Above limit Process value alarm	Monitored value is above limit (set in parameter "Upper limit").
Ar	 	Limit monitoring 3 Below limit Process value alarm	Monitored value is below limit (set in parameter "Lower limit").
AU	 	Event counter 1 Number overruns above threshold Process value alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
AY	 	Event counter 1 Number overruns above threshold Maintenance required	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
b0	 	Event counter 3 Number underruns above threshold Process value alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
b1	 	Event counter 3 Number underruns above threshold Maintenance required	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.

ID	Symbols	Message	Cause/action
b2*		Event counter 3 Number underruns above threshold Maintenance alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
bE ¹⁾		Out of service Maintenance alarm	Output signal does not represent process value. Device mode is set to "Out of service". Repair is required. Contact Technical support.
bL*		Device restart due to unexpected program error Maintenance alarm	Watchdog function has detected an internal device error. Restart the device. If the problem persists, contact Technical support.
bn		Alarm sensor limit exceeded Process value alarm	Process value has reached the sensor limit. Review process conditions versus product specifications.
bS*		Event counter 2 Number underruns above threshold Maintenance alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
bt		Event counter 3 Number overruns above threshold Process value alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
bU		Event counter 3 Number overruns above threshold Maintenance required	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
bY*		Event counter 3 Number overruns above threshold Maintenance alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
CA		Simulation mode Simulated or substitute value	The device is in simulation mode and one or more of its device variables are not representative of the process. Disable the simulation to return to normal operation.

ID	Symbols	Message	Cause/action
Cb		Diagnostics simulated Simulated or substitute value	The device is in simulation mode. Disable the simulation to return to normal operation.
Co ²⁾		Loop current fixed Manual operation	The loop current is being held at a fixed value and is not responding to process variations. Enter the loop current output value for simulation. Disable the simulation to return to normal operation.
CP ³⁾		Loop current in saturation Process value warning	The loop current has reached its upper (or lower) saturation limit and cannot increase (or decrease) any further. Adjust loop current scaling.
CU		PV status: uncertain Process value alarm	Parameter "Fail-safe loss of echo" is set to "Hold", and device is in loss of echo (LOE) OR Limit is set for a negative level value, and that value is exceeded. Check for changes in process conditions or obstructions in vessel. OR Potential product damage. Sensor has malfunctioned. A replacement of sensor is recommended. Contact Technical support.
CY*		PV status: bad Maintenance alarm	Parameter "Fail-safe loss of echo" is set to "Fault current", and device is in loss of echo (LOE). Review process conditions versus product specifications. Use a device that fulfills your process conditions. OR The measured value is 10% higher than the physical sensor range. Review process conditions versus product specifications. Use a device that fulfills your process conditions.
Fb		Supply voltage below limit	The supply voltage is too low. Make sure input voltage is within product specification. << did not exist for LU240 - Keep if LR5xx supports Limit monitoring (EDD only) for terminal voltage >>
FC		Supply voltage above limit	The supply voltage is too high. Make sure input voltage is within product specification. << Did not exist for LU240 - Keep if LR5xx supports Limit monitoring (EDD only) for terminal voltage >>
FJ		Process conditions out of specification Process value warning	Uncertain values due to process conditions. Check installation for abnormal operating conditions.

11.5 Fault codes and corrective actions

ID	Symbols	Message	Cause/action
Fn*		Connection failure to sensor electronics Maintenance alarm	Potential product damage. Restart the device. If error continues, sensor electronics may have a defect. Repair is required. Contact Technical support.
Fo*		Sensor break Maintenance alarm	Potential product damage. Sensor has malfunctioned. A replacement of sensor is recommended. Contact Technical support.
Fr		Internal power supply is out of allowable range Process value warning	A replacement of the device is recommended. Contact Technical support.
FS*		Electronics defect Maintenance alarm	Defect of device electronics. A replacement of the device is recommended. Contact Technical support.
LA	<< icons? no class in diag file >>	Incorrect PIN entered	The entered PIN does not match with the pin stored in the device. If you have forgotten the PIN, please note the 'Recovery ID' and hold it ready when calling the Technical Support. Technical Support will give you a 'PUK'. Entering the 'PUK' in the device the PIN is reset to the default PIN. << check dbase text....not approved when entered here >>
LB	<< icons? listed as config warning in diag file >>	User PIN unchanged	The default user PIN is being used. Enter a new user PIN to optimally protect the device.
SA*		Non-volatile memory check failure Maintenance alarm	Device electronics error. Restart the device. If error continues, device electronics may have a defect. Repair is required. Contact Technical support.
Sb*		Volatile memory check failure Maintenance alarm	Device electronics error. Restart the device. If error continues, device electronics may have a defect. Repair is required. Contact Technical support.

ID	Symbols	Message	Cause/action
SC*	  (red)	Invalid device configuration Configuration error	One or more of parameters are set to invalid values. Review configuration values and adjust as necessary.
Sd ⁴⁾	 	Sensor fail-safe timer expired Maintenance required	Parameter "Fail-safe loss of echo" is set to "Hold", and device is in loss of echo (LOE). Sensor is in fail-safe mode and timer has expired, based on value set in parameter "Fail-safe LOE timer". Check for changes in process conditions or obstructions in vessel.

¹⁾ bE - mA output set to **High** (see parameter "Upper fault current"). Not possible in simulation mode.

²⁾ Co - mA output set to **Fixed current mode** (see parameter "Loop current value in multidrop mode"). Not possible in simulation mode.

³⁾ CP - mA output set to **Saturated** (see default parameter settings for "Lower saturation limit", "Upper saturation limit"). Not possible in simulation mode.

⁴⁾ Sd - Loss of echo (LOE) exists and timer has expired, therefore mA output setting is based on parameter "Fail-safe loss of echo".

11.6 Operation troubleshooting

11.6.1 Common problems

11.6.1.1 Communication troubleshooting

- Check the following:
 - There is power at the instrument.
 - The local display shows the relevant data.
 - If any fault codes are being displayed see Fault codes and corrective actions (Page 138) for a detailed list.
- Verify that the wiring connections are correct.
- See the table below for specific symptoms.

Symptom	Corrective action
You try to set a SITRANS LR500 parameter via remote communications but the parameter remains unchanged.	Ensure Write Protect (6.1.) is set to the unlock value, then try setting the parameter via the handheld programmer.

If you continue to experience problems, go to our AUTOHOTSPOT and check the FAQs for SITRANS LR500, or contact your Siemens representative.

11.6.2 Measurement difficulties

If the value in parameter "Fail-safe LOE timer" expires due to a measurement difficulty, the value set in parameter "Fail-safe loss of echo" displays. In rare cases, the SITRANS LR500 series may lock on to a false echo and report a fixed or wrong reading.

Loss of echo (LOE)

The value set in parameter "Fail-safe loss of echo" displays when the echo confidence is below the threshold value set in parameter "Echo threshold".

LOE occurs when:

- The echo is lost and no echo is shown above the ambient noise (resulting in low values for parameters "Confidence").
- Two echoes are too similar to differentiate (when BLF algorithm used) (resulting in low confidence and low echo signal strength)
- No echo can be detected within the programmed range (parameter "Far Range" can be used to extend range).

If value set in parameter "Fail-safe loss of echo" displays, check if the surface monitored is within the transmitter maximum range.

11.6.2.1 Adjusting aiming

For optimum performance on solid materials, adjust aiming to provide the best confidence and echo strength for all material levels within the measurement range.

Displaying echoes

To check echo profiles, use HMI, diagnostics, and view echo profile and an engineering system such as SIMATIC PDM. For instructions on how to display an echo profile, see section SIMATIC PDM (Page 187), and for details on how to interpret an echo profile, see section Echo processing (Page 181).

Increase fail-safe timer value

Increase the value in parameter "Fail-safe LOE timer" only if the fail-safe operation will not be compromised by the larger value.

Try this only if LOE exists for short periods of time.

11.6.2.2 Fixed reading

If the reading is a fixed value, regardless of the material surface distance, ensure:

- Beam is free from obstruction
- Properly aimed
- Not in contact with any object
- Material mixer (if used) is operating while the device is operating. If it is stopped, ensure that the mixer blade has not stopped directly below the aimer.

11.6.2.3 Obstructions in the beam

Check for (and remove if present) any beam obstruction, or relocate the transmitter.

If an obstruction cannot be removed or avoided, adjust the Time Varying Threshold (TVT) curve to reduce the echo confidence derived from the sound reflected by the obstruction. Use SIMATIC PDM to adjust the TVT curve (see AUTOHOTSPOT).

11.6.2.4 Set the device to ignore the false echo

To adjust the time-varying threshold (TVT) to ignore the false echoes, use auto false echo suppression. If this does not correct the problem, enable custom TVT shaper mode and manually shape around false echoes. For more information, see:

- Near range (Page 110)
- AFES wizard (Page 77)
- Custom TVT shaper (Page 113)

11.6.3 Wrong reading

If the reading is erratic or jumps to some incorrect value periodically, ensure:

- Surface monitored is not beyond the transmitter's programmed range or the transmitter's maximum range
- Material is not falling into the transmitter's acoustic beam
- Material is not inside the blanking distance (parameter "Near range") of the transmitter.

Types of wrong readings

If a periodic wrong reading is always the same value, see section Fixed reading (Page 146).

If the wrong reading is random, ensure the distance from the transmitter to the material surface is less than value in parameter "Far range" minus one meter (i.e. ensure you are still within the measurement range programmed in the device). If the material/object monitored is outside this range, increase parameter "Far range" as required. This error is most common in OCM applications using weirs.

Liquid splashing

If the material monitored is a liquid, check for splashing in the vessel. Enter a lower value in parameter "Response rate" to stabilize the reading, or install a stilling well. (Contact Siemens representative.)

Adjust the echo algorithm

Use SIMATIC PDM to view echo profiles and to make adjustments to parameter Algorithm (3.3.3.1) (Page 110).

If multiple echoes appear on the echo profile, typical of a flat material profile (especially if the vessel top is domed), use the "True first echo" algorithm. Also, if the true echo has jagged peaks, use parameter "Reform echo".

Should a stable measurement still not be attainable, contact Siemens representative.

11.6.4 Echo profile display and trend display

To assist in troubleshooting echo profiles, pan and zoom options are available. See AUTOHOTSPOT.

A trend display is available with pan and zoom options. See AUTOHOTSPOT.

Technical specifications

12.1 Power

Supply voltage	30 V DC maximum
Signal range	4 to 20 mA
Startup current	3.6 mA maximum

SITRANS LR500 series with Explosion protection Ex ia	
U _i (Input voltage)	30 V DC maximum
I _i (Input current)	120 mA DC maximum
P _i (Input power)	0.8 W
C _i (Effective inner capacitance)	2.2 nF
L _i (Effective inner inductance)	0

12.2 Performance

Recommended measuring range

Version	Size	Beam angle	Recommended measuring range up to
LR510 Threaded connection antenna	G $\frac{3}{4}$ "	14°	10 m (32.81 ft)
	$\frac{3}{4}$ " NPT		
	G1"	10°	20 m (65.62 ft)
	1" NPT		
LR530 Flanged encapsulated PTFE antenna	G1 $\frac{1}{2}$ "	10°	30 m (98.42 ft)
	1 $\frac{1}{2}$ NPT (+250 °C)		
	G1 $\frac{1}{2}$ "	7°	30 m (98.42 ft)
	1 $\frac{1}{2}$ NPT (+150 °C)		
LR550 Polymeric horn antenna	≥ DN 25	10°	20 m (65.62 ft)
	≥ DN 50, 2"	6°	20 m (65.62 ft)
	≥ DN 80, 3"	3°	120 m (393.7 ft)
LR580 Lens antenna	DN 80	3°	120 m (393.7 ft)

Measurement Accuracy (measured in accordance with IEC 60770-1)

Maximum measured error	= 3 mm (0.12") ^{1) 2) 3)} including hysteresis and non-repeatability	
Frequency	K-band	
Maximum measurement range ⁴⁾	1.5" antenna	10 m (32.8 ft) ⁵⁾
	2" threaded PVDF antenna	
	2"/DN50/50A Flanged encapsulated antenna (FEA)	
	2" ISO 2852, DN50 DIN 11864-1/2/3, DN50 DIN11851, Tuchenhausen Types F and N Hygienic encapsulated antenna (HEA)	
	all other versions	20 m (65.6 ft)
Minimum detectable distance	50 mm (2") from end of antenna - stainless horns, PTFE flanged versions ⁶⁾ 100 mm (4") from the end of the antenna - aluminum horn, with polypropylene lens antenna version and PVDF versions	
Update time ⁷⁾	minimum 1 second, depending on settings for Response Rate (2.4.1.) and LCD Fast Mode (4.9.)	
Influence of ambient temperature	< 0.003%/K (average over full temperature range, referenced to maximum range)	
Long-term stability	<0.1 % over 60 months	
Dielectric constant of material measured	dK > 1.6 [antenna and application dependent ⁸⁾]	
Memory	non-volatile EEPROM	
	no battery required	

¹⁾ The statistical accuracy is typically 3 mm (0.12") 90% of the time, when tested in accordance with IEC 60770-1.

²⁾ Under severe EMI/EMC environments per IEC 61326-1 or NAMUR NE21, the device error may increase to a maximum of 10 mm (0.4").

³⁾ For 2" threaded PVDF, Flanged encapsulated antennas and Hygienic encapsulated antennas, the maximum measured error <500 mm from the sensor reference point =25 mm (1").

⁴⁾ From sensor reference point: see Dimensions.

⁵⁾ 20 m (65.6 ft) possible in a stillpipe/bypass

⁶⁾ Minimum range is antenna length + 50 mm (2"). See Dimension drawings.

⁷⁾ Reference conditions: **Response Rate (2.4.1.)** set to **FAST**, **LCD Fast Mode (4.9.)** set to **ON**.

⁸⁾ For 1.5" (40 mm) antenna, 2" (50 mm) threaded PVDF antenna, 2"/DN50/50A flanged encapsulated antenna, and 2" ISO 2852, DN50 DIN 11864-1/2/3, DN50 DIN11851, Tuchenhausen Types F and N hygienic encapsulated antenna the minimum dK is limited to 3 unless a stillpipe is used.

12.3 Near range

Near range

Sets minimum distance from transmitter reference point, beyond which an echo should be considered valid. This is sometimes referred to as blanking or a blanking distance. When the beginning of the measuring range is activated, the mm value is edited by pressing the down button.

Setting	Selection	Selection	Description
SIGNAL	ECHO CONFIG	NEAR RANGE ON	Measuring range begin activated Measuring range begin value
		NEAR RANGE OFF	Measuring range begin deactivated

12.4 Interface

HART 7	Standard, integral to analog output
Configuration	Local graphical display with backlight and pushbuttons. Sitrans mobile IQ App with AW050 module (non Ex devices only), Siemens Simatic PDM
HMI (local) ¹⁾	Graphical backlit liquid crystal, with bar graph (representing Level)

¹⁾ Display will be degraded -25 °C (-13 °F) and above 65 °C (149 °F)

12.5 Outputs

Analog output	
	4 to 20 mA
	800 ohms maximum
	±0.0096 mA accuracy
	Resolution of <1 µA

12.6 Construction

Enclosure	Body material	aluminum with polyurethane powder coat
	Ingress protection	- IP66, TYPE 4X - IP68 (2 meters, 24 hours), TYPE 6

Materials

LR510 (threaded connection)		
	Sealing material of the antenna/process connection	PEEK/FKM PEEK/FFKM Klingersil flat seal for G thread versions option
	Process connection material	316/316L Alloy C22 (2.4602) option
LR530 (flanged encapsulated PTFE antenna)		
	Sealing material of the antenna/process connection	PTFE/PTFE
	Process connection material	316/316L
LR550 (polymeric horn)		
	Sealing material of the antenna/process connection	PP/PP PP/FKM PP/EPDM
	Process connection material	Universal, plastic horn antenna PP/PBT mounting bracket 300mm / 316/316L Flanges: PP-GF30
LR580 (lens antenna)		
	Sealing material of the antenna/process connection	PEEK/FKM PEEK/FFKM
	Process connection material	316/316L

Weight

Instrument (depending on housing, process fitting and antenna): approx. 2 to 17.2 kg (4.409 to 37.92 lbs)

12.7 Operating conditions

12.7.1 Second line of defence (SLOD)

This option is available on the SITRANS LR510, LR530 and LR580 and provides a secondary gas tight feed-through to prevent toxic gases from permeating from the process into the housing.

12.7.2 Environmental

Location	indoor/outdoor
Altitude	5000 m (16 404 ft) maximum
Ambient, storage and transport temperature	-40 ... +80 °C (-40 ... +176 °F)

Relative humidity	Suitable for outdoor (TYPE 4X, TYPE 6, IP66, IP68 enclosure)
Installation category	I
Pollution degree	4

12.7.3 Process conditions

For the process conditions, please also note the specifications on the nameplate. The lowest value always applies.

12.7.4 Vessel pressure

Note

Device dependent

Vessel pressure is dependent on the device, please see nameplate for details.

12.7.5 Mechanical stress

Vibration resistance	
LR510	
LR530	
LR550	
LR580	

12.7.6 Air purging system

Air purging system

Recommended max. pressure with continuous rinsing	1 bar (14.50 psig)
Max. permissible pressure	6 bar (87.02 psig)
Air quality	Filtered
Air volume, depending on pressure	

LR580 flange lens antenna

LR580 flange lens antenna	Air volume	
Pressure	Without non-return valve	With non-return valve
0.2 bar (2.9 psig)	1.7 m ³ /h	
0.4 bar (5.8 psig)	2.5 m ³ /h	
0.6 bar (8.7 psig)	2.9 m ³ /h	0.8 m ³ /h
0.8 bar (11.6 psig)	3.3 m ³ /h	1.5 m ³ /h
1 bar (14.5 psig)	3.6 m ³ /h	2 m ³ /h
1.2 bar (17.4 psig)	3.9 m ³ /h	2.3 m ³ /h
1.4 bar (20.3 psig)	4 m ³ /h	2.7 m ³ /h
1.6 bar (23.2 psig)	4.3 m ³ /h	3 m ³ /h
1.8 bar (20.3 psig)	4.5 m ³ /h	3.5 m ³ /h
2 bar (23.2 psig)	4.6 m ³ /h	4 m ³ /h

LR550 polymeric horn antenna

LR550 polymeric horn antenna	Air volume	
Pressure	Without non-return valve	With non-return valve
0.2 bar (2.9 psig)	3.3 m ³ /h	
0.4 bar (5.8 psig)	5 m ³ /h	
0.6 bar (8.7 psig)	6 m ³ /h	1 m ³ /h
0.8 bar (11.6 psig)		2.1 m ³ /h
1 bar (14.5 psig)		3 m ³ /h
1.2 bar (17.4 psig)		3.5 m ³ /h
1.4 bar (20.3 psig)		4.2 m ³ /h
1.6 bar (23.2 psig)		4.4 m ³ /h
1.8 bar (20.3 psig)		4.8 m ³ /h
2 bar (23.2 psig)		5.1 m ³ /h

Connection

Thread	G $\frac{1}{8}$
Seal	Threaded plug of 316Ti

Air purging system

Material	316Ti
Thread	G $\frac{1}{8}$
Seal	FKM (SHS FPM 70C3 GLT), EPDM (COG AP310)
For connection	G $\frac{1}{8}$
Opening pressure	0.5 bar (7.25 psig)
Nominal pressure stage	PN 250

12.8 Process

Process temperature

Version	Material	Seal	Process temperature (measured on the process fitting)
LR510 Threaded connection	PEEK	FKM	-40 ... +150 °C (-40 ... +302 °F)
			-40 ... +200 °C (-40 ... +392 °F)
		FFKM	-15 ... +150 °C (5 ... +302 °F)
			-15 ... +250 °C (5 ... +482 °F)
LR530 Flange with encapsulated antenna	PTFE and PTFE 8 mm	PTFE	-60 ... +150 °C (-76 ... +302 °F)
			-196 ... +200 °C (-320 ... +392 °F)
LR550 Polymeric horn antenna	PP	PP	-40 ... +80 °C (-40 ... +176 °F)
		FKM	-40 ... +80 °C (-40 ... +176 °F)
		EPDM	-40 ... +80 °C (-40 ... +176 °F)
LR580 Lens antenna, solids	PEEK	FKM	-40 ... +150 °C (-40 ... +302 °F)
			-40 ... +200 °C (-40 ... +392 °F)
		FFKM	-15 ... +250 °C (-4 ... +392 °F)

Note

Device dependent

Process temperature is dependent on the device, see nameplate for details.

12.9 Certificates and approvals

LR500 series	
"Intrinsic safety" type of protection	
ATEX CSANe 23ATEX1113X II 1 D Ex ia IIIC Tnnn°C Da	II 1 G Ex ia IIC T4...T6 Ga
IECEX IECEX CSA 23.0025X Ex ia IIIC Tnnn°C Da	Ex ia IIC T4...T6 Ga
UKCA CSAE 23UKEX1087X II 1 D Ex ia IIIC Tnnn°C Da	II 1 G Ex ia IIC T4...T6 Ga
NEPSI (China) GYJnn.nnnnX	Ex ia IIC T4...T6 Ga Ex ia IIIC Tnnn°C Da
INMETRO (Brazil) DNV 23.nnnnX	Ex ia IIC T4...T6 Ga Ex ia IIIC Tnnn°C Da
KCs (Korea) 2023-BO-nnnn-n	Ex ia IIC T4...T6 Ga Ex ia IIIC Tnnn°C Da

LR500 series	
• EACEx (Russia) RU C-nnnnnnn	Ex ia IIC T4...T6 Ga X Ex ia IIIC Tnnn°C Da X
• PESO (India) A/P/HQ/MH/nnn/nnnn (Pnnnnnn)	Ex ia IIC T4...T6 Ga Ex ia IIIC Tnnn°C Da
• IA (S. Africa) MASC S/23-nnnnX	Ex ia IIC T4...T6 Ga Ex ia IIIC Tnnn°C Da
• Japanese hazardous CSAUK 23JPNnnnX	Ex ia IIC T4...T6 Ga Ex ia IIIC Tnnn°C Da
• CSA & FM	Class I, II, III, Div 1, Group A, B, C, D, E, F, G T4...T6
"Dust Ignition proof" type of protection	
• ATEX CSANe 23ATEX1114X	II 1 D Ex ta IIIC T200 nn°C Da
• IECEX IECEX CSA 23.0026X	Ex ta IIIC T200 nn°C Da
• UKCA CSAE 23UKEX1088X	Ex ta IIIC T200 nn°C Da
• NEPSI (China) GYJnn.nnnnX	Ex ta IIIC T200 nn°C Da
• INMETRO (Brazil) DNV 23.nnnnX	Ex ta IIIC T200 nn°C Da
• KCs (Korea) 2023-BO-nnnn-n	Ex ta IIIC T200 nn°C Da
• EACEx (Russia) RU C-nnnnnnn	Ex ta IIIC T200 nn°C Da
• PESO (India) A/P/HQ/MH/nnn/nnnn (Pnnnnnn)	Ex ta IIIC T200 nn°C Da
• IA (S. Africa) MASC S/23-nnnnX	Ex ta IIIC T200 nn°C Da
• Japanese hazardous CSAUK 23JPNnnnX	Ex ta IIIC T200 nn°C Da
• CSA & FM	Class II, III, Div 1, Group E, F, G
"Nonincendive" type of protection	
• CSA & FM	Class I, Div 2, Group A, B, C, D T4...T6

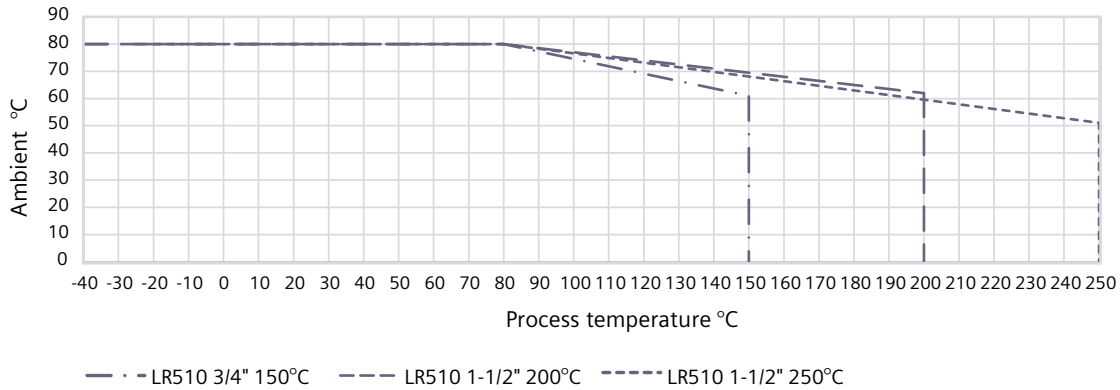
12.10 Communication

Communication type	• HART • 4 to 20 mA
Supported engineering system	SIMATIC PDM

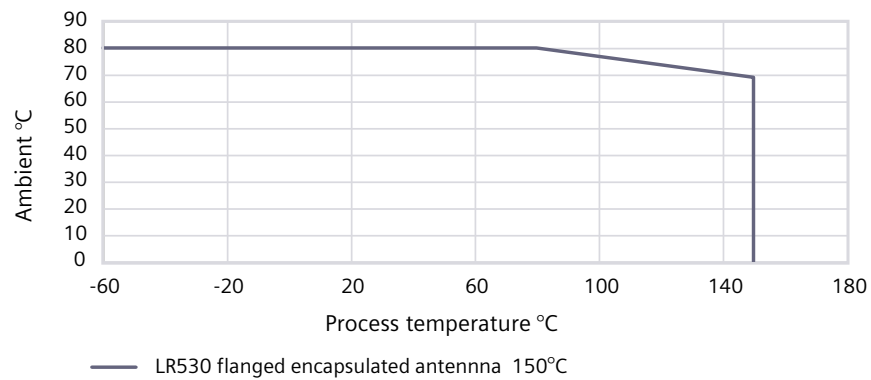
12.11 Derating curves

12.11.1 Temperature derating curves

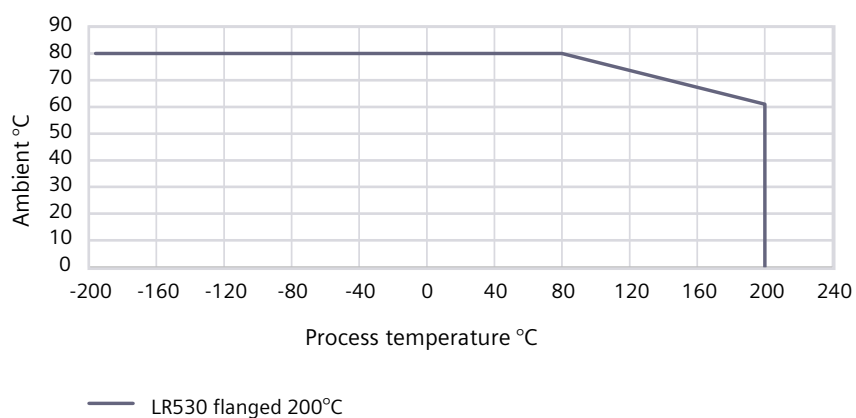
LR510 threaded lens antenna



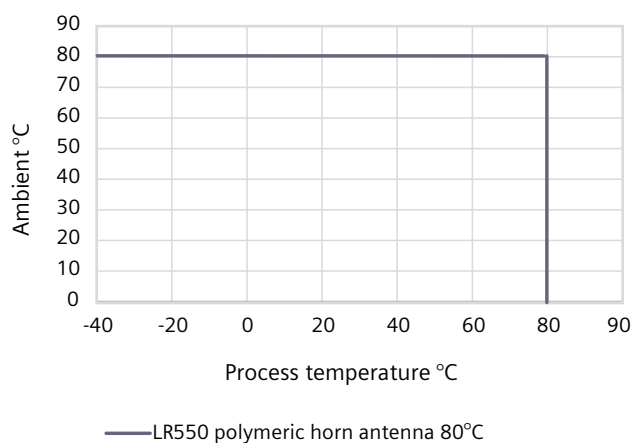
LR530 flanged encapsulated antenna



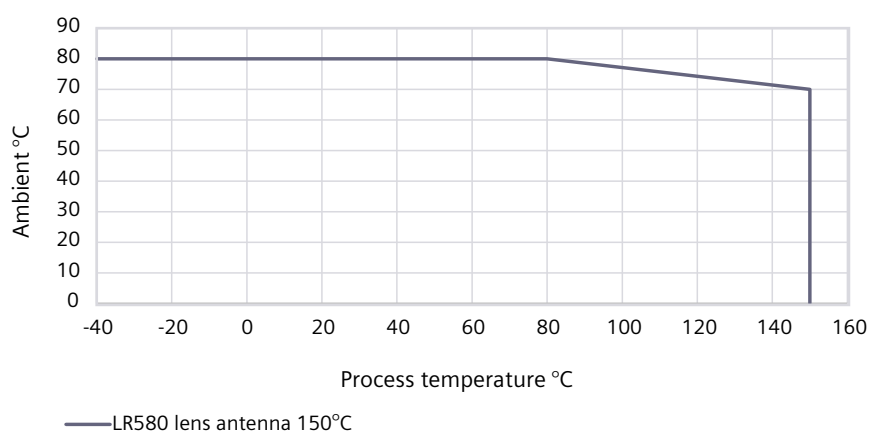
12.11 Derating curves

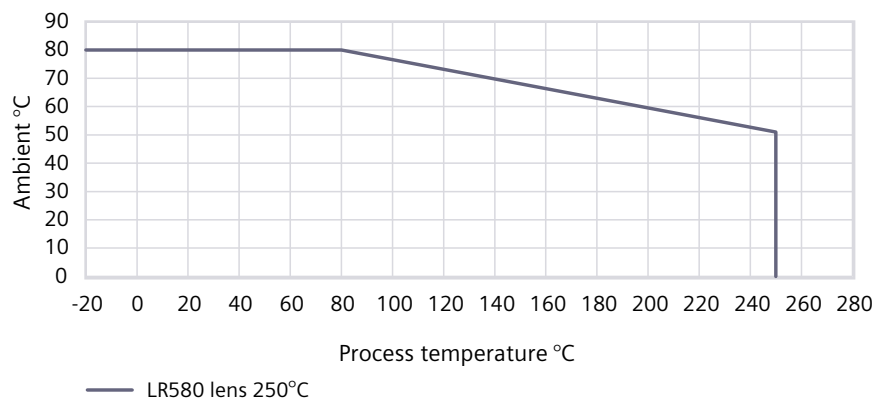


LR550 polymeric horn antenna



LR580 flanged lens antenna

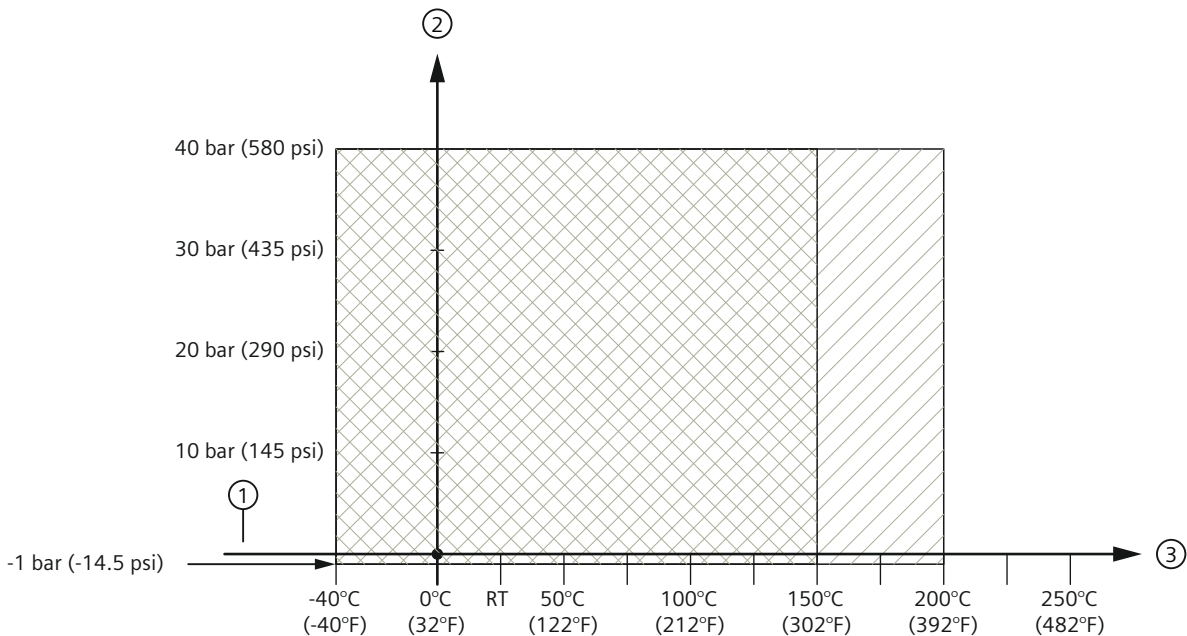




12.11.2 Temperature vs pressure derating curves

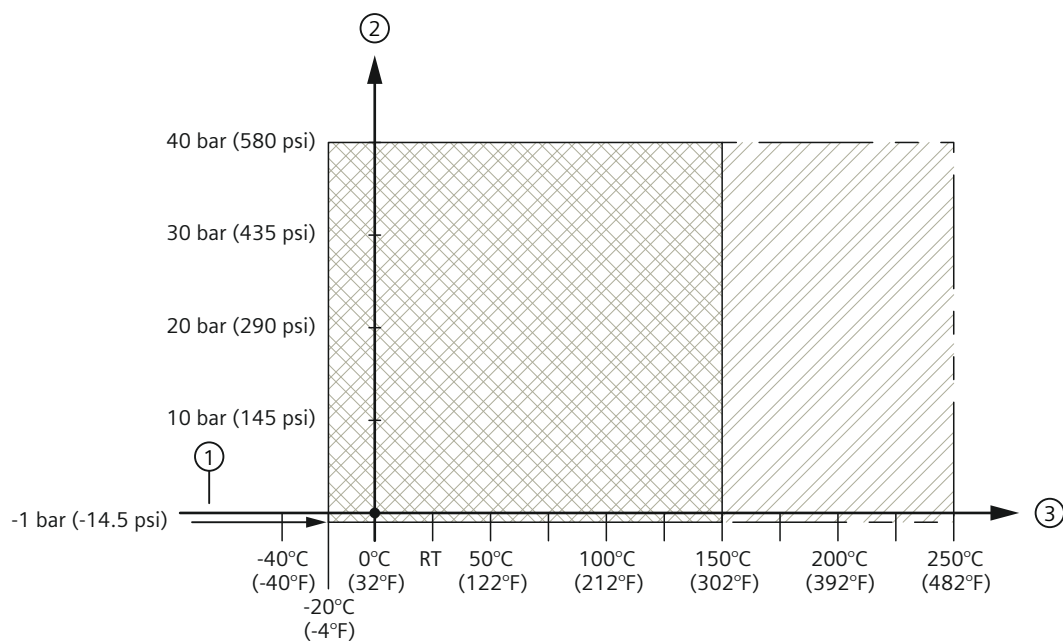
LR510 threaded lens antenna

Seal options 0 and 1



- | | |
|---|----------------------------------|
| ④ | FKM without thermal extension |
| ⑤ | FKM with thermal extension |
| ① | Atmospheric pressure |
| ② | Allowable operating pressures |
| ③ | Allowable operating temperatures |

Seal options 2 & 3

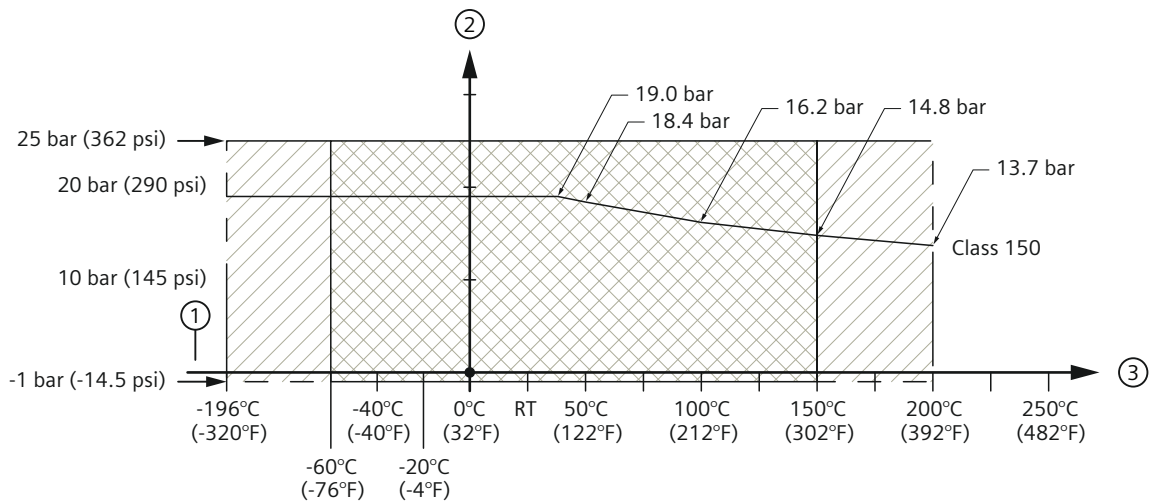


- ① Atmospheric pressure
- ② Allowable operating pressures
- ③ Allowable operating temperatures

- ④ FKM without thermal extension
- ⑤ FKM with thermal extension

LR530 flanged encapsulated antenna

ASME B16.5

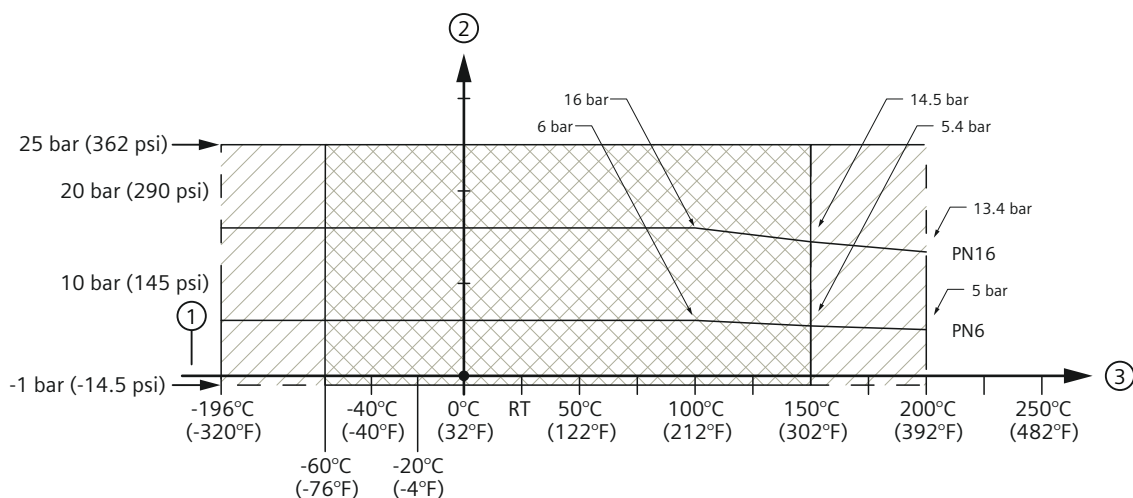


- ① Atmospheric pressure
- ② Allowable operating pressures
- ③ Allowable operating temperatures
- ④ PTFE without thermal extension
- ⑤ PTFE with thermal extension

Note: Class 300 flange maximum allowable working pressure is 25 bar (362 psi).

12.11 Derating curves

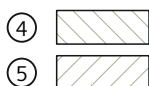
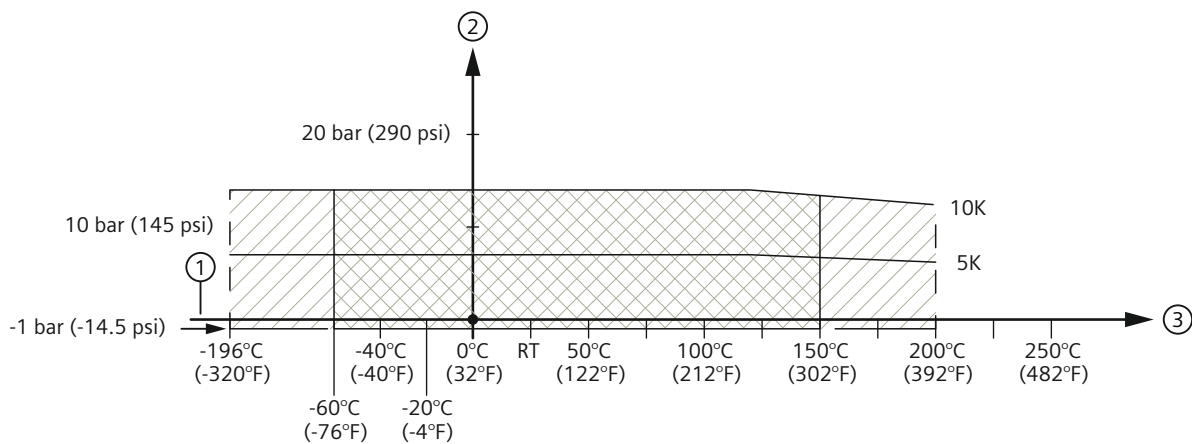
EN 1092-1



- ① Atmospheric pressure
- ② Allowable operating pressures
- ③ Allowable operating temperatures
- ④ PTFE without thermal extension
- ⑤ PTFE with thermal extension

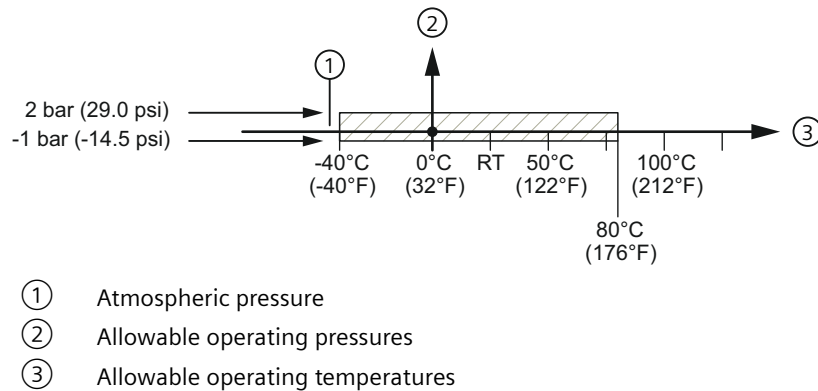
Note: PN40 flange maximum allowable working pressure is 25 bar (362 psi).

JIS B 2220



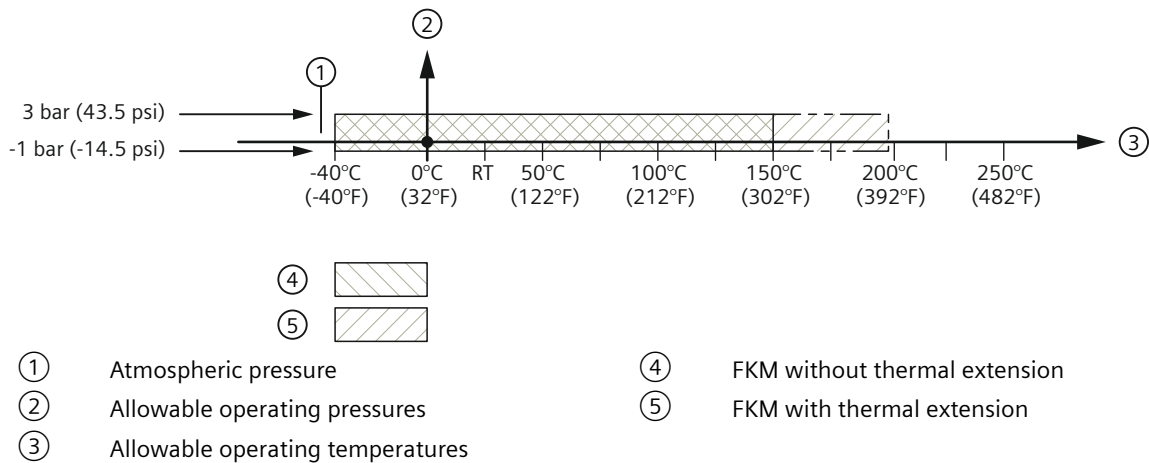
- ① Atmospheric pressure
- ② Allowable operating pressures
- ③ Allowable operating temperatures
- ④ PTFE without thermal extension
- ⑤ PTFE with thermal extension

LR550 polymeric horn antenna



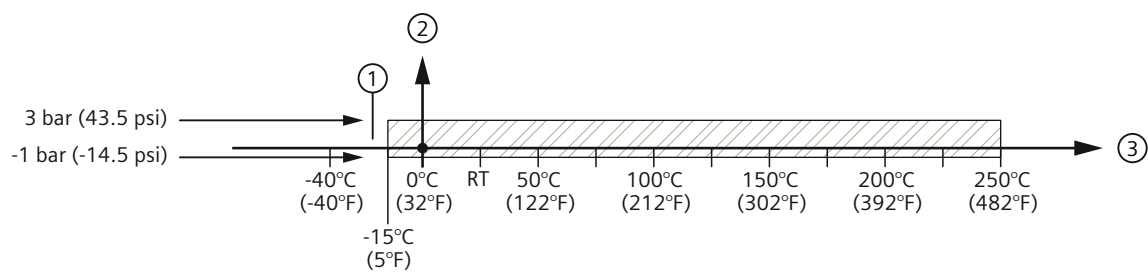
LR580 flanged lens antenna

Seal options 0 & 1



12.11 Derating curves

Seal option 2



- ① Atmospheric pressure
- ② Allowable operating pressures
- ③ Allowable operating temperatures

- ④ FFKM thermal extension

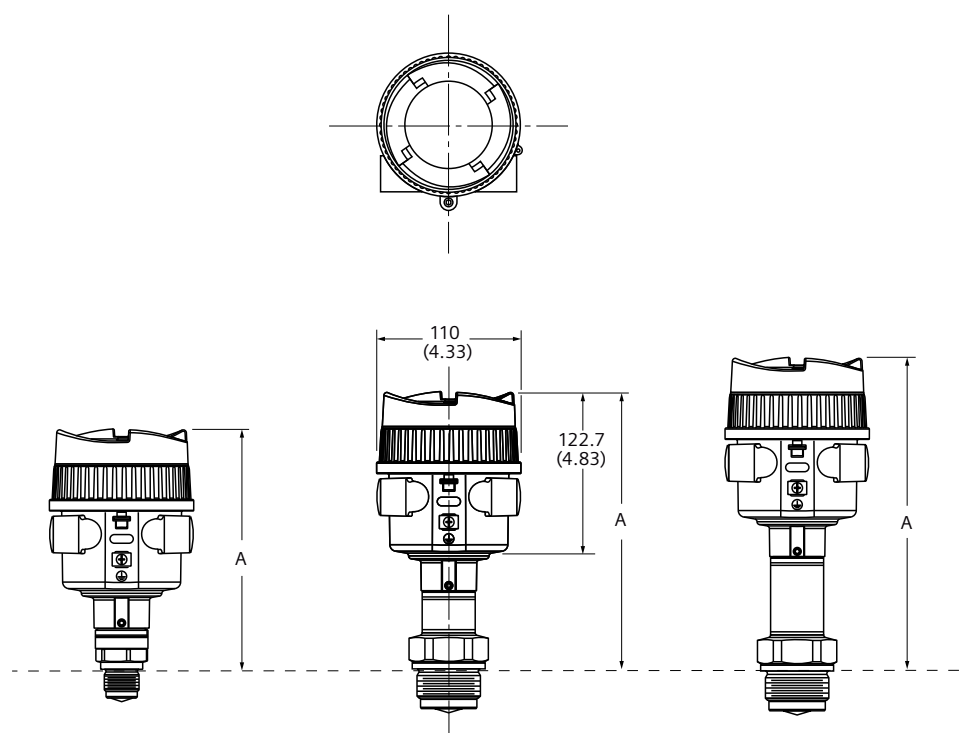
Dimension drawings

13.1 LR510 threaded lens antenna

3/4 inch

1-1/2 inch

1-1/2 inch with thermal extension



----- Sensor reference point

Dimensions in mm(inch)

Antenna type	A mm (inch)	Recommended max. range m (ft)	Beam angle	Process seal material	Temperature
Thread G3/4" PN40, DIN3852-A	182.3 (7.18)	10 (32.8)	14°	FKM	-40 ... +150 °C (-40 ... +302 °F)
Thread 3/4" NPT, ASME B1.20.1					

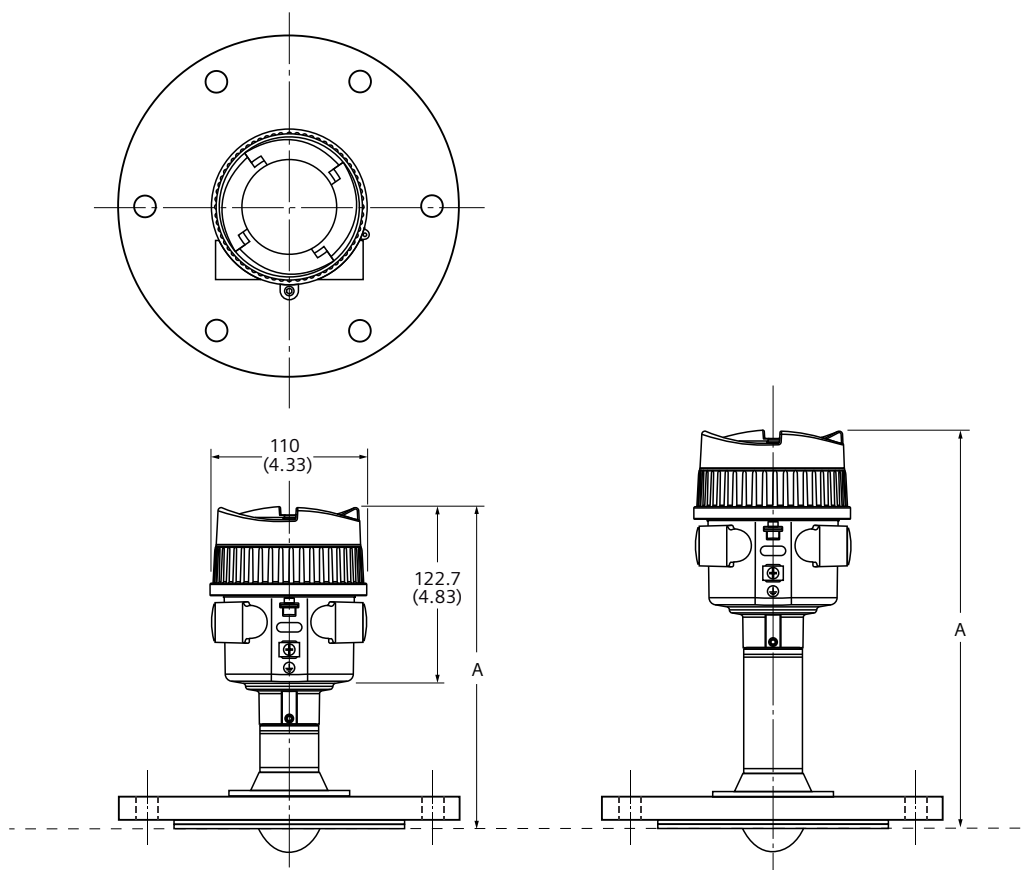
13.1 LR510 threaded lens antenna

Antenna type Thermal extension	A mm (inch)	Recommen- ded max. range m (ft)	Beam angle	Process seal material	Temperature
Thread G1" PN40, DIN3852-2-A	193.8 (7.63)	20 (65.6)	10°	FKM	-40 ... +150 °C (-40 ... +302 °F)
Thread 1" NPT, ASME B1.20.1	194 (7.64)				
Thread G1-1/2" PN40, DIN3852-2-A	213.8 (8.42)	30 (98.4)	7°		
Thread 1-1/2" NPT, ASME B1.20.1	214 (8.43)				
Thread G3/4" PN40, DIN3852-2-A	182.3 (7.18)	10 (32.8)	14°	FFKM	-20 ... +150 °C (-4 ... +302 °F)
Thread 3/4" NPT, ASME B1.20.1	182.3 (7.18)				
Thread G1" PN40, DIN3852-2-A	193.8 (7.63)	20 (65.6)	10°		
Thread 1" NPT, ASME B1.20.1	194 (7.64)				
Thread G1-1/2" PN40, DIN3852-2-A	213.8 (8.42)	30 (98.4)	7°		
Thread 1-1/2" NPT, ASME B1.20.1	214 (8.43)				
Thread G3/4" PN40, DIN3852-2-A	234.2 (9.22)	10 (32.8)	14°	FKM	-40 ... +200 °C (-40 ... +392 °F)
Thread 3/4" NPT, ASME B1.20.1	234.2 (9.22)				
Thread G1" PN40, DIN3852-2-A	245.8 (9.68)	20 (65.6)	10°		
Thread 1" NPT, ASME B1.20.1	245.8 (9.68)				
Thread G1-1/2" PN40, DIN3852-2-A	265.8 (10.46)	30 (98.4)	7°		
Thread 1-1/2" NPT, ASME B1.20.1	266 (10.47)				
Thread G3/4" PN40, DIN3852-2-A	234.3 (9.22)	10 (32.8)	14°	FFKM	-20 ... +250 °C (-4 ... +392 °F)
Thread 3/4" NPT, ASME B1.20.1	234.5 (9.32)				
Thread G1" PN40, DIN3852-2-A	245.8 (9.68)	20 (65.6)	10°		
Thread 1" NPT, ASME B1.20.1	246 (9.68)				
Thread G1-1/2" PN40, DIN3852-2-A	237.8 (9.36)	30 (98.4)	10°		
Thread 1-1/2" NPT, ASME B1.20.1	238 (9.37)				

13.2 LR530 flanged encapsulated antenna

LR530

LR530 with thermal extension



---- Sensor reference point

Dimensions in mm(inch)

Process connection type	A mm (inch)	A with thermal extension	Beam angle	Recommended max. range [m (ft)]	Flange O.D. [mm (inch)]	Bolt hole circle Ø [mm (inch)]	Bolt hole Ø [mm (inch)]	No. of bolt holes	Flange thick- ness [mm (inch)]
flange DN25 PN6, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	201.7 (7.94)	221.7 (8.73)	10°	20 (65.6)	100 (3.94)	75 (2.95)	11 (0.43)	4	16 (0.63)
flange DN50 PN6, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	216.1 (8.51)	268.1 (10.56)	6°	30 (98.4)	140 (5.51)	110 (4.33)	14 (0.55)	4	20 (0.79)

13.2 LR530 flanged encapsulated antenna

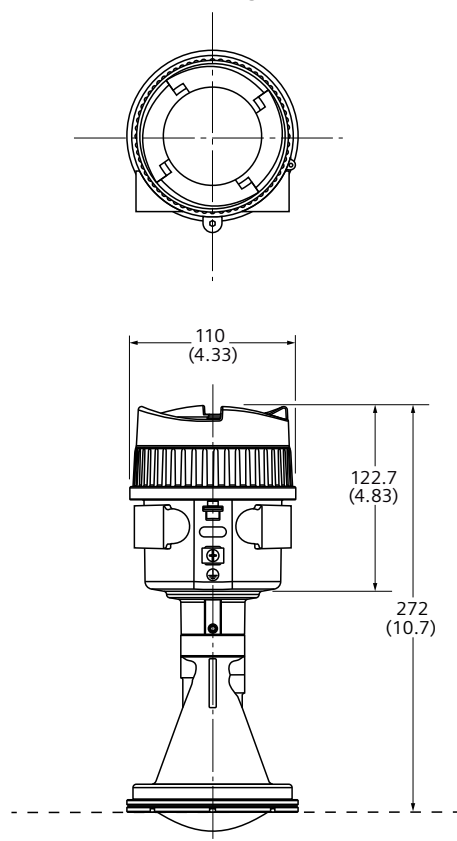
Process connection type	A mm (inch)	A with thermal extension	Beam angle	Recommended max. range [m (ft)]	Flange O.D. [mm (inch)]	Bolt hole circle Ø [mm (inch)]	Bolt hole Ø [mm (inch)]	No. of bolt holes	Flange thickness [mm (inch)]
flange DN80 PN6, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	190 (7.48)	150 (5.91)	18 (0.71)	4	20 (0.79)
flange DN100 PN16, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	220 (8.66)	180 (7.09)	18 (0.71)	8	20 (0.79)
flange DN150 PN16, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	285 (11.22)	240 (9.45)	22 (0.87)	8	22 (0.87)
flange DN200 PN16, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	340 (13.39)	295 (11.61)	22 (0.87)	12	24 (0.94)
flange DN25 PN40, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	201.7 (7.94)	221.7 (8.73)	10°	20 (65.6)	115 (4.53)	85 (3.35)	14 (0.55)	4	18 (0.71)
flange DN50 PN40, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	216.1 (8.51)	268.1 (10.56)	6°	30 (98.4)	165 (6.5)	125 (4.92)	18 (0.71)	4	20 (0.79)
flange DN80 PN40, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	200 (7.87)	160 (6.3)	18 (0.71)	8	24 (0.94)
flange DN100 PN40, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	235 (9.25)	190 (7.48)	22 (0.87)	8	24 (0.94)
flange DN150 PN40, raised face, Form B1, EN1092-1, DIN2501 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	300 (11.81)	250 (9.84)	26 (1.02)	8	28 (1.1)
flange 1" 150lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	10°	20 (65.6)	108 (4.25)	79.2 (3.13)	15.7 (0.62)	4	16 (0.63)
flange 2" 150lb RF, ASME B16.5 / 316/316L	216.1 (8.51)	268.1 (10.56)	6°	30 (98.4)	152.4 (6)	120.7 (4.75)	19.1 (0.75)	4	19.1 (0.75)
flange 3" 150lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	190.5 (7.5)	152.4 (6)	19.1 (0.75)	4	23.9 (0.94)
flange 4" 150lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	228.6 (9)	190.5 (7.5)	19.1 (0.75)	8	23.9 (0.94)

13.2 LR530 flanged encapsulated antenna

Process connection type	A mm (inch)	A with thermal extension	Beam angle	Recommended max. range [m (ft)]	Flange O.D. [mm (inch)]	Bolt hole circle Ø [mm (inch)]	Bolt hole Ø [mm (inch)]	No. of bolt holes	Flange thickness [mm (inch)]
flange 6" 150lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	279.4 (11)	241.3 (9.5)	22.4 (0.88)	8	25.4 (1)
flange 8" 150lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	342.9 (13.5)	298.5 (11.75)	22.4 (0.88)	8	28.4 (1.12)
flange 1" 300lb RF, ASME B16.5 / 316/316L	201.7 (7.94)	221.7 (8.73)	10°	20 (65.6)	124 (4.88)	88.9 (3.5)	19.1 (0.75)	4	17.5 (0.69)
flange 2" 300lb RF, ASME B16.5 / 316/316L	216.1 (8.51)	268.1 (10.56)	6°	30 (98.4)	165.1 (6.5)	127 (5)	19.1 (0.75)	8	22.4 (0.88)
flange 3" 300lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	209.5 (8.25)	168.1 (6.62)	22.4 (0.88)	8	28.4 (1.12)
flange 4" 300lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	254 (10)	200.2 (7.88)	22.4 (0.88)	8	31.8 (1.25)
flange 6" 300lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	317.5 (12.5)	269.7 (10.62)	22.5 (0.89)	12	36.6 (1.43)
flange 8" 300lb RF, ASME B16.5 / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	381 (15)	330.2 (13)	25.4 (1)	12	41.1 (1.63)
flange DN25 5K RF, JIS / 316/316L	201.7 (7.94)	221.7 (8.73)	10°	20 (65.6)	95 (3.74)	75 (2.95)	12 (0.47)	4	16 (0.63)
flange DN50 10K RF, JIS / 316/316L	216.1 (8.51)	268.1 (10.56)	6°	30 (98.4)	155 (6.1)	120 (4.72)	19 (0.75)	4	20 (0.79)
flange DN80 10K RF, JIS / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	185 (7.28)	150 (5.91)	19 (0.75)	8	20 (0.79)
flange DN100 10K RF, JIS / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	210 (8.27)	175 (6.89)	19 (0.75)	8	20 (0.79)
flange DN150 10K RF, JIS / 316/316L	243.2 (9.57)	295.2 (11.62)	3°	120 (393.7)	280 (11.02)	240 (9.45)	23 (0.91)	8	22 (0.87)

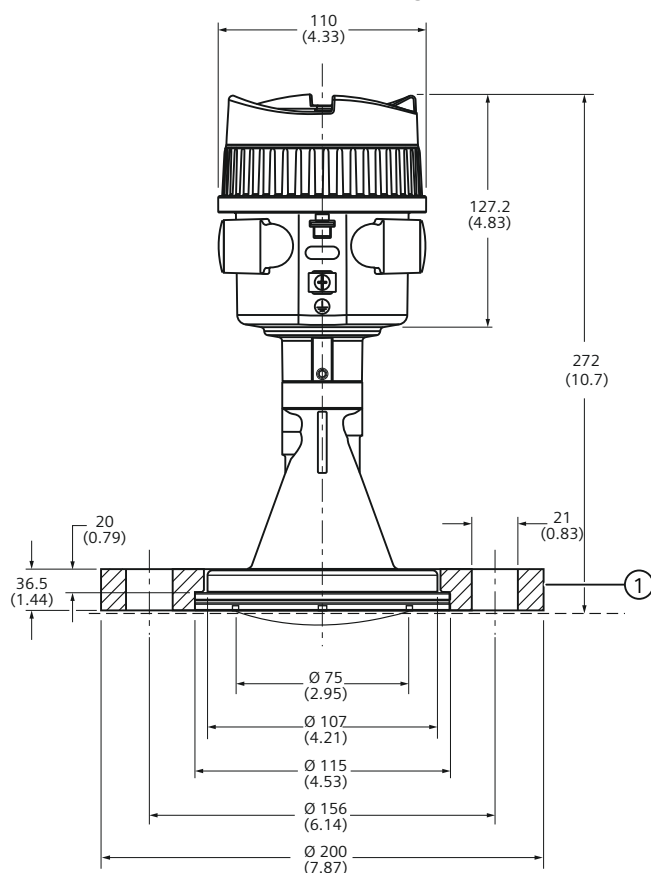
13.3 LR550 polymeric horn antenna

LR550 without flange



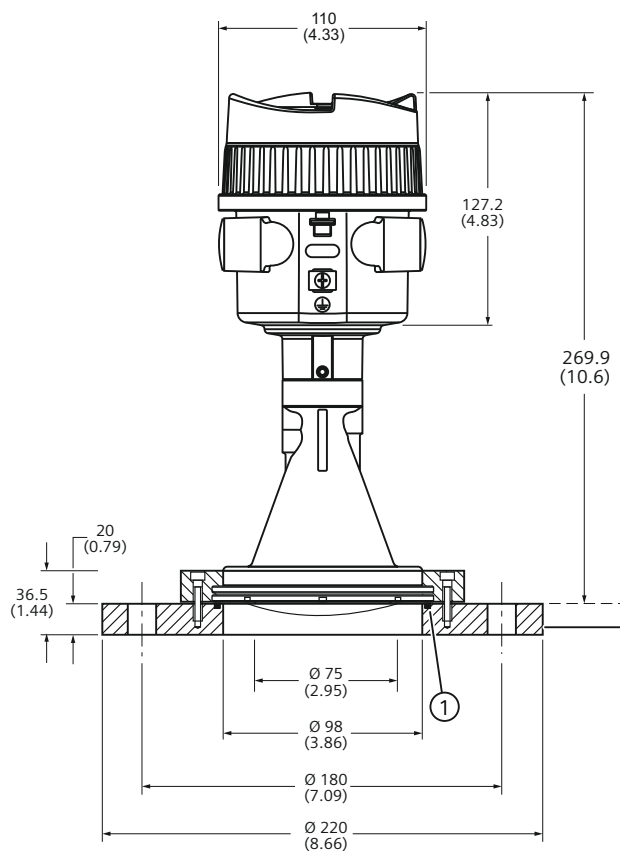
---- Sensor reference point
Dimensions in mm(Inch)

LR550 with Universal bolted flange 3"



① 3" Universal bolted flange

LR550 with flange

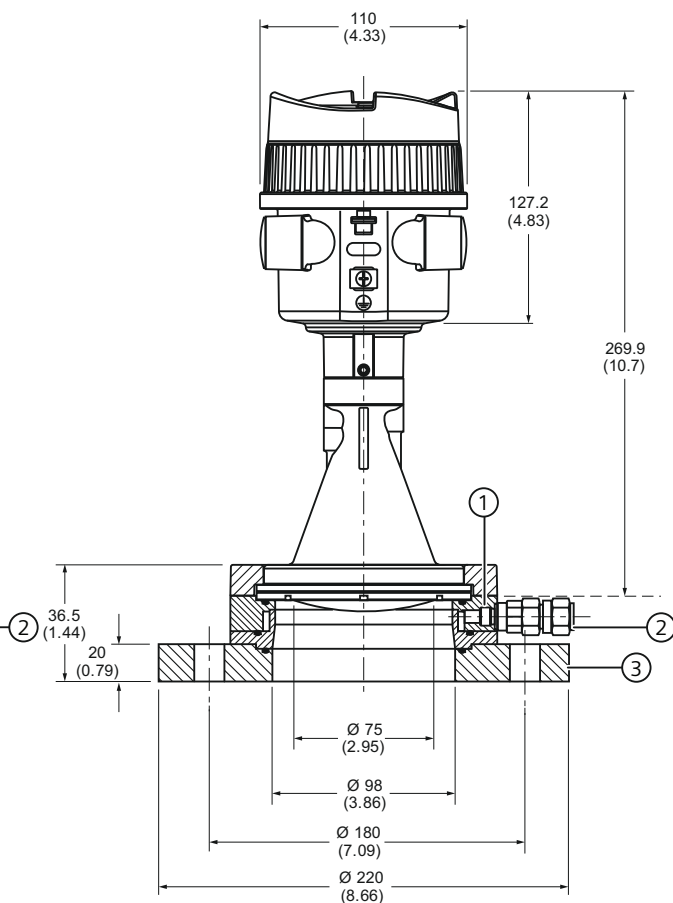


- ① Process seal
- ② Device flange

--- Sensor reference point

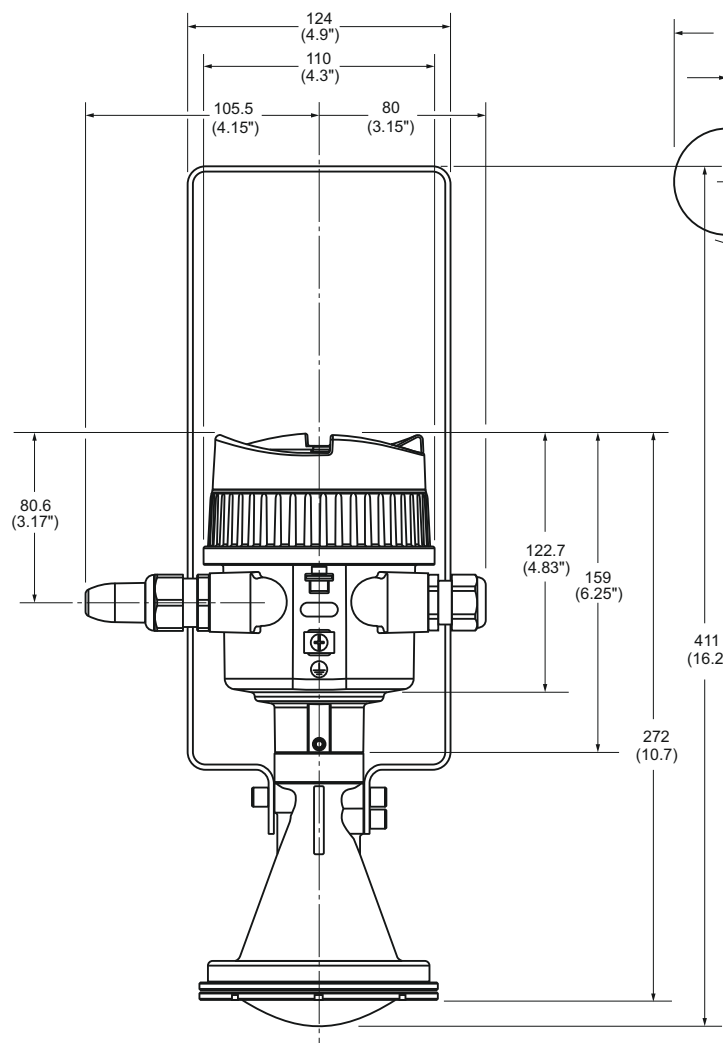
Dimensions in mm(Inch)

LR550 with flange and purge connection

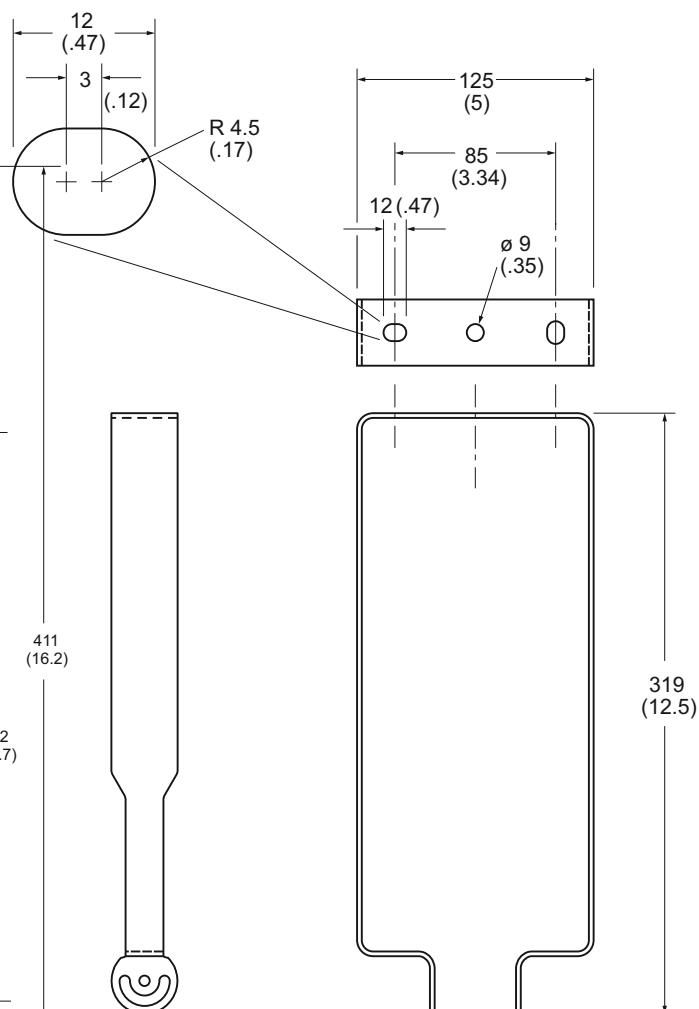


- ① Air purge inlet
- ② Non return valve
- ③ Device flange

LR550 with mounting bracket



LR550 mounting bracket side and top view



Dimensions in mm(Inch)

LR550 with flange

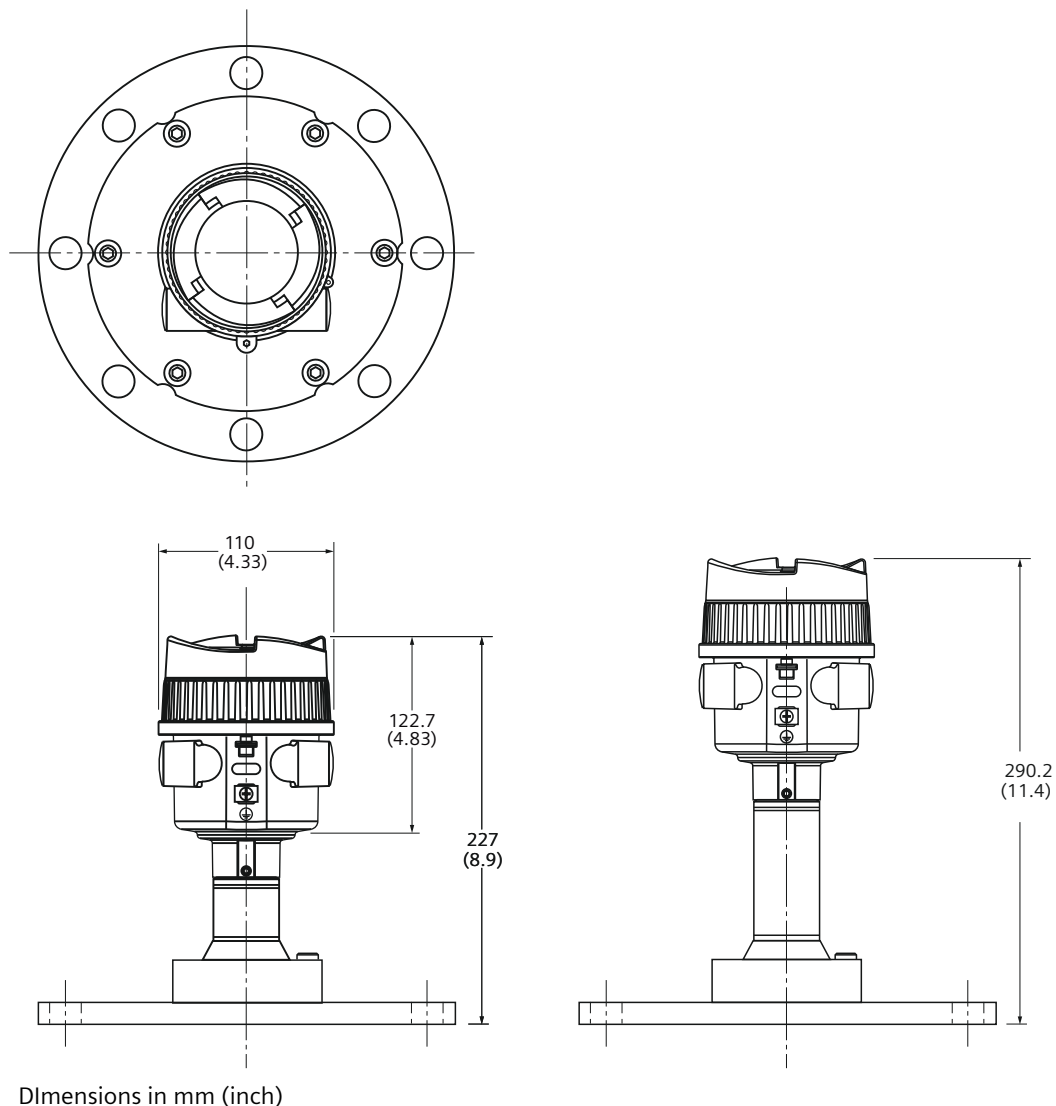
Flange	Flange O.D. [mm (inch)]	Bolt hole circle Ø [mm (inch)]	Bolt hole Ø [mm (inch)]	No. of bolt holes	Flange thickness [mm (inch)]
DN100 PN 6, flat face	210 (8.27)	170 (6.7)	18 (0.71)	4	20 (0.79)
DN100 PN16, flat face	220 (8.99)	180 (7.09)	18 (0.71)	8	
DN150 PN16, flat face	285 (11.22)	240 (9.49)	22 (0.87)	8	
DN200 PN16, flat face	340 (13.38)	295 (11.61)	22 (0.87)	12	
DN250 PN16, flat face	405 (15.94)	355 (13.98)	26 (1.02)	12	
3" 150lb FF	190.5 (7.5)	152.4 (6)	19.1 (0.75)	4	
4" 150lb FF	228.6 (9)	190.5 (7.5)	19.1 (0.75)	8	
6" 150lb FF	279.4 (11)	241.3 (9.5)	22.4 (0.88)	8	
8" 150lb FF	342.9 (13.5)	298.5 (11.75)	22.4 (0.88)	8	
DN100 10K FF, JIS	210 (8.27)	175 (6.89)	19 (0.75)	8	
DN150 10K FF, JIS	280 (11.02)	240 (9.49)	23 (0.9)	8	

Recommended max. range 120 m (393.7 ft)

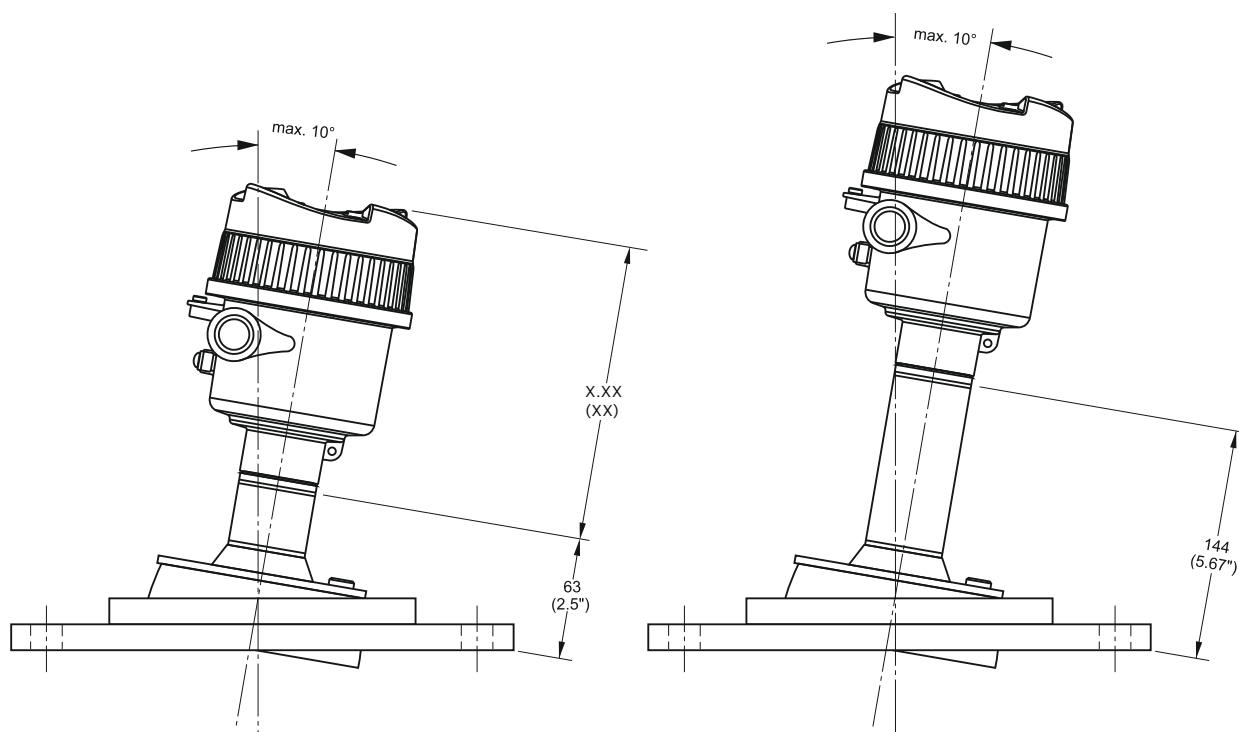
Beam angle 3°

13.4 LR580 flanged lens antenna

LR580 flat face flanges



LR580 aiming flanges



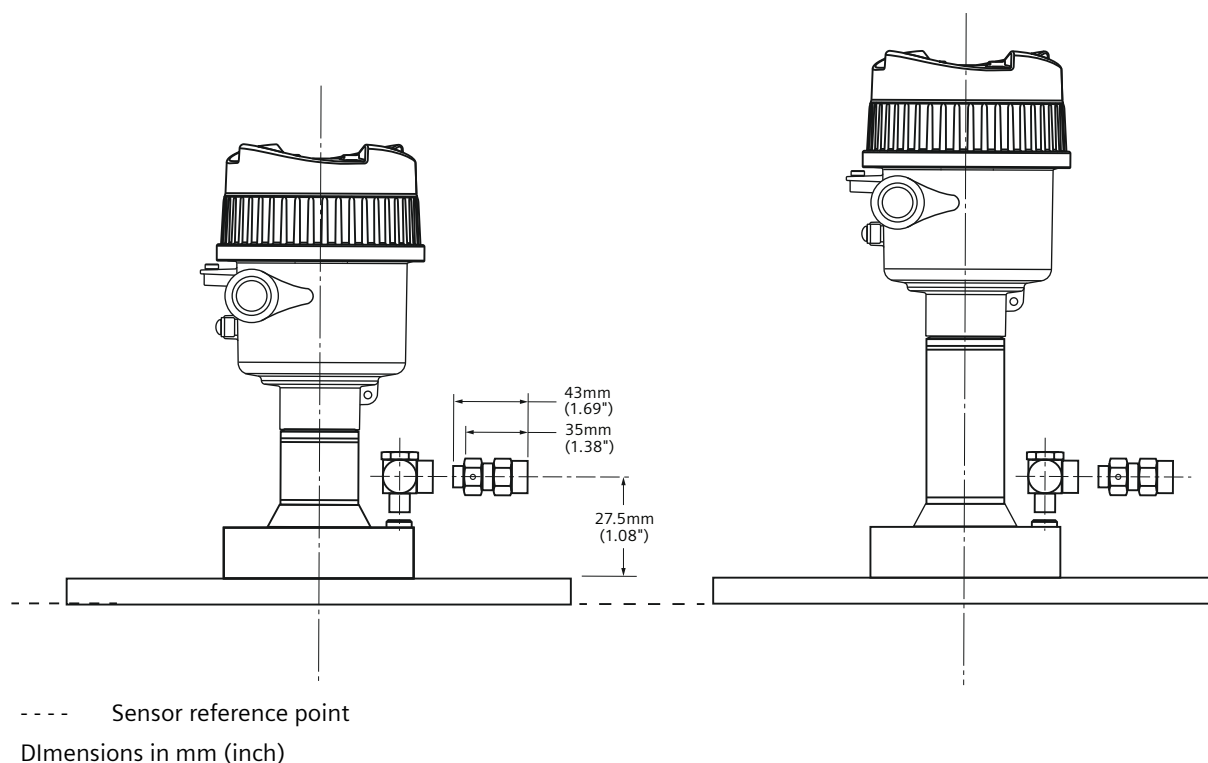
Dimensions in mm (inch)

Flange	Flange O.D. [mm (inch)]	Bolt hole circle Ø [mm (inch)]	Bolt hole Ø [mm (inch)]	No. of bolt holes	Flange thickness [mm (inch)]
DN80 PN16, flat face	200 (7.87)	160 (6.93)	18 (0.06)	8	11.5 (0.04)
DN100 PN16, flat face	220 (8.66)	180 (7.09)	18 (0.06)	8	
DN150 PN16, flat face	285 (11.22)	240 (9.45)	22 (0.07)	8	
3" 150lb flat face	190.5 (7.5)	152.4 (6)	19.1 (0.06)	4	
4" 150lb flat face	228.6 (9)	190.5 (7.5)	19.1 (0.06)	8	
6" 150lb flat face	279.4 (11)	241.3 (9.5)	22.4 (0.07)	8	
DN80 10K, flat face, JIS	185 (7.28)	150 (5.9)	19 (0.06)	8	
DN100 10K, flat face, JIS	210 (8.27)	175 (6.89)	19 (0.06)	8	
DN150 10K, flat face, JIS	280 (11.02)	240 (9.45)	23 (0.07)	8	
Aiming flange universal DN100/4"	228.6 (9)	175...191	19.1 (0.06)	8	
Aiming flange universal DN150/6"	285 (11.22)	241 (9.49)	24 (0.08)	8	

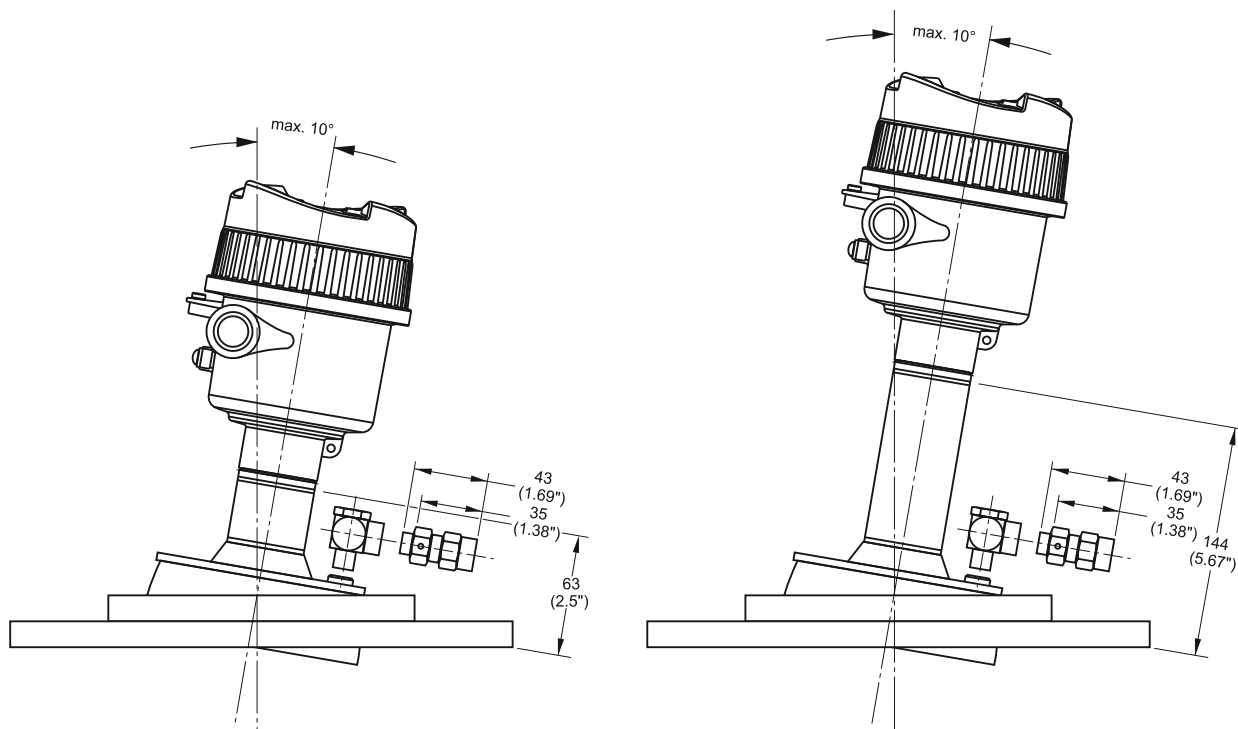
Recommended max. range: 120 m (394 ft)

Beam angle: 3°

LR580 lens antenna with purge connection



LR580 lens antenna with aiming flange and purge connection



Dimensions in mm (inch)

Product documentation and support

A.1 Product documentation

Process instrumentation product documentation is available in the following formats:

- Certificates (<http://www.siemens.com/processinstrumentation/certificates>)
- Downloads (firmware, EDDs, software) (<http://www.siemens.com/processinstrumentation/downloads>)
- Catalog and catalog sheets (<http://www.siemens.com/processinstrumentation/catalogs>)
- Manuals (<http://www.siemens.com/processinstrumentation/documentation>)
You have the option to show, open, save, or configure the manual.
 - "Display": Open the manual in HTML5 format
 - "Configure": Register and configure the documentation specific to your plant
 - "Download": Open or save the manual in PDF format
 - "Download as html5, only PC": Open or save the manual in the HTML5 view on your PC

You can also find manuals with the Mobile app at Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/sc/2067>). Download the app to your mobile device and scan the device QR code.

Product documentation by serial number

Using the PIA Life Cycle Portal, you can access the serial number-specific product information including technical specifications, spare parts, calibration data, or factory certificates.

Entering a serial number

1. Open the PIA Life Cycle Portal (<https://www.pia-portal.automation.siemens.com>).
2. Select the desired language.
3. Enter the serial number of your device. The product documentation relevant for your device is displayed and can be downloaded.

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

Scanning a QR code

1. Scan the QR code on your device with a mobile device.
2. Click "PIA Portal".

To display factory certificates, if available, log in to the PIA Life Cycle Portal using your login or register.

A.2 Technical support

Technical support

If this documentation does not completely answer your technical questions, you can enter a Support Request (<http://www.siemens.com/automation/support-request>).

For help creating a support request, view this video here (www.siemens.com/opensr).

Additional information on our technical support can be found at Technical Support (<http://www.siemens.com/automation/csi/service>).

Service & support on the Internet

In addition to our technical support, Siemens offers comprehensive online services at service & support (<http://www.siemens.com/automation/serviceandsupport>).

Contact

If you have further questions about the device, contact your local Siemens representative at Personal Contact (<http://www.automation.siemens.com/partner>).

To find the contact for your product, go to "all products and branches" and select "Products & Services > Industrial automation > Process instrumentation".

Contact address for business unit:

Siemens AG

Digital Industries

Process Automation

Östliche Rheinbrückenstr. 50

76187 Karlsruhe, Germany

Technical reference

B.1 Principles of operation

SITRANS LR500 series is a 4-wire, 80 GHz FMCW (Frequency Modulated Continuous Wave) radar level transmitter for continuous monitoring of liquids, solids and slurries in vessels to a range of 100 m (329 ft)¹⁾. Radar level measurement uses the time of flight principle to determine distance to a material surface.

FMCW radar transmits a continuous wave. The frequency of the wave is constantly increasing: this is known as the sweep. By the time the first part of the wave has been reflected off the target and returned to the device, the part of the wave that is just being emitted is at a higher frequency. The difference in frequency between the transmitted and received signals is proportional to time of flight.

Electromagnetic wave propagation is virtually unaffected by temperature or pressure changes, or by changes in the vapor levels inside a vessel. Electromagnetic waves are not attenuated by dust.

SITRANS LR500 series consists of an enclosed electronic circuit coupled to an antenna and process connection. The electronic circuit generates a radar signal (78 GHz) that is directed to the lens antenna.

The signal is emitted from the lens antenna, and the reflected echoes are digitally converted to an echo profile. The profile is analyzed to determine the distance from the sensor reference point²⁾ to the material surface. This value (sensor value) is used as a basis for calculating the display of material level and mA output.

¹⁾ The microwave output level is significantly less than that emitted from cellular phones.

²⁾ See AUTOHOTSPOT

B.2 Echo processing

B.2.1 Echo processing

Echo processing consists of echo enhancement, true echo selection, and selected echo verification.

Echo enhancement is achieved by filtering ¹⁾ and reforming ²⁾ the echo profile. The true echo (echo reflected by the intended target) is selected when that portion of the echo profile meets the evaluation criteria of Process Intelligence. Insignificant portions of the echo profile outside of the measurement range ³⁾, below the TVT curve ⁴⁾, and less than the confidence threshold ⁵⁾, are automatically disregarded. The remaining portions of the echo profile are evaluated using the selected algorithm ⁶⁾. The echo profile portion providing the best echo confidence ⁷⁾ is selected.

Echo verification is automatic. The position (relation in time after transmit) of the new echo is compared to that of the previously accepted echo. When the new echo is within the echo

lock window ⁸⁾, it is accepted, and displays and outputs are updated per the rate parameters ⁹⁾. If the new echo is outside of the window, it is not accepted until echo lock requirements ¹⁰⁾ are satisfied.

¹⁾ AUTOHOTSPOT

²⁾ AUTOHOTSPOT

³⁾ AUTOHOTSPOT

⁴⁾ AUTOHOTSPOT

⁵⁾ AUTOHOTSPOT

⁶⁾ AUTOHOTSPOT

⁷⁾ AUTOHOTSPOT

⁸⁾ AUTOHOTSPOT

⁹⁾ AUTOHOTSPOT and AUTOHOTSPOT

¹⁰⁾ AUTOHOTSPOT

B.2.2 Echo selection

B.2.2.1 Echo selection algorithms

The echo is selected based on echo selection algorithms that ultimately use confidence to select the echo.

Preferred algorithm types are marked with an asterisk. They provide the best echo selection results in most applications. Other algorithms may produce better results in specialized applications, but should only be used after consulting an experienced technical expert.

Algorithm abbreviation	Algorithm name	Echo determination	Applications
ALF	Area largest first echo	Selects the echo (average of widest, tallest, and first), with the highest confidence value.	- Solids - General purpose - Where material return echo is wide and tall, and where competing smaller echoes challenge algorithm "BLF"
A	Echo area	Selects the widest echo above the TVT curve.	- Solids - Coarse, heaped material - Distance to material must be greater than 2 m
L	Largest echo	Selects the tallest echo above the TVT curve.	- Liquids (open vessel) - Where material return echo is tall
F	First echo	Selects the first echo above the TVT curve.	Liquids (closed vessel)
AL	Largest echo area	Selects the echo (average of tallest and widest), with the highest confidence value.	- Solids - Fine, heaped material with high angle of repose
AF	First echo area	Selects the echo (average of first and widest), with the highest confidence value.	- Solids - Course, flat material

Algorithm abbreviation	Algorithm name	Echo determination	Applications
LF	Largest echo at first	Selects the echo (average of tallest and first), with the highest confidence value.	- Liquids - General purpose
BLF	Best echo of the first and largest echo	Selects the echo (best of first and tallest), with the highest confidence value.	- Liquids and Solids - General purpose - Where material return echo is relatively tall and sharp
BL	Largest echo 2	Selects the tallest echo above the TVT curve.	- Solids, and Liquids (open vessel) - Use when experiencing stability challenges with algorithm "L"
BF	First echo 2	Selects the first echo above the TVT curve.	- Liquids (closed vessel) - Use when experiencing stability challenges with algorithm "F"
TF	True first echo	Selects the first echo above the TVT curve.	- Liquids (free of obstructions) - Use to ignore multiple echoes, where confidence value of first echo is high

B.3 Loop power

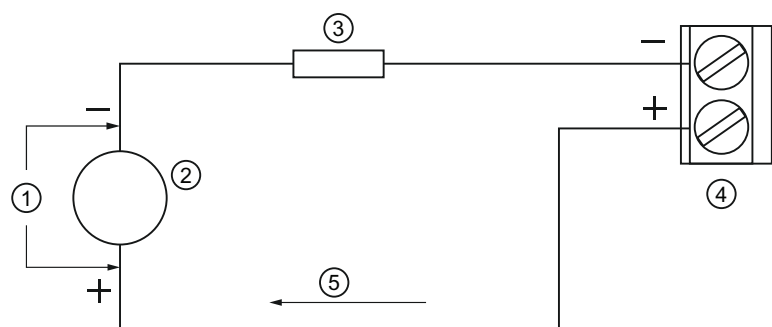
B.3.1 Loop power

Note

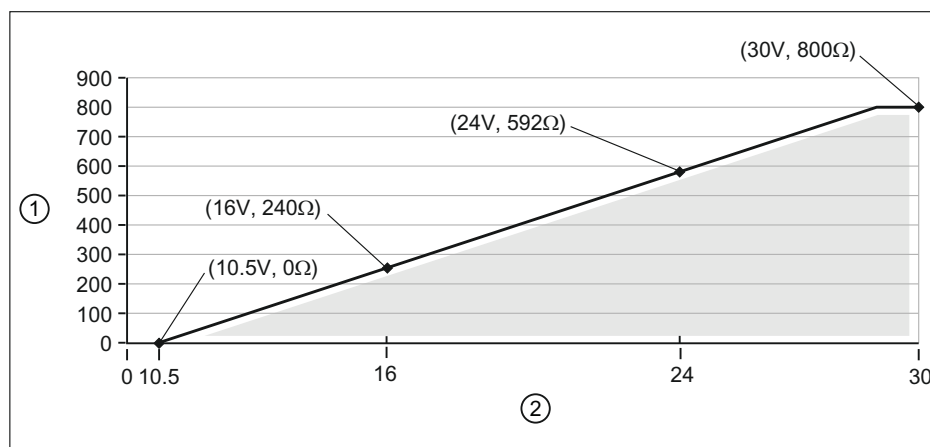
Loop voltage

Loop voltage is the voltage at the terminals of the power supply (not the voltage at the terminals of the device).

Loop resistance versus Loop voltage



- ① Loop voltage V_L
- ② Power supply
- ③ Loop resistance R_L
- ④ SITRANS Probe LU240
- ⑤ Loop current I_L



- ① Loop resistance - R_L
- ② Loop voltage - V_L

Note

HART communication

For example as per graph, when using HART communication with 240 Ohms of Loop resistance (R_L), the minimum Loop voltage (V_L) is 16 V DC.

HART communication

C.1 HART communications

Highway Addressable Remote Transducer, HART, is an industrial protocol that is superimposed on the 4-20 mA signal. It is an open standard, and full details about HART can be obtained from the HART Communication Foundation website:

HART Communication Foundation

The radar device can be configured over the HART network using either the HART Communicator 375 by Fisher-Rosemount, or a software package. The recommended software package is the SIMATIC Process Device Manager (PDM) by Siemens.

C.2 HART communication protocol

This device supports HART communication protocol. Signals are processed using Process Intelligence which has been field-proven in over 1,000,000 applications worldwide (ultrasonic and radar).

C.3 SIMATIC PDM

This software package is designed to permit easy configuration, monitoring, and troubleshooting of HART devices. The HART EDD for this device was written with SIMATIC PDM in mind and has been extensively tested with this software. For more information, see Operating via SIMATIC PDM.

C.4 HART Electronic Device Description (EDD)

In order to configure a HART device, the configuration software requires the HART Electronic Device Description for the instrument in question.

You can download the HART EDD for this device from our website:

Product page

Click on **Support>Software Downloads**. Older versions of the library will have to be updated in order to use all the features of this device.

Remote operation

D.1 SIMATIC PDM

D.1.1 Simulation (under PDM appendix)

Both process values and diagnostics can be simulated in SIMATIC PDM. For more details, see AUTOHOTSPOT.

D.1.2 Overview SIMATIC PDM

SIMATIC PDM (Process Device Manager) is a general-purpose, manufacturer-independent tool for the configuration, parameter assignment, commissioning, diagnostics and maintenance of intelligent field devices and field components. Follow-up installations and additional information on SIMATIC PDM are available on the Internet at SIMATIC PDM (<https://www.siemens.com/simatic-pdm>).

SIMATIC PDM monitors the process values, alarms and status signals of the device. It allows you to display, compare, adjust, verify, and simulate process device data; also to set schedules for calibration and maintenance.

For information on, for example, how to install and integrate devices, commission the software, see Operating Manual 'Help for SIMATIC PDM'. The manual is delivered with SIMATIC PDM software. Once the SIMATIC PDM is installed on your computer you find the manual under: Start > All programs > Siemens Automation > SIMATIC > Documentation. Link at our website: SIMATIC PDM instructions and manuals (<https://support.industry.siemens.com/cs/ww/en/ps/16983/man>).

Note

Field device parameters

- For a list of parameters and additional information, consult section "AUTOHOTSPOT".
 - The field device remains in measurement mode during the time you configure the field device.
-

D.1.3 Check SIMATIC PDM version

Procedure

1. Go to SIMATIC PDM Download (<http://www.siemens.com/simaticpdm/downloads>).
2. Check the support page to make sure you have:
 - The latest version of SIMATIC PDM
 - The most recent Service Pack (SP)
 - The most recent hot fix (HF)

D.1.4 Updating the Electronic Device Description (EDD) or Field Device Integration (FDI)

Procedure

1. Check that the EDD or FDI revision match the Firmware revision in the device according to the table in section AUTOHOTSPOT.
2. Go to the support page Software downloads (<https://www.siemens.com/processinstrumentation/downloads>).
3. Enter the product name in the field "Enter search term...".
4. Download the most current EDD or FDI of your device.
5. Save files to your computer in an easily accessed location.
6. Launch SIMATIC PDM – Device Integration Manager.
From the File menu, click "Read device descriptions from compressed source...".
7. Browse to the compressed EDD or FDI files, select and open it.
8. From the Catalog menu, use the "Integration" function to integrate the EDD or FDI into the device catalog. The EDD or FDI is now accessible via SIMATIC Manager.

D.2 Bluetooth

D.2.1 Scope of delivery of SITRANS AW050 Bluetooth adapter kit

<< Need to confirm list of components (more or less items from below) that are shipped with LR5xx >>

- SITRANS AW050 Bluetooth adapter
- Flat ribbon cable
- Cable gland

D.2.2 Connecting field device and SITRANS AW050 Bluetooth adapter

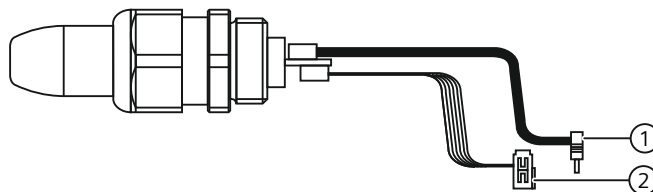
D.2.2.1 Connecting field device when Bluetooth adapter installed

Procedure

NOTICE
General purpose use SITRANS AW050 Bluetooth module is only approved for use with general purpose non-hazardous devices

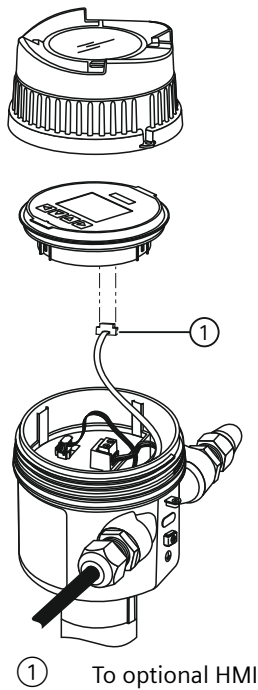
When the HMI adapter is already installed, follow these steps to connect the field device:

1. Remove the current HMI cable.
2. Connect the blue cable to the HMI display.
3. Connect the red cable to the device.



- ① to the optional HMI
② to the electronics

The cables are best run separately inside the enclosure as shown in the figure following. Care must be taken when installing the display to be sure that the ribbon cables are not pinched or torn. Excessive force should not be necessary for installation of the display mounting.

**Use of the display while the AW050 is installed**

When power is applied to the device, the display will activate for approximately 15 seconds, and then deactivate for 5 seconds as the AW050 integrates.

When the AW050 connection is made through SITRANS mobile IQ, the display will not be accessible. When the AW050 Bluetooth connection is disconnected, the display will activate again.

Note

Connecting a SITRANS LR500 series display after a connected and functioning AW050 will require a power cycle of the LR500 series for the display to function properly.

D.2.2.2 Installing or replacing Bluetooth adapter**Procedure**

Follow these steps to install or replace the Bluetooth adapter. For more information, refer to illustrations in Connecting field device when Bluetooth adapter installed (Page 189).

1. Run both cables through conduit entry where Bluetooth adaptor will be installed.
2. Install cable gland and tighten against enclosure. Ensure the adapter cables are not pinched inside the housing.
3. Install the O-ring onto the adapter against the step of the shaft.

4. Connect wires to adapter as shown in the illustration above. Note that the spacing of the connectors on the adapter is offset. To connect the wires to the adapter, first connect the red wire to the connector closest to the edge of the circuit board. Next, connect the blue wire to the connector that is furthest from the edge of the circuit board.
5. Slide the adapter into the gland against the O-ring.
6. Tighten the gland to the adapter, without twisting the cables.
7. Plug the cables into the display and electronics.

D.2.3 Connecting field device with SITRANS mobile IQ app

SITRANS mobile IQ is an app for mobile devices that enables authorized service technicians to monitor and configure compatible field instrumentation over a Bluetooth interface. You can find information and the app for download at: Mobile app "Industry Online Support" (<https://support.industry.siemens.com/cs/ww/en/sc/2067>)

Requirements for establishing the first connection

1. Field device is in operation.
2. There is a line of sight to the field device.
3. You are less than 10 meters away from the field device.
4. LED on the SITRANS AW050 Bluetooth adapter flashes every 2 seconds.

Requirements for connection setup

1. Android: "Location" access is enabled in the mobile device.
2. SITRANS mobile IQ is authorized to access the location.

Procedure

NOTICE
Unauthorized access It is your responsibility to prevent unauthorized access to the field device.

D.2 Bluetooth

1. Start the SITRANS mobile IQ app.
The smartphone or tablet automatically searches for Bluetooth field devices in the vicinity. The field devices found are listed. Select the desired field device in the device list.
2. Enter the default delivery password "Sitrans AW050!". The delivery password must be changed for first connection setup.
3. Assign a new password.
 - Before assigning a password, ensure that no 2 field devices with the same serial number are displayed in the selection list.
 - Assign a new password that is not the same as the default password. The new password must consist of at least 12 characters (of any type).
 - If the mobile end device, e. g. Smartphone or tablet, has access protection, the SITRANS mobile IQ automatically saves the passwords of connected field devices. Individual, stored device passwords can be deleted in the app.

When the connection is established, the LED on the SITRANS AW050 Bluetooth adapter flashes every second.

D.2.4 Default password

The default delivery password must be changed for the first connection setup.

The default password is: "Sitrans AW050!".

Note that this password:

- Is used in the procedure to connect the field device with SITRANS Mobile IQ.
- Is the default used when the password is reset.

D.2.5 Reset Password

Procedure

1. Select "Reset password".
2. Once you have selected "Reset password", disconnect the ribbon cable between the SITRANS AW050 and the device within 60 seconds.
3. Wait for 30 seconds.
4. Insert the ribbon cable again.

The password is reset to the default password.

D.2.6 Technical data: SITRANS AW050 Bluetooth adapter

<< Need review of specs for LR5xx, mainly 'weight' and any information based on glands included (weight, torque, etc) >>

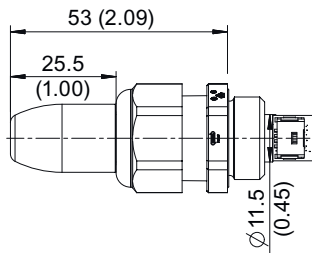
Operating conditions and structural design	
Ambient conditions	For use indoors and outdoors.
Ambient temperature	Observe the maximum permissible ambient temperature of the connected field device.
Permissible ambient temperature for operation	-40 ... +80 °C (-40 ... +176 °F)
Relative humidity	0 ... 100%
Degree of pollution	2
Overvoltage category	II
Weight	
With cable gland	24 g
Without cable gland	13 g
Degree of protection	- Type 4X, Type 6 in accordance with UL 50E - IP66, IP68 in accordance with IEC 60529
EMC	EN 61326
Input voltage range	2.2 ... 3.4 V DC
Maximum current consumption	2.5 mA
Material	Polycarbonate
Torque for cable gland	10 Nm (7.38 ft lb)
Communication, interface	Bluetooth 4.2
Range	Class 2; approx. 10 m
Radio approvals	Contains FCC ID: RYYEYSHJN Contains IC ID: 4389B-EYSHJN CMIIT ID: 2020DJ15120

D.2.7 Technical data: SITRANS mobile IQ

Software requirements	
Required Android version	7.0 or higher
Required iOS version	12.0 or higher
Bluetooth	BLE 4.2 or higher

D.2.8 Dimensions SITRANS AW050 Bluetooth adapter

<< Review dimension drawing - may have to update depending on glands included for LR5xx >>



Dimension drawing SITRANS AW050 Bluetooth adapter, dimensions in mm (inch)

D.2.9 Information for radio approval FCC and IC

Canada Regulatory Information

1. This device complies with Industry Canada's applicable licence-exempt RSSs. Operation is subject to the following two conditions:
 - (1) This device may not cause interference; and
 - (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

 - (1) l'appareil ne doit pas produire de brouillage;
 - (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.
2. This product is certified as type of the portable device with Industry Canada Rules. To maintain compliance with RF Exposure requirement, please use within specification of this product.

Ce produit est certifié comme type de l'appareil portable avec Industrie Règles de Canada. Pour maintenir l'acquiescement avec exigence Exposition de RF, veuillez utiliser dans spécification de ce produit. -IC: 4389B-EYSHJN
3. Please notify certified ID by either one of the following method on your product.
 - Contains IC: 4389B-EYSHJN

Spécifiez ID certifiée dans votre produit par une de méthode suivante.

 - Contains IC: 4389B-EYSHJN

FCC Regulatory Information

1. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
2. Please notify certified ID by either one of the following methods on your product.
 - Contains Transmitter Module FCC ID: RYHEYSHJN
 - Contains FCC ID: RYHEYSHJN

3. CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the use's authority to operate the equipment.
4. This product is certified as type of the portable device with FCC Rules. To maintain compliance with RF Exposure requirement, please use within specification of this product.
5. The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
6. This module can change the output power depending on the circumstances by the application software which is developed by module installer. Any end user cannot change the output power.

D.3 HART

D.3.1 HART communication

Specific device versions (6 m, 12 m) support HART communication protocol. For more information, see AUTOHOTSPOT.

D.3.2 Communication (HART)

Highway Addressable Remote Transducer (HART) is an industrial protocol that is superimposed on the 4 to 20 mA signal. It is an open standard and full details about HART can be obtained from:

- AUTOHOTSPOT

SITRANS Probe LU240 can be configured over the HART network using the HART Communicator 375/475 by Emerson, or a software package. The recommended software package is the SIMATIC Process Device Manager (PDM) by Siemens.

HART version

SITRANS Probe LU240 conforms to HART revision 7.6.

HART multi-drop mode

HART multi-drop mode allows the connection of multiple field devices via HART. To setup multi-drop mode via a HART network, the polling address must be set.

To set up multi-drop mode via the HMI:

1. Set the polling address (AUTOHOTSPOT)
2. Set the device mode (AUTOHOTSPOT)
3. Set the mA value for multi-drop mode (AUTOHOTSPOT)

SIMATIC PDM

This software package is designed to permit easy configuration, monitoring, and troubleshooting of HART devices. The HART EDD for SITRANS Probe LU240 was written

with SIMATIC PDM in mind and has been extensively tested with this software. For more information, see AUTOHOTSPOT.

HART Electronic Device Description (EDD)

In order to configure a HART device, the configuration software requires the HART Electronic Device Description specific to the device. Download the HART EDD for SITRANS Probe LU240 from the product page of our website:

- AUTOHOTSPOT

Click "**Support > Software Downloads**". Older versions of the library will have to be updated in order to use all the features of SITRANS Probe LU240.

HART status

Information on HART status is outlined in an application guide **Working with HART networks**, which can be downloaded from the product page of our website:

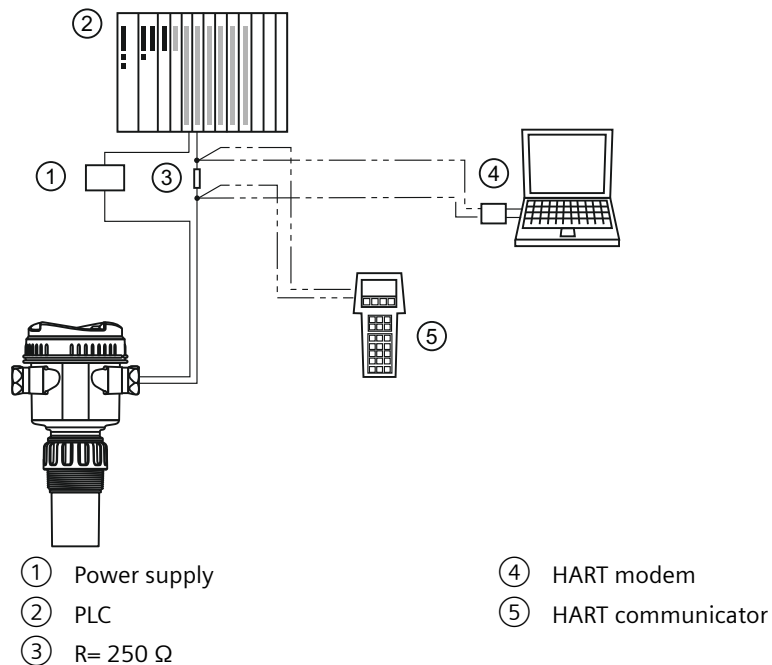
- AUTOHOTSPOT

Under **More information**, click **Application guides**.

D.3.3 Communication connections

The SITRANS Probe LU240 can be connected to a computer system via a HART modem (connected to the mA OUT/HART terminal block).

Typical PLC/mA configuration with passive HART connection



Note**HART configuration**

- Depending on the system design, the power supply may be separate from the PLC, or integral to it.
 - HART resistance [total loop resistance, that is, cable resistance plus 250 Ohm (resistor)] must be limited according to the allowable operating area as shown in graph under AUTOHOTSPOT.
-

A HART network requires a polling address be configured.

D.3.4 Configuring communication ports

Note**HART modem**

It is recommended that only HCF registered modems be used.

Polling address

AUTOHOTSPOT (or poll ID) is a unique identifier for the device on a HART network.

Setting	0 to 63 (Set within range of 0 to 15 if HART 5 master used.)
Default	0

Prior to HART 6, the polling address was set to 0 for point to point operation. For HART multidrop mode, the device was set to any value other than 0 within the range. (Setting a non-zero address forced the device into fixed current mode.)

With HART 6 and above (version 7.6 supported by SITRANS Probe LU240), multidrop mode no longer depends on the polling address. However, it is recommended that a non-zero address be set to avoid confusion based on previous HART requirements.

To put SITRANS Probe LU240 into multidrop mode, disable AUTOHOTSPOT. When Loop current mode is disabled, a low fixed current is used, allowing for multiple devices to be connected. (A custom fixed current value can be entered in AUTOHOTSPOT.)

D.3.5 Communication troubleshooting

For more information, refer to AUTOHOTSPOT.

HMI menu structure

Note**Parameter visibility on device**

All available device menus and parameters are included in the following HMI menu structure, each with its own identifying number (with the exception of wizard parameters). The menu/parameter number shown in the HMI menu structure will match the menu/parameter number that appears on the device. However, note that some menus and parameters are only visible on the device based on configuration settings.

Note**Navigating menus**

Use the local buttons (4) on the device to navigate in parameter view. For instructions see AUTOHOTSPOT.

For detailed information on Quick start parameters see AUTOHOTSPOT.

For detailed information on all other parameters see AUTOHOTSPOT.

1 Quick start	
1.1 Quick commission.	
About	Vessel dimension A
Level	Vessel dimension L
Operation	Lower calibration
Material type	Upper calibration
Application type	Next
Units	Response rate
Vessel shape	Volume units
Vessel dimension A	Custom units
Vessel dimension L	Upper range value
Lower calibration	Next
Upper calibration	Confirm
Next	Exit
Response rate	1.2 Demo mode
Volume units	Units
Custom units	Lower calibration
Upper range value	Confirm
Next	1.3 AFES wizard
Confirm	About
Space	AFES range
Operation	Next
Material type	Confirm?
Application type	Exit
Units	
Vessel shape	2 Setup
Vessel dimension A	2.1 Select output
Vessel dimension L	2.1.1 PV selection
Lower calibration	2.1.2 SV selection
Upper calibration	2.1.3 TV selection
Next	2.1.4 QV selection
Response rate	2.1.5 Linearization type
Volume units	2.2 Sensor
Custom units	2.2.1 Units
Upper range value	2.2.2 Temperature units
Next	2.2.3 Fill rate limit
Confirm	2.2.4 Empty rate limit
Distance	2.3 Calibration
Operation	2.3.1 Lower calibration
Material type	2.3.2 Upper calibration
Application type	2.3.3 Lower level point
Units	2.3.4 Upper level point
Vessel shape	2.3.5 Sensor offset
Vessel dimension A	2.3.6 Low level cut-off
Vessel dimension L	2.3.7 Propagation factor
Lower calibration	2.3.8 Antenna offset
Upper calibration	2.4 Current output
Next	2.4.1 Loop current mode
Response rate	2.4.2 Multidrop current
Volume units	2.4.3 Damping value
Custom units	2.4.4 Lower range value
Upper range value	2.4.5 Upper range value
Next	2.4.6 Lower saturation
Confirm	2.4.7 Upper saturation
Volume	2.4.8 Lower fault current
Operation	2.4.9 Upper fault current
Material type	2.4.10 Fault current
Application type	2.4.11 Fail-safe LOE
Units	2.4.12 Fail-safe LOE timer
Vessel shape	2.5 Volume
	2.5.1 Vessel shape
	2.5.2 Vessel dimension A

2.5.3 Vessel dimension L	
2.5.4 Volume units	
2.5.5 Upper scaling point	
2.6 Custom	
2.6.1 Upper scaling point	
2.6.2 Custom curve	
2.6.2.1 X-value 1	2.6.2.55 X-value 28
2.6.2.2 Y-value 1	2.6.2.56 Y-value 28
2.6.2.3 X-value 2	2.6.2.57 X-value 29
2.6.2.4 Y-value 2	2.6.2.58 Y-value 29
2.6.2.5 X-value 3	2.6.2.59 X-value 30
2.6.2.6 Y-value 3	2.6.2.60 Y-value 30
2.6.2.7 X-value 4	2.6.2.61 X-value 31
2.6.2.8 Y-value 4	2.6.2.62 Y-value 31
2.6.2.9 X-value 5	2.6.2.63 X-value 32
2.6.2.10 Y-value 5	2.6.2.64 Y-value 32
2.6.2.11 X-value 6	
2.6.2.12 Y-value 6	2.7 Local display
2.6.2.13 X-value 7	2.7.1 Start view
2.6.2.14 Y-value 7	2.7.2 Contrast
2.6.2.15 X-value 8	
2.6.2.16 Y-value 8	
2.6.2.17 X-value 9	3 Maint. and diag.
2.6.2.18 Y-value 9	3.1 Identification
2.6.2.19 X-value 10	3.1.1 Tag
2.6.2.20 Y-value 10	3.1.2 Long tag
2.6.2.21 X-value 11	3.1.3 Descriptor
2.6.2.22 Y-value 11	3.1.4 Message
2.6.2.23 X-value 12	3.1.5 Device
2.6.2.24 Y-value 12	3.1.6.1 Manufacturer
2.6.2.25 X-value 13	3.1.6.2 Product name
2.6.2.26 Y-value 13	3.1.6.4 Article number
2.6.2.27 X-value 14	3.1.6.5 Serial number
2.6.2.28 Y-value 14	3.1.6.6 HW version
2.6.2.29 X-value 15	3.1.6.7 FW version
2.6.2.30 Y-value 15	3.1.6.8 Final assembly no.
2.6.2.31 X-value 16	3.1.7 Local display
2.6.2.32 Y-value 16	3.1.7.1 HW version
2.6.2.33 X-value 17	3.1.7.2 FW version
2.6.2.34 Y-value 17	3.2 Diagnostics
2.6.2.35 X-value 18	3.2.1
2.6.2.36 Y-value 18	3.2.2
2.6.2.37 X-value 19	3.3 Signal
2.6.2.38 Y-value 19	3.3.1 Signal quality
2.6.2.39 X-value 20	3.3.1.1 Confidence
2.6.2.40 Y-value 20	3.3.1.2 Signal strength
2.6.2.41 X-value 21	3.3.1.3 Noise average
2.6.2.42 Y-value 21	3.3.2 Echo configuration
2.6.2.43 X-value 22	3.3.2.1 Near range
2.6.2.44 Y-value 22	3.3.2.2 Far range
2.6.2.45 X-value 23	3.3.3 Echo select
2.6.2.46 Y-value 23	3.3.3.1 Algorithm
2.6.2.47 X-value 24	3.3.3.2 Echo threshold
2.6.2.48 Y-value 24	3.3.3.3 Position detect
2.6.2.49 X-value 25	3.3.3.4 Echo marker
2.6.2.50 Y-value 25	3.3.4 Filtering
2.6.2.51 X-value 26	3.3.4.1 Reform echo
2.6.2.52 Y-value 26	3.3.4.2 Near range suppr.
2.6.2.53 X-value 27	3.3.4.3 NRS distance
2.6.2.54 Y-value 27	3.3.4.4 NRS distance thold
	3.3.4.5 NRS strength thold
	3.3.4.6 NRS expiry time
	3.3.4.7 Number of shots
	3.3.5 Sampling
	3.3.5.1 Echo lock
	3.3.5.2 Echo lock window
	3.3.5.3 Gain factor

3.3.6 TVT configuration	3.3.6.6.24 Breakpoint 54
3.3.6.1 Hover level	3.3.6.6.25 Breakpoint 55
3.3.6.2 AFES	3.3.6.6.26 Breakpoint 56
3.3.6.3 AFES range	3.3.6.6.27 Breakpoint 57
3.3.6.4 TVT shaper mode	3.3.6.6.28 Breakpoint 58
3.3.6.5 Breakpoint 1...30	3.3.6.6.29 Breakpoint 59
3.3.6.5.1 Breakpoint 1	3.3.6.6.30 Breakpoint 60
3.3.6.5.2 Breakpoint 2	3.3.6.7 Breakpoint 61...90
3.3.6.5.3 Breakpoint 3	3.3.6.7.1 Breakpoint 61
3.3.6.5.4 Breakpoint 4	3.3.6.7.2 Breakpoint 62
3.3.6.5.5 Breakpoint 5	3.3.6.7.3 Breakpoint 63
3.3.6.5.6 Breakpoint 6	3.3.6.7.4 Breakpoint 64
3.3.6.5.7 Breakpoint 7	3.3.6.7.5 Breakpoint 65
3.3.6.5.8 Breakpoint 8	3.3.6.7.6 Breakpoint 66
3.3.6.5.9 Breakpoint 9	3.3.6.7.7 Breakpoint 67
3.3.6.5.10 Breakpoint 10	3.3.6.7.8 Breakpoint 68
3.3.6.5.11 Breakpoint 11	3.3.6.7.9 Breakpoint 69
3.3.6.5.12 Breakpoint 12	3.3.6.7.10 Breakpoint 70
3.3.6.5.13 Breakpoint 13	3.3.6.7.11 Breakpoint 71
3.3.6.5.14 Breakpoint 14	3.3.6.7.12 Breakpoint 72
3.3.6.5.15 Breakpoint 15	3.3.6.7.13 Breakpoint 73
3.3.6.5.16 Breakpoint 16	3.3.6.7.14 Breakpoint 74
3.3.6.5.17 Breakpoint 17	3.3.6.7.15 Breakpoint 75
3.3.6.5.18 Breakpoint 18	3.3.6.7.16 Breakpoint 76
3.3.6.5.19 Breakpoint 19	3.3.6.7.17 Breakpoint 77
3.3.6.5.20 Breakpoint 20	3.3.6.7.18 Breakpoint 78
3.3.6.5.21 Breakpoint 21	3.3.6.7.19 Breakpoint 79
3.3.6.5.22 Breakpoint 22	3.3.6.7.20 Breakpoint 80
3.3.6.5.23 Breakpoint 23	3.3.6.7.21 Breakpoint 81
3.3.6.5.24 Breakpoint 24	3.3.6.7.22 Breakpoint 82
3.3.6.5.25 Breakpoint 25	3.3.6.7.23 Breakpoint 83
3.3.6.5.26 Breakpoint 26	3.3.6.7.24 Breakpoint 84
3.3.6.5.27 Breakpoint 27	3.3.6.7.25 Breakpoint 85
3.3.6.5.28 Breakpoint 28	3.3.6.7.26 Breakpoint 86
3.3.6.5.29 Breakpoint 29	3.3.6.7.27 Breakpoint 87
3.3.6.5.30 Breakpoint 30	3.3.6.7.28 Breakpoint 88
3.3.6.6 Breakpoint 31...60	3.3.6.7.29 Breakpoint 89
3.3.6.6.1 Breakpoint 31	3.3.6.7.30 Breakpoint 90
3.3.6.6.2 Breakpoint 32	3.3.6.8 Breakpoint 91...120
3.3.6.6.3 Breakpoint 33	3.3.6.8.1 Breakpoint 91
3.3.6.6.4 Breakpoint 34	3.3.6.8.2 Breakpoint 92
3.3.6.6.5 Breakpoint 35	3.3.6.8.3 Breakpoint 93
3.3.6.6.6 Breakpoint 36	3.3.6.8.4 Breakpoint 94
3.3.6.6.7 Breakpoint 37	3.3.6.8.5 Breakpoint 95
3.3.6.6.8 Breakpoint 38	3.3.6.8.6 Breakpoint 96
3.3.6.6.9 Breakpoint 39	3.3.6.8.7 Breakpoint 97
3.3.6.6.10 Breakpoint 40	3.3.6.8.8 Breakpoint 98
3.3.6.6.11 Breakpoint 41	3.3.6.8.9 Breakpoint 99
3.3.6.6.12 Breakpoint 42	3.3.6.8.10 Breakpoint 100
3.3.6.6.13 Breakpoint 43	3.3.6.8.11 Breakpoint 101
3.3.6.6.14 Breakpoint 44	3.3.6.8.12 Breakpoint 102
3.3.6.6.15 Breakpoint 45	3.3.6.8.13 Breakpoint 103
3.3.6.6.16 Breakpoint 46	3.3.6.8.14 Breakpoint 104
3.3.6.6.17 Breakpoint 47	3.3.6.8.15 Breakpoint 105
3.3.6.6.18 Breakpoint 48	3.3.6.8.16 Breakpoint 106
3.3.6.6.19 Breakpoint 49	3.3.6.8.17 Breakpoint 107
3.3.6.6.20 Breakpoint 50	3.3.6.8.18 Breakpoint 108
3.3.6.6.21 Breakpoint 51	3.3.6.8.19 Breakpoint 109
3.3.6.6.22 Breakpoint 52	3.3.6.8.20 Breakpoint 110
3.3.6.6.23 Breakpoint 53	3.3.6.8.21 Breakpoint 111

- 3.3.6.8.22 Breakpoint 112
- 3.3.6.8.23 Breakpoint 113
- 3.3.6.8.24 Breakpoint 114
- 3.3.6.8.25 Breakpoint 115
- 3.3.6.8.26 Breakpoint 116
- 3.3.6.8.27 Breakpoint 117
- 3.3.6.8.28 Breakpoint 118
- 3.3.6.8.29 Breakpoint 119
- 3.3.6.8.30 Breakpoint 120
- 3.4 Peak values
 - 3.4.1 Min. electr. temp.
 - 3.4.2 Max. electr. temp.
 - 3.4.3 Minimum distance
 - 3.4.4 Maximum distance
 - 3.4.5 Min. echo strength
 - 3.4.6 Max. echo strength
 - 3.4.7 Min. confidence
 - 3.4.8 Max. confidence
- 3.5 Non-reset. peak val.
 - 3.5.1 Min. electr. temp.
 - 3.5.2 Max. electr. temp.
 - 3.5.3 Min. terminal volt.
 - 3.5.4 Max. terminal volt.
- 3.6 Trend log settings
 - 3.6.1 No. of logged values
 - 3.6.2 No. of logged points
 - 3.6.3 Logging interval
 - 3.6.4 Logging behavior
 - 3.6.5 Logging value 1
 - 3.6.6 Logging value 2
 - 3.6.7 Logging value 3
 - 3.6.8 Logging value 4
 - 3.6.9 Logging value 5
 - 3.6.10 Logging value 6
 - 3.6.11 Logging value 7
 - 3.6.12 Logging value 8
- 3.7 Simulation
 - 3.7.1 Simulation mode
 - 3.7.2 Simulation value
 - 3.7.3 PV status
 - 3.7.4 Ramp end
 - 3.7.5 Ramp steps
 - 3.7.6 Ramp duration
- 3.8 Current loop
 - 3.8.1 Loop test
 - 3.8.2 Terminal voltage
- 3.9 Resets
 - 3.9.1 Device restart
 - 3.9.2 Reset
 - 3.9.3 Reset peak values
- 3.10 Frequency
- 3.11 Audit trail
 - 3.11.1 Cfg. change counter
- 4 Communication
 - 4.1 Polling address
 - 4.2 Identify the device
- 5 Security
 - 5.1 Change user PIN
 - 5.2 Recovery ID
 - 5.3 PIN recovery
 - 5.4 User PIN
 - 5.5 Button lock
- 6 Language

Abbreviations

Glossary

Index

A

- Algorithm, 182
- Approvals, 54
- Auto false echo suppression
 - disabled, 114

B

- Bluetooth
 - Connecting, 52, 189
 - Default password, 192

C

- Catalog
 - catalog sheets, 179
- Certificates, 19, 179
- Cleaning, 130
- Communication protocol
 - HART communication foundation, 195
 - HART electronic device description, 196
- Conformity with UK directives, 20
- Customer Support, (Refer to Technical support)

D

- Disassembly, 37
- Disposal, 134
- Document history, 13
- Downloads, 179

E

- Echo processing, 181
 - algorithm, 182

F

- Firmware revision, 61

H

- HART communication foundation
 - downloading the electronic device description (EDD), 196
- HART Communications
 - details, 185
- Hazardous area
 - Laws and directives, 19
 - Qualified personnel, 22
- hazardous area installations device nameplate, 54
- HMI
 - activating, 61
 - operating the display, 61
- Hotline, (Refer to Support request)

I

- Icons, (see Symbol)

L

- Laws and directives
 - Disassembly, 19
 - Personel, 19

M

- Maintenance, 129
 - device information symbols, 138
 - device status symbols, 136
- Manuals, 179
- Material adapter
 - Technical data, 193
- Mechanical construction
 - Technical data, 193
- Modifications
 - correct usage, 21
 - improper, 21

O

- operating principles, 181

P

Password
Reset, 192

Q

Qualified personnel, 22

R

Restart, 122
Return procedure, 133

S

Scope of delivery, 14
Security
 related parameters, 125
Sensor reference point, 67, 72, 92, 93
Service, 180
Service and support
 Internet, 180
SIMATIC PDM
 with HART devices, 195
SITRANS LR500
 FMCW, 181
 operating principles, 181
Support, 180
Support request, 180
Symbol, 138
 configuration, 136
 device status, 136, 138
 diagnostics, 136, 138
 maintenance, 136, 138
 operating mode, 136
 process value, 136
Symbols, (Refer to warning symbols)

T

Technical support, 180
 partner, 180
 personal contact, 180
Test certificates, 19
troubleshooting
 communication, 145

V

Volume calculation
 example, 85
 vessel shape, 74, 102

W

Warning symbols, 19
Warranty, 17