LDS 6

In-situ Laser Gas Analyzer

Operating Instructions · 01/2009

Continuous Gas Analysis

SIEMENS

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Continuous Gas Analysis

In Situ Laser Gas Analyzers LDS 6

Operating Instructions

01/2009
A5E00295894-05

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

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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 device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

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 adhered to. The information in the relevant documentation must be observed.

Trademarks

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

Disclaimer of Liability

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

Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

Ordernumber: A5E00295894
℗ 04/2009

Content

General Information

1

1.1 Information for our Customers

Before beginning work with this device, please study this manual carefully! It contains important information and data whose observation ensures proper device function and saves you servicing costs. The manual will help you to operate the device more easily and efficiently, allowing you to achieve reliable results.

1.2 General Information

The product described in this manual has left the factory in a high quality and tested condition. In order to preserve this condition and to operate this product correctly and safely, it may only be used in the manner described by the manufacturer. Furthermore, proper transportation, storage, installation, operation and maintenance of the device is vital for ensuring correct and safe operation.

This manual contains the information required for the intended use of the described product.

It is addressed to technically qualified personnel who are specially trained or who have the relevant knowledge of automation technology (measuring and control systems).

Knowledge and technically correct implementation of the safety notes and warnings contained in this manual are required for safe installation and commissioning, as well as for safety during the operation and maintenance of the described product. Only qualified personnel have the required professional knowledge for correctly interpreting the generally valid safety notes and warnings in this manual in each specific case and to act accordingly.

This manual is an inherent part of the scope of delivery, despite the fact that it can be ordered separately for logistic reasons.

Due to the variety of technical details, it is not possible to consider every single detail for all versions of the described product and for every conceivable case in the set-up, operation, maintenance and use in systems. For further information, or in the case of problems which are not covered in enough detail in this document, please request the required information from your local or responsible Siemens regional office.

Note

In particular, before using the device for new research and development applications, we recommend that you first contact your Siemens representative or our application department to discuss the application in question.

1.3 Special Information and Warnings

This manual provides you with information on using, installing, operating, and maintaining the device.

Pay particular attention to all special information and warnings. Information of this type is set apart from the rest of the text and is marked with the corresponding pictograms. This information provides you with useful tips and helps to avoid faulty operation.

1.4 Warranty Conditions

We expressly point out that the product quality is exclusively and conclusively described in the sales contract. The content of this product documentation is neither a part of a previous or existing agreement, promise or legal relationship, nor is it intended to modify these. All obligations on the part of Siemens AG are contained in the respective sales contract, which also contains the complete and solely applicable liability provisions. The provisions defined in the sales contract for the responsibility for defects are neither extended nor limited by the remarks in this document.

1.5 Delivery Information

The respective scope of delivery is listed on the shipping documents – enclosed with the delivery – in accordance with the valid sales contract.

When opening the packaging, please observe the corresponding information on the packaging material. Check the delivery for completeness and undamaged condition. In particular, you should compare the Order No. on the rating plates with the ordering data, if available.

If possible, please retain the packaging material, since you can use it again in case of return deliveries.

1.6 Standards and Regulations

As far as possible, the harmonized European standards were the basis for the specification and production of this device. If no harmonized European standards have been applied, the standards and regulations for the Federal Republic of Germany are valid.

When this product is used beyond the scope of these standards and regulations, the valid standards and regulations of the country of the operating company apply.

Technical Information

2

2.1 General Description

Overview

LDS 6 is a diode laser gas analyzer with a measuring principle based on the specific light absorption of different gas components. LDS 6 is suitable for fast and non-contact measurement of gas concentrations or temperatures in process or flue gases. One or two signals from up to three measuring points are processed simultaneously by one central analyzer unit. The in-situ cross-duct sensors at each measuring point can be separated up to 700 m from the central unit by using fiber-optic cables. The sensors are designed for operation under harsh environmental conditions and contain a minimum of electrical components.

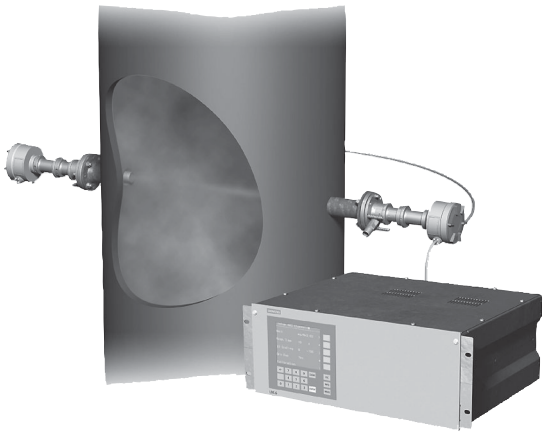


Figure 2-1 LDS 6, typical installation with transmitted-light sensors

Benefits

The in-situ gas analyzer LDS 6 is characterized by a high availability and unique analytical selectivity, and by a broad scope of suitable applications. LDS 6 enables the measurement of one or two gas components or – if desired – the gas temperature directly in the process:

- With high levels of dust load
- In hot, humid, corrosive, explosive, or toxic gases
- In applications showing strong varying gas compositions
- Under harsh environmental conditions at the measuring point
- Highly selective, i.e. mostly without cross-sensitivities

LDS 6 properties:

- Little installation effort
- Minimum maintenance requirements
- Extremely rugged design
- High long-term stability through built-in, maintenance-free reference gas cell, field calibration is unnecessary
- Real-time measurements

Moreover, the instrument provides warning and failure messages upon:

- Need for maintenance
- Erroneous reference function
- Bad signal quality
- Exceeding of a lower or upper alarm level for the measured variable
- Transmitted amount of light exceeding an upper or lower limit

Application

The LDS 6 laser gas analyzer is suitable for a wide range of applications. The most common of them are:

- Process optimization
- Continuous emission monitoring for all kinds of fuels (oil, gas, coal, and others)
- Process measurements in power utilities and any kind of incinerator
- Process control
- Explosion protection
- Measurements in corrosive and toxic gases
- Quality control
- Environmental protection
- Plant and operator safety

Sectors

- Power plants
- Steel works
- Cement industry
- Chemical and petrochemical plants
- Automotive industry
- Waste incinerators
- Glass and ceramics production
- Research and development

Special applications

In addition to the standard applications, special applications are available upon request.

Essential characteristics

- Integrated calibration adjustment with an internal reference cell
- Negligible long-term drifts of zero and span
- Dynamic background correction for varying dust loads
- Isolated signal outputs, 4 to 20 mA
- User-friendly, menu-driven operation
- Selectable time constants (response time)
- Two user levels with individual access codes for prevention of unwanted and unauthorized operations
- Operation according to NAMUR recommendations
- Monitoring of overall optical transmission
- Remote preventive maintenance and servicing via Ethernet/modem
- Straightforward replacement of the central unit, since connections can easily be removed
- Sensor and central unit housing free of wear and corrosion
- Easy operation with a numerical keypad and menu prompting

Certified versions for emission monitoring

The LDS 6 is available as certified instrument for emission monitoring of NH_3, NH_3/H_2O, H_2O, HCl, HCl/H_2O. The certificates are issued by TÜV for Germany and MCERTS for the United Kingdom. For conducting regular linearity and calibration checks, test kits for ammonia, water and HCl should be used. These kits can be ordered separately as instrument accessories. For new analyzer orders, the NH_3, NH_3/H_2O and H_2O kits named "Version 2" must be ordered. In case of doubt or for already installed analyzers, please contact Siemens for spotting the correct kit version.

2.2 Design

The gas analyzer LDS 6 consists of a central unit and up to three in-situ sensors. The connection between the central unit and the sensors is established by a so-called hybrid cable, which contains optical fibers and copper wires. An additional cable connects the transmitter and receiver parts of the cross-duct sensor.

Central unit

The central unit is housed in a 19" rack with 4 holders for mounting in a hinged frame in racks with or without telescopic rails.

The LDS 6 operates as an independent unit powered by a 100-240 V AC main power supply.

Figure 2-2 CentralUnit

Display and control panel

- Large LCD field for simultaneous display of measurement result and device status
- Contrast of the LCD field is adjustable via the menu
- LED background illumination of the display with energy-saving function
- Easy-to-clean membrane touch pad with softkeys
- Menu-driven operation for parameterization and diagnostics
- Operation support in plain text

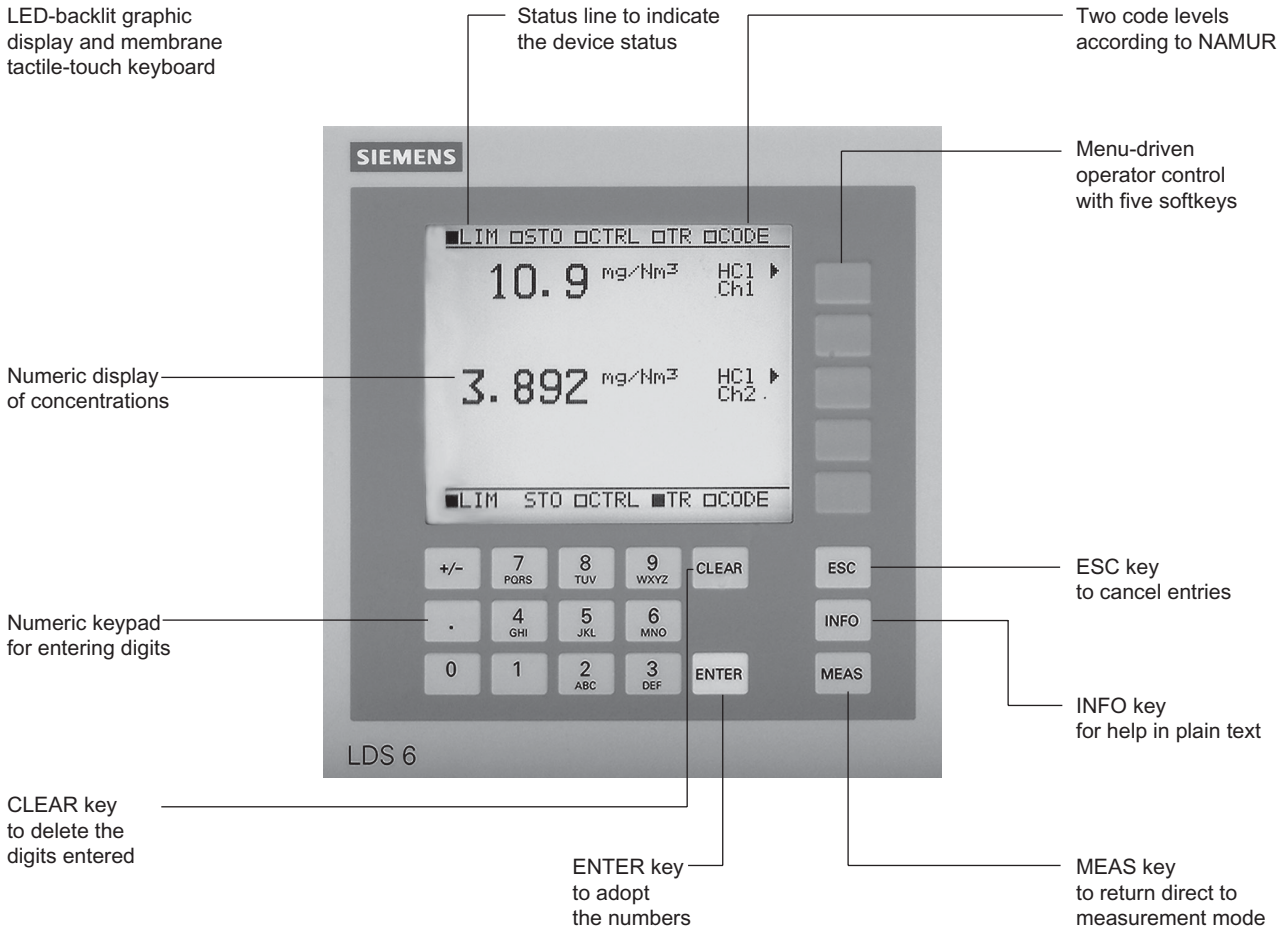


Figure 2-3 LDS 6 central unit, membrane keyboard and graphic display

Inputs and outputs

- One to three measurement channels with hybrid connections for the sensors at the measuring points
- Two analog inputs per channel for process gas temperature and pressure
- Two analog outputs per channel for gas concentration(s) or for gas temperature and concentration For selected versions, the transmission can be read out as an alternative.
- Six freely configurable binary inputs per channel for signalling faults or maintenance requests from external temperature or pressure transducers or sensor purging failure.
- Six freely configurable binary outputs per channel (signalling of faults, maintenance requirements, function control, transmission limit alarms, concentration limit alarms, store analog output)

Communication

Network connection: Ethernet (10Base-T) for remote diagnostics and maintenance.

The LDS 6 can be operated remotely via the Ethernet port with a PC running Windows 95/98/ME or Windows NT/2000/XP. It is also possible to connect the LDS 6 via modem to the public telephone net. In that case an LDS 6 LAN modem kit is required. Any external connection requires the optional software LDSComm (LDS Communication Client) to be installed on the remote computer. All aspects of LDS 6 can be controlled in this way. For the operation of the LDS 6 using LDSComm software refer to the LDSComm Manual (A5E02183317).

Maintenance and fault messages

LDS 6 outputs different warnings via relays:

- Need for maintenance (measured value is not influenced)
- Operating error (measured value might be influenced)

Cross-duct sensors

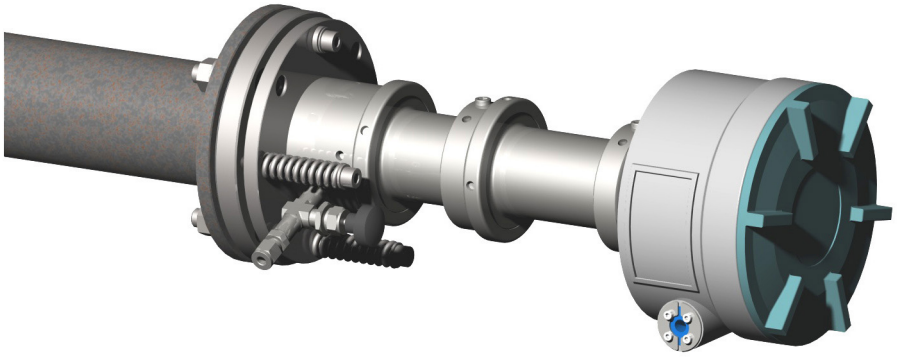


Figure 2-4 Sensor CD 6, transmitter or receiver unit

- In-situ cross-duct sensors, configured as transmitter and receiver unit, connected via sensor cable
- Connection to the LDS 6 central unit by a so-called hybrid cable, max. length 700 m
- Stainless steel, partially painted
- IP65 degree of protection for sensor
- Adjustable flanges with flange connection
  DN 65/PN 6, ANSI 4"/150 lbs
- Optional flameproof window flanges with dimensions: DN 65/PN 6, DN 80/PN 16, ANSI 4"/150 lbs, other process interfaces available on request
- Purging facilities on the process and the sensor sides, configurable application with purging gas connections for:
  - Instrument air
  - Purging air blower
  - Steam
  - Nitrogen
  - Process gases to which the pressure equipment directive cat. 2 does not apply
- In combination with high-pressure window flanges, purging with instrument air or nitrogen is possible
- Fast connectors for cleaning the measurement openings and the sensor window

- Optional: Ex-protected version according to
  ATEX II 1GD T135 °C EEx ia IIC T4, Cert. No. DEMKO 06 ATEX 139648X. Certificates according to IEC and TIIS are also available
- Sensor types CD 6 and CD 6C are compliant with the pressure equipment directive

Note

The sensors are described in detail in separate manuals which is part of their delivery.

ATEX sensors

The sensors are also available in an ATEX version - see also separate user manual. These have very low power electronics and are intrinsically safe. For use in areas with potentially explosive atmosphere a barrier box must be installed additionally.

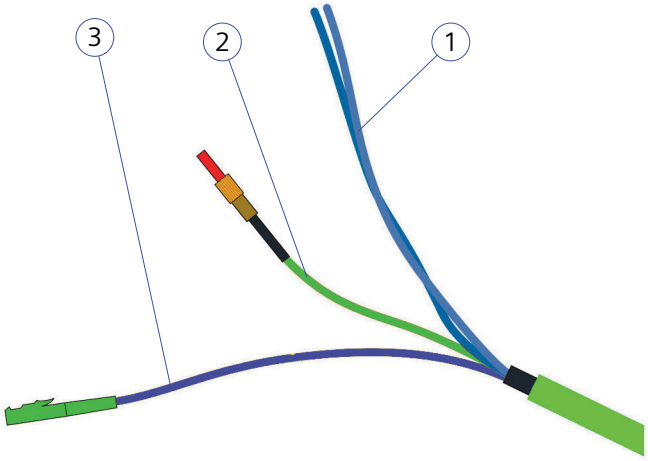
For further information regarding the ATEX option please refer to the separate ATEX manual for LDS 6.

Parts in contact with the process gases

The sensors normally do not come into contact with the process gas, since purging with a gaseous media is applied at the process side. Stainless steel purging gas tubes in front of the sensor windows immerse slightly into the process gas and thus limit the purging volume. Special materials such as Hastelloy, plastics (PP) and ceramics are available on request.

Hybrid and sensor cables

A combination of fiber-optic cables and twisted copper wires connects the sensors to the central unit. The hybrid cable connects the central unit with the transmitter unit of the sensor, the sensor cable connects the transmitter and receiver units of the sensor.



1 Twisted pair of wires
2 Multimode fiber
3 Singlemode fiber

Figure 2-5 Connections of the hybrid cable

For installation in EEx-protected environments, the legislative regulations have to be complied with, such as the spatial separation of intrinsically-safe from non-intrinsically-safe cables.

- Max. 700 m between central unit and measuring point
- Hybrid and sensor cables
  - Multimode fiber-optic cable, provided with SMA connections for transmission of the measured signal
  - Two-wire copper cable, in twisted pair version, for +24 V supply of the detector electronics (+12 V in the case of EEx-suitable instruments)
- Additionally for the hybrid cable:
  - Single-mode fiber-optic cable, configured double-sided with E2000 connectors for transmission of laser light
- Rugged cable sheath for mounting in open cable ducts or ductworks
- Sheath material: oil-resistant polyurethane

2.3 Operating Principle

LDS 6 is a gas analyzer employing single-line molecular absorption spectroscopy. A diode laser emits a beam of near-infrared light, which passes through the process gas and is detected by a receiver unit. The wavelength of the laser diode output is tuned to a gas-specific absorption line. The laser continuously scans this single absorption line with a very high spectral resolution.

The result is a fully resolved single molecular line which is analyzed in terms of absorption strength and line shape. The influence of cross-sensitivities on the measurement is negligible, since the quasi-monochromatic laser light is absorbed very selectively by only one specific molecular line in the scanned spectral range.

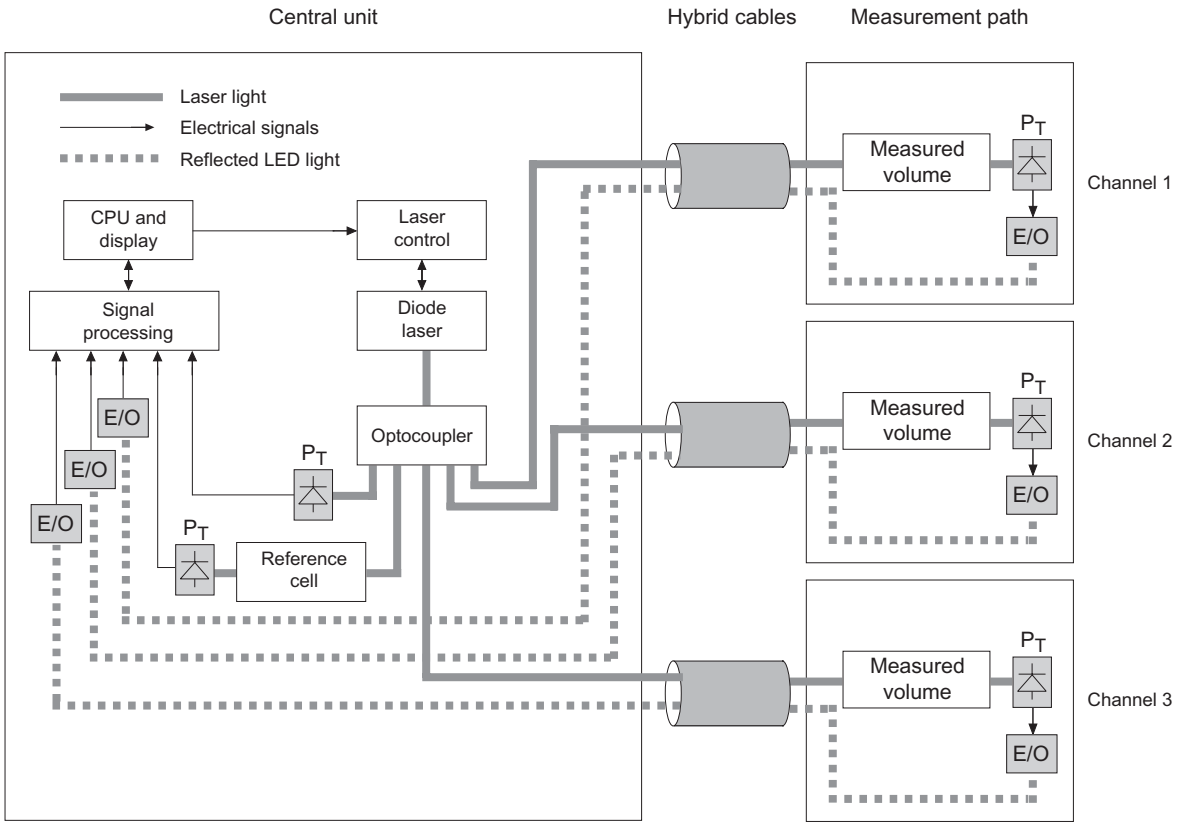


Figure 2-6 Basic design of the LDS 6

2.4 Configuration Examples

A feature of the in-situ analytical procedure is that the physical measurement takes place directly in the stream of process gas, and usually also directly in the actual process gas line. All process parameters such as gas matrix, pressure, temperature, moisture, dust load, flow velocity and mounting orientation can influence the measuring properties of the LDS 6 and must therefore be systematically investigated for each new application.

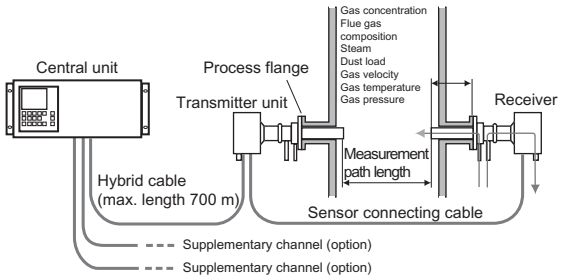


Figure 2-7 Typical transmitted light setup of LDS 6, in-situ

A feature of the standard applications defined in the ordering data of the LDS 6 is that the typical process conditions are well-known and documented, and that the guaranteed measuring properties can be proven by reference installations. If you cannot find your application among the standard applications, please contact Siemens. We will be pleased to check your possible individual application of the LDS 6. You can find an application questionnaire on the LDS product sites on the Internet.

To avoid contamination of sensor openings on the process side, clean gaseous purging media are used such as instrument air, N_2 or steam. Purging air tubes on the sensor heads, which slightly penetrate into the process gas stream, define the effective measuring path length.

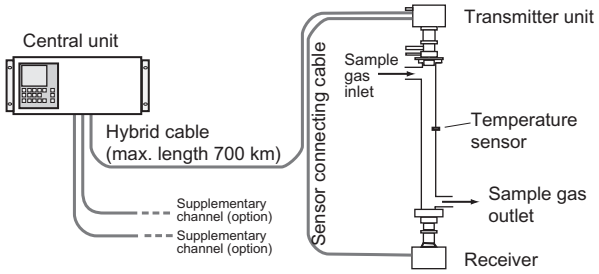


Figure 2-8 Typical transmitted light setup of LDS 6, in bypass

The LDS 6 can measure in both the transverse and longitudinal directions of the process gas flow. In certain cases, the process conditions make it necessary to condition the sample gas stream in a bypass line with respect to process temperature, pressure and/or optical path length. Further treatment of the process gas, such as drying or dust precipitation, is usually not necessary.

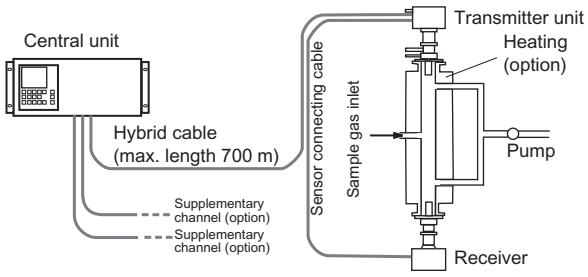


Figure 2-9 Measuring configuration of LDS 6 with heated flow cell

2.5 Measurement Principle

Mode of operation

The operation of LDS 6 is based on the fact that light propagating through a gas mixture will be absorbed according to Beer-Lambert's law at certain narrow wavelength bands. This is where the gases possess molecular transitions forming narrow absorption lines.

The light source in LDS 6 is a semi-conductor laser tuned to an appropriate absorption line for the gas to be measured. The laser light is spectrally much narrower than the gas absorption line and this, together with a proper choice of absorption line, will result in low interference from other gases.

The light is modulated, both in frequency and in amplitude, to facilitate detection on the second harmonic as well as elimination of contribution from spectrally broad absorption originating from dust, smoke, etc.

LDS 6 is connected to the measuring points by fiber optics. The laser light is guided by a single-mode fiber from the central unit to the transmitter unit of the in-situ sensor. The sensor consists of a transmitter and a receiver; the distance between them defines the measurement path. In the receiver box, the light is focused onto a suitable detector. The detector signal is then converted into an optical signal and transmitted via a second optical fiber to the central unit, where the concentration of the gas component is determined from the detected absorption signal.

LDS 6 usually measures a single gas component by means of the absorption capacity of a single fully resolved molecular absorption line. The absorption results from conversion of the radiation energy of the laser light into the internal energy of the molecule. In the working range of the LDS 6, both rotation-vibration transitions and electronic transitions – such as with O_2 – can be triggered.

In some specific cases, two components can be measured simultaneously if their absorption lines are so close to each other that they can be detected within the laser spectrum by one single scan (for example water (H_2O) and ammonia (NH_3)).

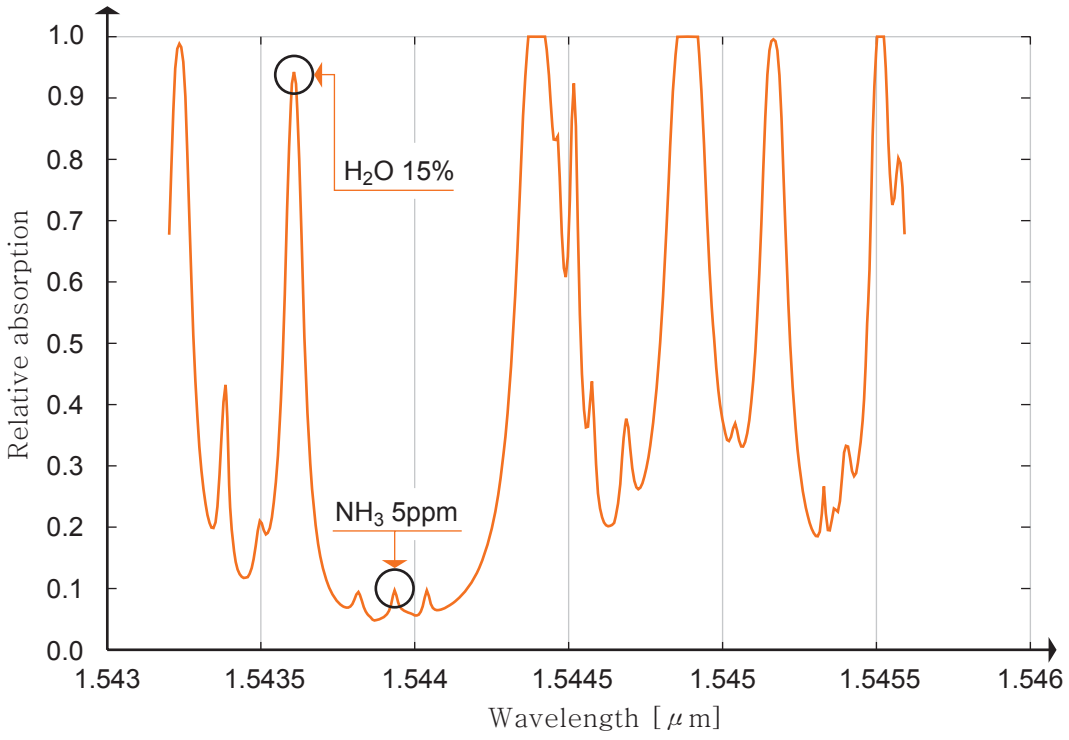


Figure 2-10 Absorption spectra of water and ammonia

Moreover, in some applications it is possible to determine the gas temperature as a measured value. In this case, the ratio of the absorbance of two characteristic lines of the same molecule measured at the same time in the same volume gives the actual temperature in the process gas.

Typical measurable gases for LDS 6 are:

- Oxygen (O_2) for low and high pressure
- Oxygen + temperature
- Hydrogen fluoride (HF) + water
- Hydrogen chloride (HCl) + water
- Ammonia (NH_3) + water
- Water vapor (H_2O)
- Carbon monoxide (CO)
- Carbon dioxide (CO_2)
- CO + CO_2

By using an internal reference cell normally filled with the gas measured, the stability of the spectrometer is permanently checked in a reference channel.

By doing so, the continuous validity of the calibration is ensured without the need to carry out external recalibration using bottled test gases or reference gas cells.

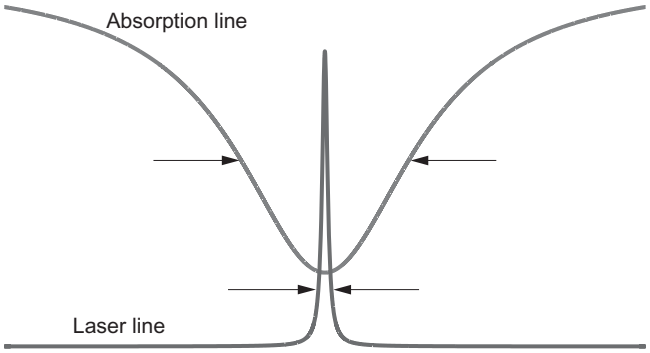


Figure 2-11 Typical spectral bandwidth of an absorption line compared to the bandwidth of the laser light

Influences on the measurement

Dust load

As long as the laser beam is able to generate a suitable detector signal, the dust load of the process gases does not influence the analytical result. By applying a dynamic background correction, measurements can be carried out without any negative impact. Under good conditions, particle densities up to 100 g/Nm³ can be handled by the LDS 6. Varying dust loads are compensated by scanning the laser over the gas absorption line and the current background. At a scan position next to the absorption line, the instrument can "see" only absorption caused by the dust load where at the line center the signal is composed of the molecular absorption and the continuous, unspecific background absorption. With the wavelength modulation technique, the actual measured transmission is always compared with the baseline. After signal processing, phase-sensitive application delivers a signal only from the molecular line free of background.

The influence of a high dust load is complex and depends on the path length and particle size. The optical damping increases at longer path lengths. Smaller particles also have a large influence on the optical damping. With a combination of high dust load, long path length and small particle size, the technical support at Siemens should be consulted.

Temperature

The temperature influence on the absorption line strength is compensated by a correction factor determined during calibration. A temperature signal can be fed into the instrument from an external temperature sensor. This signal is then used to correct the influence of the temperature on the observed line strength. If the temperature of the sample gas remains constant, it is alternatively possible to carry out a static correction using a preset value.

At high temperatures there may be noticeable broadband IR radiation of gas and dust, or flames may occasionally occur in the measurement path. In this case the detector is protected by an optical bandpass filter to prevent saturation by the strong background radiation.

Pressure

The gas pressure can affect the line shape of the molecular absorption line. LDS 6 uses a special algorithm to adapt the line shape. Additionally, an external pressure signal can be fed to the instrument to provide complete compensation for the pressure influence including the density effect.

Cross-interferences

Since LDS 6 derives its signal from a single fully resolved molecular absorption line, cross-interferences with other gases are quite unlikely. LDS 6 is therefore able to measure the desired gas components very selectively. In special cases, the composition of the process gas might have an influence on the shape of the absorption line features. This influence is compensated by analyzing the full shape of the detected signal curve applying specific algorithms.

Optical path length

The absorption values analyzed by the LDS 6 are typically small. As a result of Beer-Lambert's law, the absorption of laser light depends on the optical path length within the gas. Therefore, the precision in determining the effective optical path length in the process might limit the overall precision of the measurement.

As the sensor openings toward the process normally need to be purged to keep them clean over a long period of time, the thickness of the mixing zone between the purging medium and the process gas and its concentration distribution need to be considered. In a typical in-situ installation with some meters of path, the influence of the purging gas on the effective path length can be neglected.

Path length and dust load are mutually influencing: the higher the dust load in the process, the shorter the max. possible path length.

Note

Individual requirements for the measuring point can make the utilization of special sensor equipment necessary. The possibilities for adapting the sensors are:

- Different purging media, such as instrument air, ambient air, nitrogen or steam
- Different purging modes on process and sensor sides
- Special materials of purging tubes and/or sensor flanges
- Cooling or heating of the sensors
- EEx-proof sensor configurations

Installation Guidelines

3

3.1 Safety Information

It is essential that you observe the given information and warnings!

Electrical Safety

⚠ DANGER

Certain parts inside the gas analyzer LDS 6 carry dangerous voltages.

The housing must be closed and grounded before switching on the analyzer.

Death, personal injury and/or damage to persons and/or property may result if this is not observed.

LDS 6 and CD 6 meet all regulations specified in the present EU regulations (LVD regulation 2006/95/EC and EMC regulation 2004/108/EC).

The device can be used in an industrial environment.

Laser Safety

All lasers used by LDS 6 are of class 1. The emitted laser light is in most cases invisible (near infrared) and the intensity is low enough so that the unprotected eye is not damaged under normal circumstances. LDS 6 has warning labels at appropriate positions according to DIN EN 60825-1.

⚠ CAUTION

This device emits laser beams.

To avoid damage to your eyes never look directly into the laser beam.

If this rule is not followed there is a chance that damage to the unprotected eye may occur if you look directly into the laser beam particularly when using focusing optics (e. g. binoculars).

Heat Safety

Some metal parts and piping placed near the sensors are at elevated temperatures. The reason is high temperature purging - either from steam or from air.

⚠ CAUTION

The sensors are designed for work at elevated temperatures, particularly when a purging system is in operation. Even after operation these parts cool off slowly.

For any work around these sensors be sure to wear protective gloves.

If this rule is not followed serious burns of the unprotected skin may happen.

Pressure Safety

The sensor is tested at a pressure of 600 kPa. This pressure value should not be exceeded in operational conditions.

⚠ WARNING

Should pressures higher than 600 kPa occur in the process, this can lead to destruction of the sensors and their environment. In worst case process media may break free and pollute the environment.

Avoid under any circumstances process pressures higher than 600 kPa.

If this rule is not followed, death, injuries and/or damage to property and environment can occur.

Explosion Protection - II 1GD T135 °C EEx ia IIC T4 IP65

The LDS 6, with a central unit and sensors interconnected with optical fibers, is explosion safe. Only a limited, low energy part of the electronics is located at the measurement site. The distance between the central unit and the sensors can be several hundred meters. The LDS 6 system is available in an Ex version and is then delivered with an approval for use in hazardous environments. The ATEX certificate is a system certificate and is only valid if LDS 6 is installed according to the instructions given in the certificate.

Approval

The concept of the Ex approval is that the central unit is unchanged from a standard unit and that a special Ex sensor pair (CD 6 Ex) is used in the hazardous zone. In addition to this an explosion protection barrier is added before entry into the hazardous zone. An absolute condition for the approval is that the equipment is set up according to the drawing, ADM 3040 3050, please refer to the separate ATEX manual for LDS 6.

The protection is as follows:

Cross Duct Sensor - **⟨Ex⟩ II 1G Ex ia IIC T4 ⟨Ex⟩ II 1D IP65 T135 °C**.

Central (Barrier) Unit - **⟨Ex⟩ II (1)G Ex [ia] IIC ⟨Ex⟩ II (1)D Ex [iaD]**.

- Equipment Group: Group II - Surface.
- Equipment Category: Category 1G D - Zone 0. Flammable material can be present continuously, frequently or for long periods, in gas and dust.
- Type of protection: EEx ia. The equipment present in the hazardous area is intrinsically safe.
- Explosion group: IIC. This corresponds to a gas group containing Acetylene and Hydrogen.
- Temperature class: T4. The maximum surface temperature on the equipment is 135 °C (275 °F) and the ignition temperature of the gas or vapor is between 135 °C (275 °F) and 200 °C (392 °F).
- The sensor housing protection is IP65 and the ambient temperature must be between -30 °C (-22 °F) and +60 °C (140 °F) .

Liability

Following commissioning, the total responsibility is with the owner.

3.2 General Installation Information

Mounting Conditions

The central unit LDS 6 should be placed on a location which is dust-free and as free as possible from vibrations. The distance between the central unit and the measurement point, i.e. the sensor, may not exceed 1000 meters (3,280 ft) for the non ATEX version and 600 m (1,970 ft) for the ATEX version.

During operation the permissible surrounding air temperature is 5 °C (41 °F) to 45 °C (113 °F), with a relative humidity of maximum 85% non-condensing, around the central unit. Also ensure that the unit is not exposed to direct solar radiation. If these conditions can't be fulfilled the LDS 6 must be installed in a cabinet with controlled environment.

Note

As condensing is normally a problem when moving the device from outside to inside a building it is recommended that the device should be adapted to room climate for a couple of hours before starting it.

The back of the unit must be freely accessible. There should be at least 10 cm (4 ") of free space behind the LDS 6 to accommodate the signal and hybrid cables. To meet the safety requirements for air convection and cooling there must be a free space of at least 5 cm (2 ") above and at least 3 cm (1 1/4 ")below LDS 6.

For detailed information on the sensor installation, please refer to the sensor manual corresponding to your system setup.

Hybrid Cables

The hybrid cables should be installed such that they are protected from mechanical wear such as sharp edges or moving parts. During installation always keep the protective tube in such a position that the single mode fiber connector is protected from dust. The operating temperature for the cables is -40 to +80°C (-40 to 176 °F) and the installation temperature is -20 to +80°C (-4 to 176 °F). The bending radius of the cables may never be smaller than 100 mm (4 ").

Note

Throughout the entire installation, keep the fiber ends protected by the protective tubes; observe that these should only be removed by authorized personnel.

There are three kinds of cables used for the LDS 6 depending on the application:

- Hybrid cables for all types of systems except oxygen. These are installed between the LDS 6 and the transmitter sensor.
- Hybrid cables for oxygen systems only, also installed between the LDS 6 and the transmitter sensor.
- Loop cables, same for all systems, are installed between the transmitter sensor and the receiver sensor.

3.3 Electrical Connections

3.3.1 Power Supply Connections

⚠ WARNING

The respective country-specific standards for the installation of power systems with rated voltages below 1000 V must be followed. Failure to observe these regulations may result in death, personal injury and/or damage to property.

General

- Check that the local voltage agrees with that specified on the label on the analyzer.
- The cable must be tested according to IEC 60227 or IEC 60245 and must be suitable for 70 °C (158 °F).
- The power cable must be routed separately from the hybrid cables.

Detachable Cord

- The analyzer is supplied with an appliance plug which may only be connected to the power supply by qualified personnel. The cross-section of the conductors must be at least 1 mm^2. The phase conductor must be connected to the identified position (L).
- Only detachable power supply cords tested by an accepted third party Lab accredited for the region where the unit is to be used is allowed. This cord must be suitable for the rated current and limited in length. This flexible cord must also be suitable for an ambient temperature of 70 °C (158 °F) and is not allowed to be mounted in building installations.
- As the kind of appliance inlet is only suitable for 70 °C (158 °F) ambient temperature the power cord must be kept away with suitable means from surfaces of more than 70 °C (158 °F) at max. rated operation conditions.
- It is not allowed to install a switch within the power supply cord.

Electrical Protection

- A circuit-breaker shall be part of the installation. It must be provided in the immediate vicinity of the analyzer (see rating plate for loading capacity). It must also be labeled to correlate with the instrument.

3.3.2 Hybrid Cable Connection

The hybrid cable is connected at the back of the central unit, where its two optical cables and the supply line for the sensor wire are attached, as shown in the picture below.

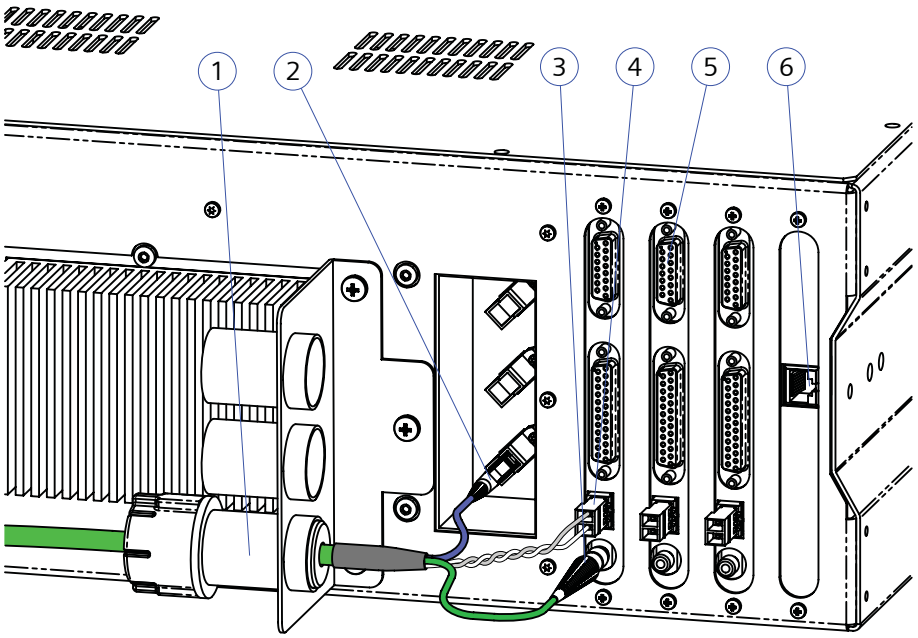


Figure 3-1 LDS 6 cable connections (here only channel 3 is connected)

WARNING

Keep the fiber end protected, by the protective tube, until it is time for connection. Only authorized personnel are entitled to remove the protective tube and proceed with the connecting operation.

1. Hybrid cable holder.
2. E2000 Single Mode fiber connector, angle polished.
3. SMA Multi Mode fiber connector.
4. Sensor voltage supply connection. 24 V/60 mA.
5. Signal output connections.
6. Network connection. Ethernet 10Base-T (RJ-45).

See also

Pin Assignment of LDS 6 (Page 34)

Signal Cable Connection (Page 32)

3.3.3 Signal Cable Connection

⚠ CAUTION

The signal voltages must be electrically isolated extra-low voltages (SELV). The maximum voltage potential accessible to persons is 33 V_{eff} or 46,7 V peak or 70 V dc. If several SELV voltages are available, then it is possible that the sum of these potentials is higher than that allowed to get in contact with the human body.

⚠ WARNING

The signal cables must only be connected to devices which guarantee safe isolation from their power supply.

If signals (i.e. analog output 4-20 mA) are to be routed into a potentially explosive atmosphere of zone 1, they must be intrinsically safe. Supplementary retrofitting of the analyzer with energy-limiting modules is necessary.

The Ex identification of these modules must be clearly visible on the housing:

- The signal cables in the rack mount analyzer are connected to the DSUB plugs at the rear.
- RC elements must be connected according to the figure "Spark suppression" below as a measure to suppress the generation of sparks across the relay contacts (i.e. limit relays). Note that the RC element results in a drop-out delay for an inductive component (i.e. solenoid valve). The RC element should therefore be dimensioned according to the following rule-of-thumb:

  $R\ [\Omega] \cong 0.2 \times R_L\ [\Omega]\ C\ [\mu F] \cong I_L\ [A]$

  Additionally, make sure that you only use a non-polarized capacitor C.

  Note

  When using direct current, it is possible to fit a spark suppression diode instead of the RC element.

The cables to the relay outputs and binary inputs as well as the analog inputs and outputs must be screened. They must be connected to the corresponding trapezoidal DSUB plug according to the diagram "Pin assignments for I/O connectors". The conductor cross-section should be 0.5 mm^2. It is recommended to use cables of type JE-LiYCY... BD. The cable length of the analog outputs depends on the load.

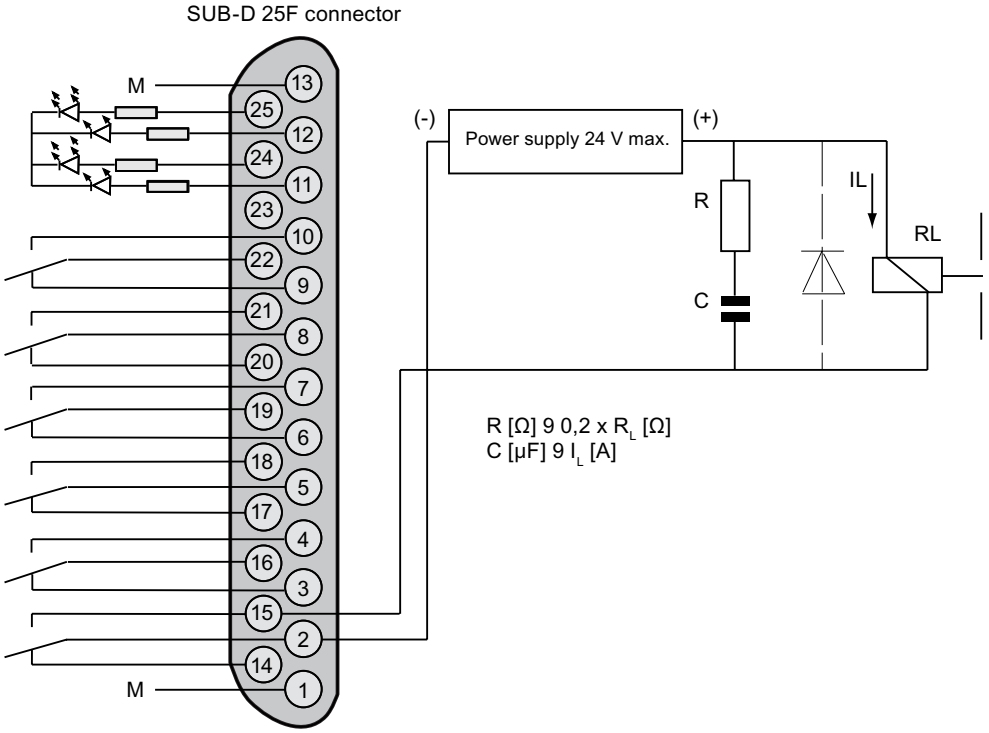


Figure 3-2 Spark suppression on a relay contact

The preceding figure shows an example of measure to suppress sparks on a relay contact. Since the DSUB connector and the spacings on board and on connector are only suitable for detachable voltages (signal) and as the power is located outside this powers supply, circuit must be SELV and the power must be limited according to EN61010-1 (Table 13 or 14) when an over current protective device is used.

- The reference ground of the analog inputs is the housing potential.
- The analog outputs are floating, also with respect to one another.
- The interface cable must be screened and connected to housing potential. The cable screen must be connected with a large-area contact to the screen of the DSUB plug. The conductor cross-section should be at least 0.5 mm^2. The interface cable must not be longer than 500 meters (1,640 ft).
- In the case of analyzers with two or three channels, the analyzer sections are connected in parallel and the signal cables of each channel are independent. Only the power plug is common to all channels.

3.3.4 Pin Assignment of LDS 6

The signal connection is carried out by using two DSUB connectors for each channel – one 15 pins and one 25 pins.

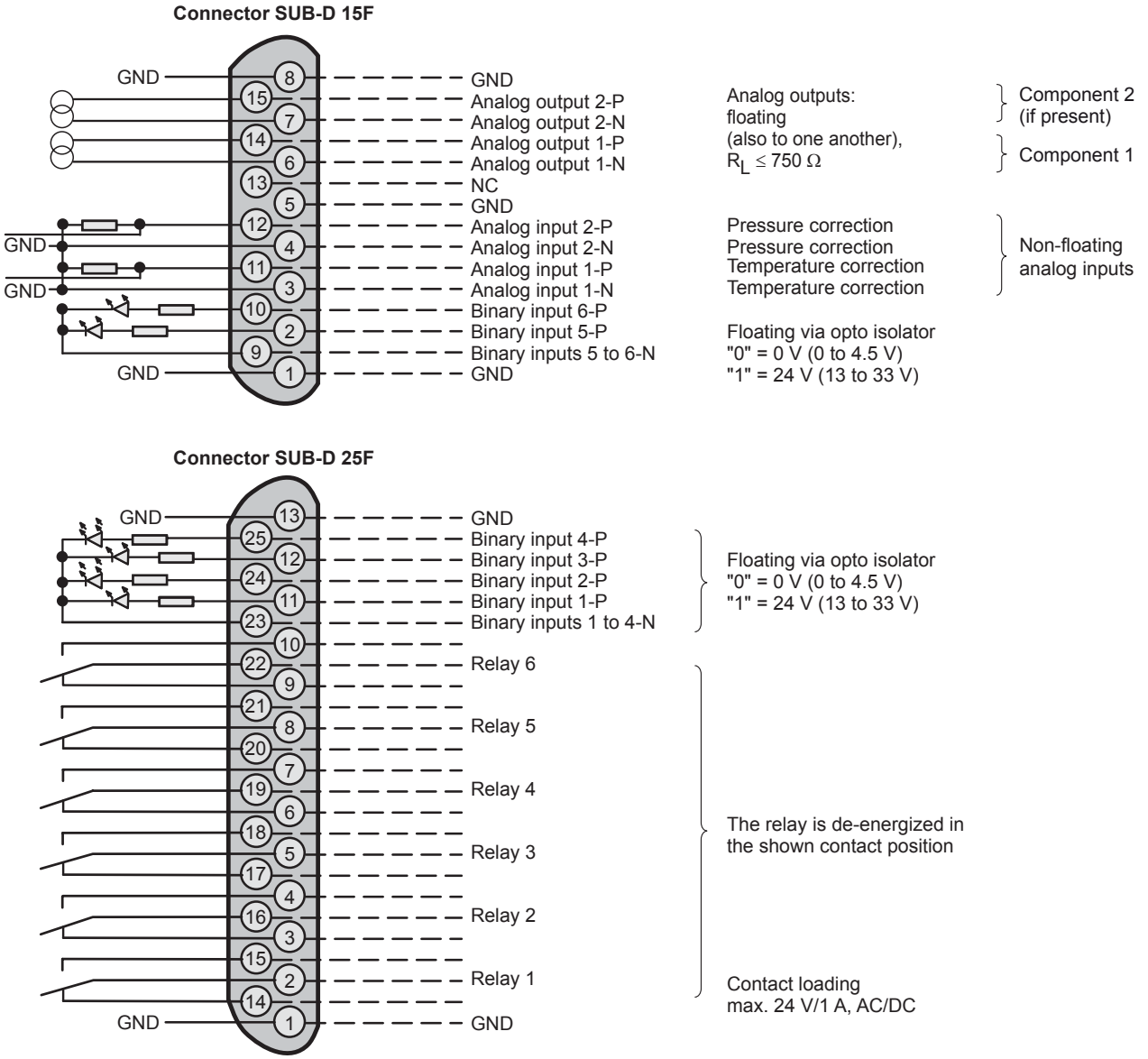


Figure 3-3 Pin assignment for I/O connections

3.4 Three Channel System

3.4.1 External Power Supply

The three channel version of LDS 6 uses an external power supply for the sensors. The setup at the sensor site is the same as for one and two channel systems. Also the ATEX version of the three channel LDS 6 is using an external power supply leaving the sensors unaffected when a third channel is added. The external power supply is connected by adding the pins into two corresponding screws of the 6 pole socket at the back of the central unit as seen in the following figure.

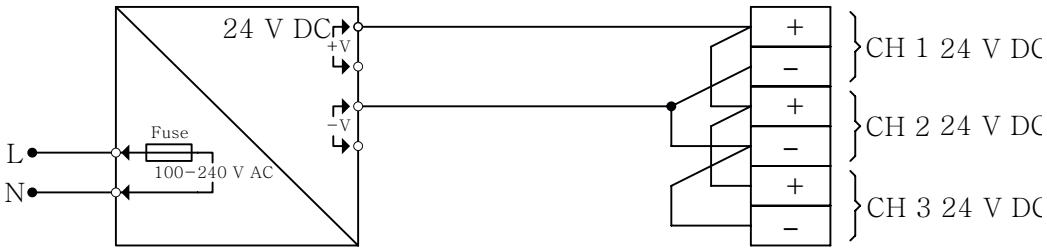


Figure 3-4 Schematics of the external power supply.

Fuses: Central unit:100 ... 240 V: T2.5L250V
External power supply:100 ... 240 V: T1.25L250V

3.4.2 Three Channel Hybrid Cable Connection

In a three channel instrument, the electrical wires in the hybrid cables are connected according to the following figure.

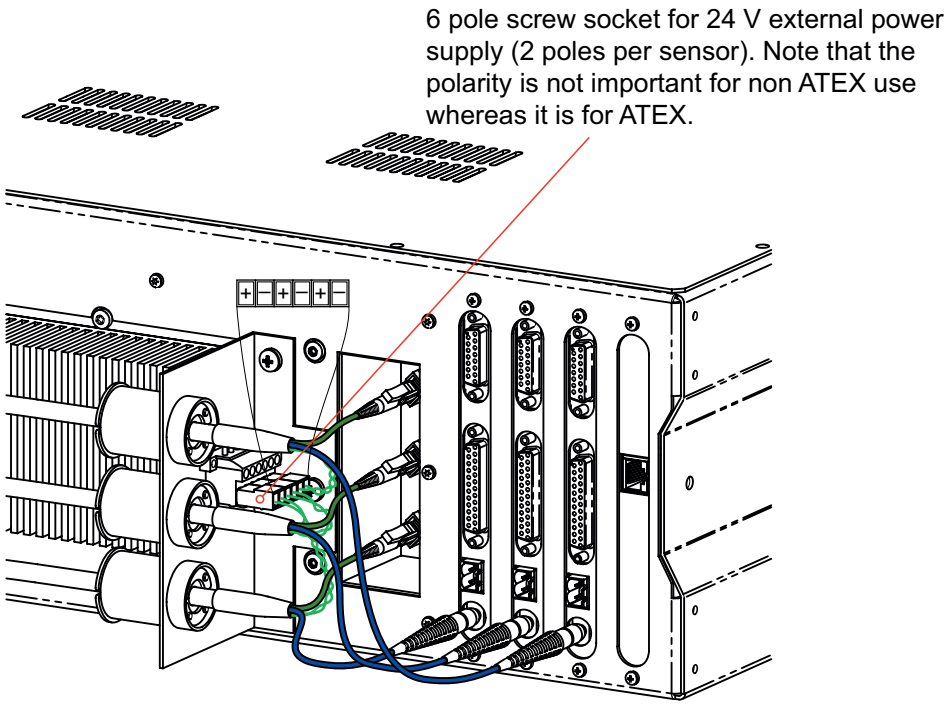


Figure 3-5 Connection of electrical cables for a 3 channel unit

CAUTION
The instrument is not designed to feed 3 sensors using the internal power supply.

3.5 Flange Installation Requirements

Before the gas analyzer and its sensors can be used, a pair of process flanges should be installed at the measurement site. The flanges must be installed at a safe and accessible position to make installation and service easy to accomplish.

The flanges should be welded to the wall of the furnace or funnel as shown in the figure below.

The flange must protrude at least 100 mm (4") from the wall and 0-30 mm (0-1.2") into the furnace/funnel.

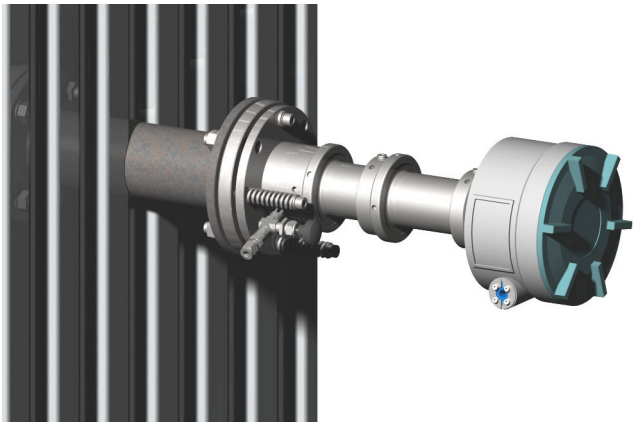


Figure 3-6 Sensor CD 6 mounted on a process flange

There are applications where furnace walls move due to variations in temperature. If the furnace walls move the sensors will be miss-aligned and the measurement interrupted. To overcome this, the sensor can be fixed to a girder or other structure that is not influenced by the temperature and the flexible metal tube is fitted between the process flange and the sensor flange. Remember that the flanges fitted for the sensors must not deviate more than ±2°.

Note

It is very important that the flanges are mounted so that they are aligned. Otherwise the measurements will not be correct.

3.6 Installation of Flanges

When welding the flange tubes it is recommended to have the Flange Alignment Kit. The Flange Alignment Kit from Siemens consists of a light source, two flanges, an aiming tool and a battery charger for the light source.

Make sure there is enough room for the sensor. Especially take into consideration that it should be easy to mount or dismount and that the sensors lid should be able to open fully. Safe working space around the sensors are also needed, guardrails, ladders, etc. The figure below illustrates the process for installation of flanges.

Alignment procedure.

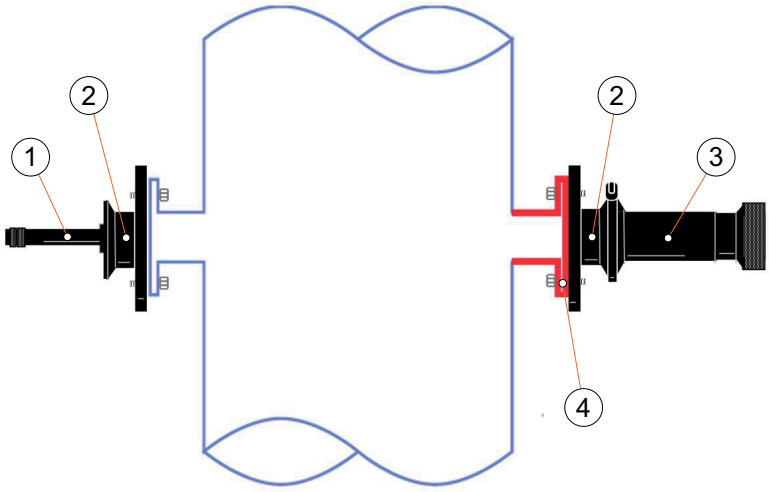


Figure 3-7 Usage of the items in the flange alignment kit

1. Light source
2. Alignment flanges
3. Aiming tool
4. Process flange to be aligned

This is the alignment procedure

1. Weld the flange tubes loosely on each side of the wall. Do not weld them so hard that the angle of the tubes can not be adjusted with a hammer.
2. Mount the light source on one flange and the aiming tool on the other flange.
3. Turn on the light source.
4. Adjust the focus on the aiming tool until the light spot from the light source is sharp.
5. Adjust the angle of the process flange tube, using for instance a rubber hammer, until the light spot is centered on the cross hair on the aiming tool.
6. Weld the aligned flange tube permanently into this position.
7. Shift light source and aiming tool and repeat the procedure above for the opposite flange until the other tube also is permanently welded.

Note

It is important that the flanges are aligned from both sides. Therefore, remember to shift light source and aiming tool and repeat the procedure from the other side as well. It is also important that the sensor flanges are oriented in such a way that the spring loaded bolts are located in the lower section of the flange.

Flange Alignment Deviation

When both flange-tubes are permanently fixed the deviation from the theoretical optical path must not exceed ±2°. This is because the alignment flanges can be adjusted maximum ±2°. See the figure below.

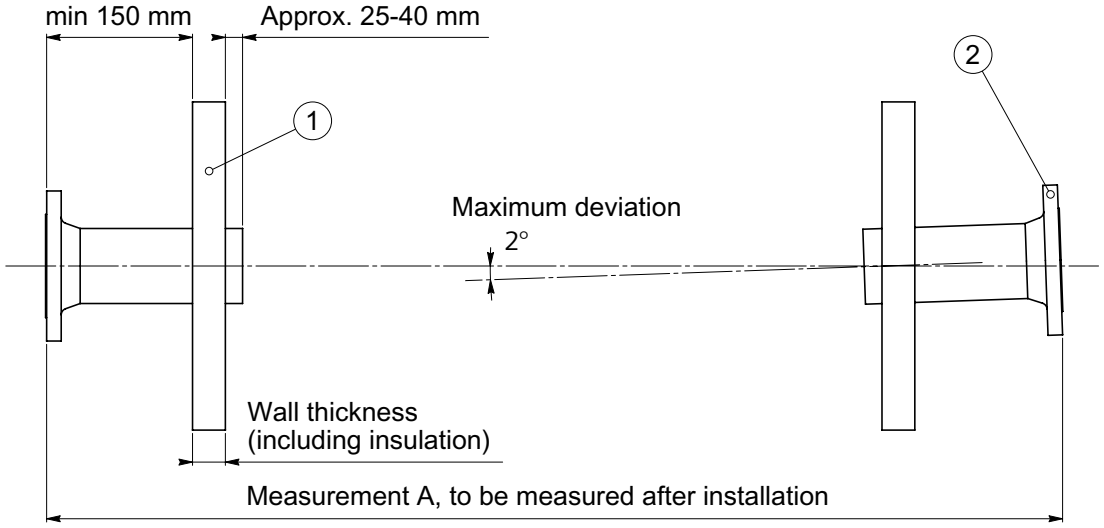


Figure 3-8 Customer flange alignment

The required precision of the flange alignment

The aim should always be to achieve the best possible alignment of the flanges, i.e. to get the center of the dot as close as possible to the center of the crosshair on the alignment tool. This will allow for small changes, for example caused by thermal movement later on.

For a normal installation using standard 400 mm purging tubes the alignment is usually good enough if the center of the dot is within 3 mm from the center. The lines closest to the center of the crosshair are about 3 mm from the center.

Note

If long purging tubes will be used, a greater effort should be made to align the flanges perfectly. Depending on the diameter and length of the stubs the possibility to align the sensors is more restricted when long purging tubes are used.

Operation

4

4.1 General

Once the installation of the sensors at the measurement points is done and the connection via hybrid cables to the LDS 6 is established, the system is ready to be used. The functions in the LDS 6 are controlled through a keypad on the front of the panel. A 5" LCD screen is used to present the measurement values as well as the instrument's interface - the MMI.

Note

In the following screen examples the application illustrated is mainly for the gas NH_3 (ammonia). However they are valid for all applications and gases.

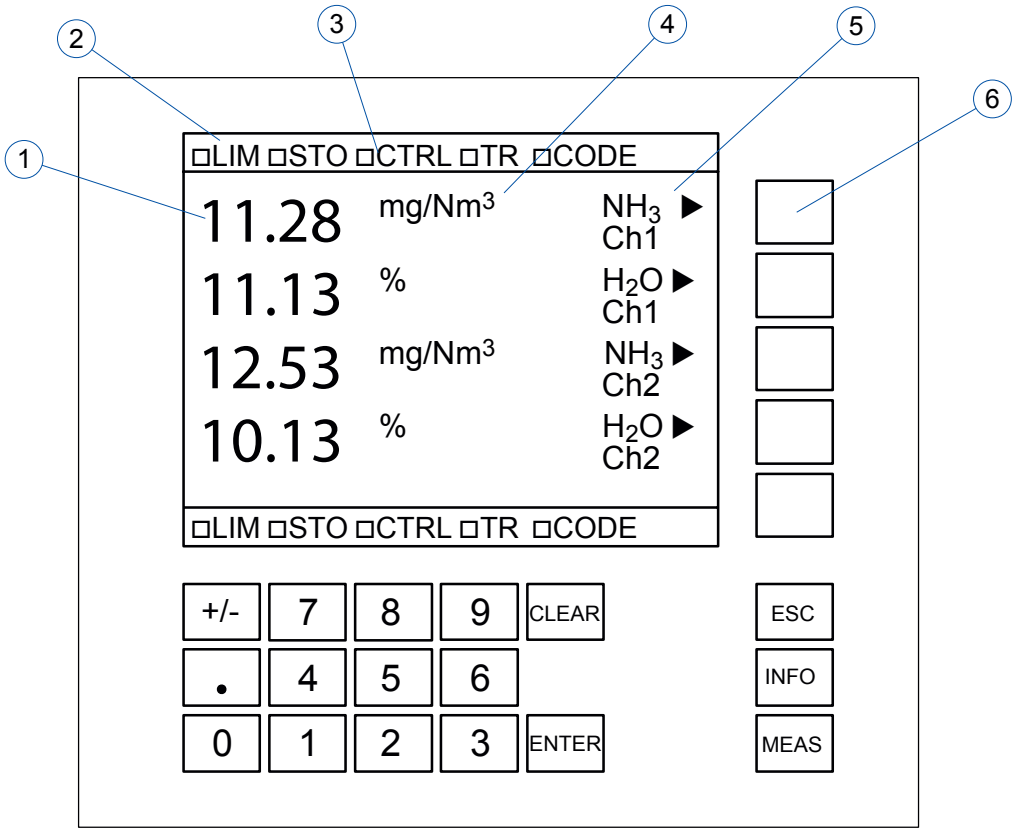


Figure 4-1 The keypad and the screen on LDS 6

1. Measured value.
2. Status display: □LIM means: limit (alarm) signaling is idle and ■LIM means: limit (alarm) has been triggered.

3. Status line (can be parameterized using function 53). If a fault occurs during operation, the message "Maintenance request" or "Fault" appears in the status line depending on the importance of the fault. This message is displayed alternately with the status messages.
4. Unit display.
5. Measured component display.
6. Function keys with adaptive meaning (soft keys).

Points 1 to 6 apply to channel 1. The elements are repeated in an analogous manner in the bottom half of the display for a two-channel analyzer (as shown).

Table 4- 1 Table Op. 1

Switches/Keys	Meaning
CLEAR	Deletes a commenced number input.
ENTER	Every digit input (except fast selection of a function) must be confirmed by using this key.
ESC	Return by one step in the input structure. Modifications are imported.
INFO	Help information.
MEAS	Return from any position in the input structure to service mode (possibly with request whether to import the entered data). Pressing the MEAS key again results in locking of the analyzer; i.e. changing to service mode again is only possible following input of the code.
Soft key	Possible adaptive meanings: Selection of item in menu tree Selection of function Switch function ON/OFF Component selection

Editing Entries

The values in the menus shown in this chapter should be understood as examples.

- An active input field is represented with brackets ([10]) as limiter. The cursor is positioned as a flashing line underneath the number to be entered (e.g. [23.45]).
- The input is terminated by pressing the ENTER key, and the value is stored. If several input fields are present in a menu, the cursor is automatically positioned to the next input field.

Note

Each input value must be confirmed with ENTER before you leave the menu.

- The CLEAR key can be used to delete an input. The cursor then returns to the first position of the input field.

Graphic Styling Elements

■ Switching function (ON status).

□ Switching function (OFF status, also status display in the status line).

► Entry into a subsequent menu.

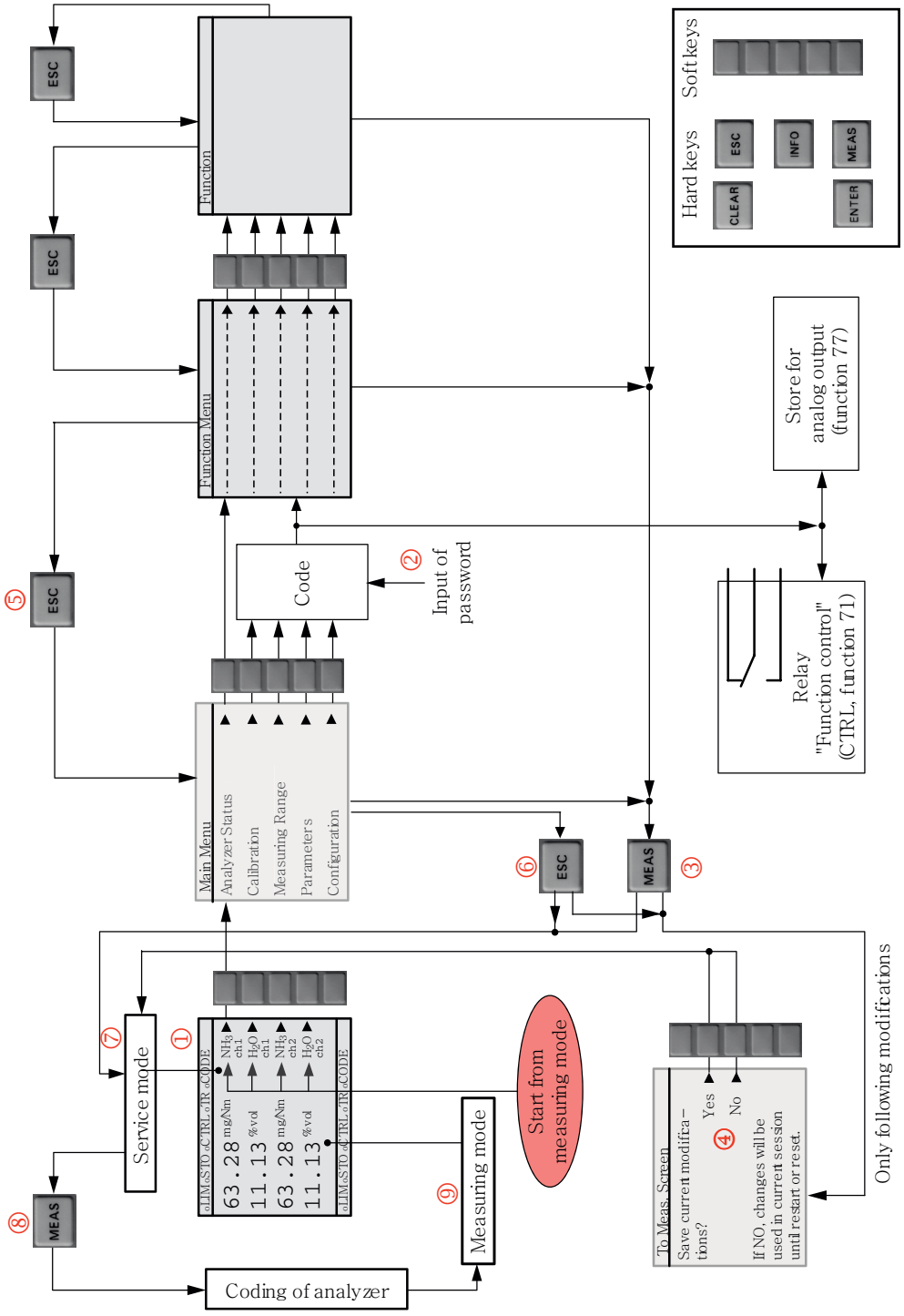
● Triggering of a function.

Measuring mode: analyzer is coded.

Service mode: signals are activated according to functions 71 and 77.

4.2 Input Sequence of Data

The figure "Input sequence interacting with LDS 6" below shows the input sequence of LDS 6. The circled numbers marking certain steps in the input sequence can also be found in the text following the figure.

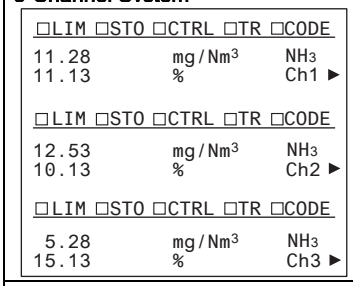


Entry into Main Menu for a 1- or 2-Channel System

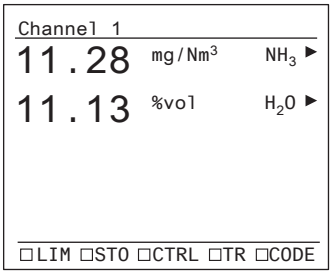
Whilst in **Measuring Mode**, the component is shown on the right, with an arrow (►). A soft key ① is assigned to this specific component and it is called by pressing it.

Figure 4-2 Input sequence interacting with LDS 6

Entry into Main Menu for a 3-Channel System

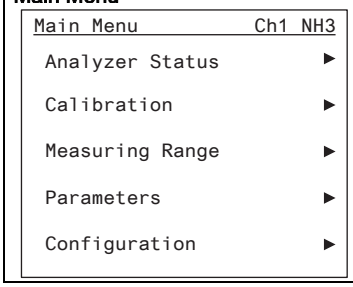


The appearance of the screen menu varies depending on the number of channels and the number of measured components. For a 3-channel system the soft keys of the measuring screen are assigned to channels instead of measured components. If the channel has two components it is necessary to pass a second channel-specific measuring screen before entering the component-specific main menu.



Each channel can be operated independently.

Main Menu



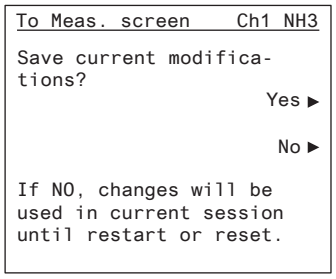
The main menu consists of the five items shown in the adjacent screen.

Entering a Submenu

Following the selection of a submenu, you will be asked to enter a password for service mode ② (exception: submenu "Analyzer status" which requires no password and is thus freely accessible).

Analyzer status	No code
Calibration	Access level 3
Measuring ranges	Access level 1
Parameters	Access level 1
Configuration	Access level 2

The passwords for levels 1 and 2 are factory-set to the values "111" and "222" respectively.

Return to Measuring Screen 	When pressing the **MEAS** key you return immediately to the measuring screen from any position in the menu structure ③. Any input started is aborted. The adjacent question is displayed before the return is carried out. The modifications are imported into the working area of the parameter memory by pressing "Yes". By pressing "No" the modifications are nevertheless used in the working area of the parameter memory and are valid for the current session. To reject the modifications a restart of the instrument is required. The **ESC** key leads back step-by-step to measuring screen ⑤. Modifications are imported without questioning ⑥.

Coding of Analyzer

After returning to measuring screen using **ESC** or **MEAS**, the symbol ■CODE in the status line shows that the analyzer is still in service mode ⑦. The analyzer can be coded again (□ CODE) by pressing the MEAS key once more ⑧, thus entering **Measuring Mode** ⑨.

Simultaneously with the symbol ■CODE the symbol ■CTRL (Function control) appears in the status line, showing that the analyzer is not in measuring mode. External signaling via a relay contact is then possible if a corresponding relay has been configured with **CTRL** under function 71.

Fast Selection of Functions

A "Power user" input has been incorporated to allow immediate switching from the measuring display to the desired function display if frequent inputs are necessary. It is then possible to directly access the desired function by bypassing the menu levels. The "Power user" input can only be started from the Measuring Screen and comprises the following input steps:

- Enter number of desired function in measuring screen using the digit keys;
- Press the soft key next to the desired component;
- If you do not have the required privileges to change the desired function you will be requested to enter the password.

For a channel with two components on a three-channel instrument you must first press the soft key next to the desired channel and thereafter (in the next window) press the soft key next to the desired component.

4.3 Analyzer Functions

4.3.1 Summary of Analyzer Functions

The analyzer functions can be divided into the following three categories:

- Analyzer-specific functions act on all channels and components of the analyzer, independently from the analyzer component through which the function was called.
- Channel-specific functions act on all components of the corresponding channel, independently from the analyzer component through which the function was called.
- Component-specific functions act on a single component, and can only be called through this.

The following table summarizes the functions of the analyzer.

Table 4- 2 Summary of Analyzer Functions

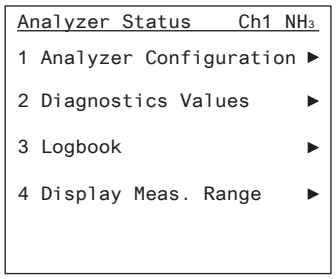
Main menu item (section)	Function number	Function designation	1*	2*	3*
5.2.1 Analyzer Status	1 2 3 4	Analyzer Configuration Diagnostics Values Logbook Display Measuring Ranges	x	x x x	 x
5.2.2 Calibration (code 3)	20 21	Zero Calibration Span Calibration		x	 x
5.2.3 Measuring Range (code 1)	41	Define Ranges			x
5.2.4 Parameters (code 1)	50 51 52 53 55 56 58 60	Response Time Limits Transmission Status Messages Select Display Digits LCD Contrast Date/Time Setup Logbook	 x x	 x x x	x x x
5.2.5 Configuration (code 2)	70 71 72 73 74 75 77 79 81 80 82 83 84 85 86 87 88 89	Analog Output Relay Outputs Binary Inputs Communication Reset Save/Load Data Store Analog Output Codes Input Levels Select Language Analyzer Test Pressure Correction Temperature Correction Water Correction Path Length Unit Dry Gas On/Off Error On/Off Ethernet On/Off	 x x x x x	 x x x x x x x x 	x x x x

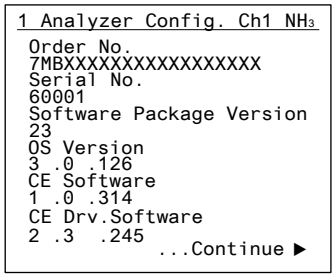
1* Analyzer-specific functions.
2* Channel-specific functions.
3* Component-specific functions.

Some of the existing functions in other Siemens analyzers are not present in LDS 6, thus some function numbers may be missing in the preceding table.

4.3.2 Analyzer Status

Table 4- 3

	This display appears when pressing the first soft key ("Analyzer Status"), following the selection of the diagnostics functions in the main menu. The status functions are freely-accessible. You will not be asked to enter a password.

1 Analyzer Configuration 	You can use this function to display important manufacturing data of the analyzer.

- Ordering No: Information on ordering data of analyzer.
- Serial No: Consecutive number of analyzer.
- Software Package Version: Version number of the application-specific configuration software.
- OS Version: Version number of the Windows CE operative system running in the analyzer.
- CE Software: Version number of the LDS 6-specific software.
- CE Driver Software: Version number of the driver software.
- Analyzer uC Drv.Software: Version number of the software running on the main micro controller.
- Channel uC Drv.Software: Version number of the software running on the measurement channel micro controller.
- Opto uC Drv.Software: Version number of the software running on the opto module micro controller.
- Chan. FPGA Firmware: Version number of the firmware running on the measurement channel FPGA.
- Opto. FPGA Firmware: Version number of the firmware running on the laser controller FPGA.
- Ref. FPGA Firmware: Version number of the firmware running on the reference channel FPGA.

2 Diagnostics Values	You can use this function to display internal diagnostic values. These may be of interest when assessing faults or for adjustment operations. The absolute transmission is expressed in arbitrary units. The relative transmission is expressed as a percentage of the nominal value. The temperature and pressure reflect the measured or set conditions at the measurement point, and the measuring path the effective length of the path.

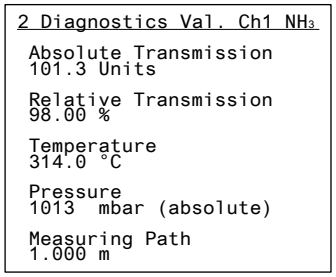
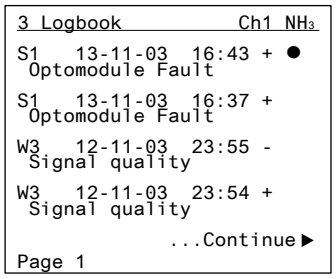


Table 4- 4

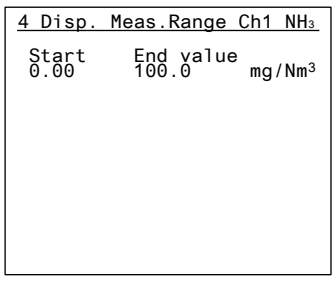
3 Logbook	You can use this function to display logged messages. Any event which leads to a maintenance request (**W**) or fault message (**S**) is listed in the logbook (for a more detailed description of error handling see the chapter Alarms. Limit alarms (**LIM**), transmission alarms (**TR**), and function check (**CTRL**) are also recorded. However, these do not trigger a maintenance request or fault message. The soft key can be used to acknowledge the respective fault entry. The dot will then disappear. A "+" sign at the end of the entry means an activated alarm, a "-" sign an inactivated alarm. The logbook contains a maximum of ten pages, each of which can accommodate four messages. It operates according to the principle of a circulating buffer, i.e. the oldest message is overwritten when all ten pages are full (40 messages). Fault messages are not deleted if they have not been acknowledged. The logbook entries can be deleted or blocked (function 60), or also switched off individually (function 88).



Note

If a fault occurs when the error message is switched off by function 88, there is no reaction at the interface. This applies to the analog as well as to the relay outputs.

4 Display Measuring Ranges	You can use this function to display measuring ranges. However, you cannot use this menu to modify the measuring ranges. To do so use function 41. The follwoing parameters are displayed. Start Value This value corresponds to a 4mA current on the analog output. End Value This value corresponds to a 20mA current on the analog output.



See also

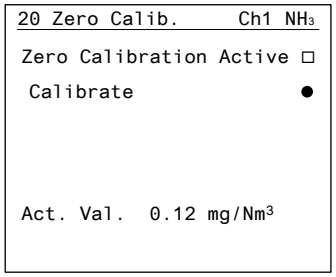
Alarms (Page 65)

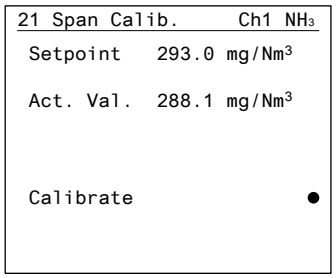
4.3.3 Calibration

The LDS 6 is calibrated when delivered and does not normally require on site recalibration. Please consult Siemens support if recalibration is needed.

CAUTION
Never use functions 20 and 21 without having contacted Siemens service staff first. Inappropriate use of these functions may seriously affect the accuracy of the analyzer.

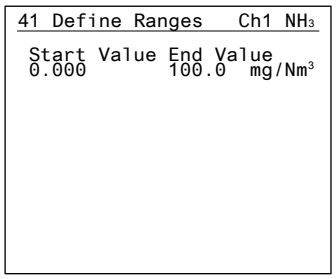
Access to the calibration functions requires access code 3.

20 Zero Calibration 	You can use this function to calibrate the zero of a measuring range. When zero calibration is triggered the current measurement value is stored. This value will thereafter always be subtracted from the measurement signal. Only start the calibration, when the measured value is stable. The status of the calibration will be shown at the bottom of the screen.

21 Span Calibration 	You can use this function to calibrate the span setpoint of a measuring range. This display lists the setpoint and the current value. The calibration is triggered by pressing the third soft key. The current value is then set to coincide with the set point.

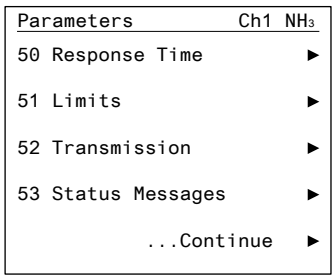
4.3.4 Measuring Ranges

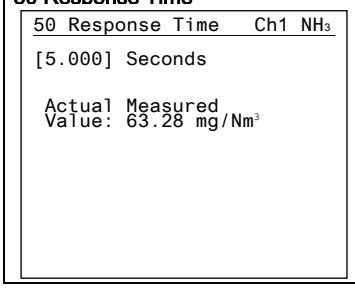
Table 4- 5

41 Define Ranges 	You can use this function to define a measuring range by assigning a start-of-scale value to the bottom value (4 mA) and a full-scale to the top value (20 mA) of the analog output.

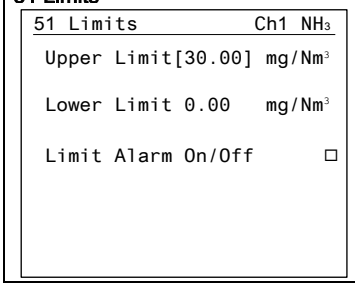
4.3.5 Parameters

Table 4- 6

	This display, showing the selection of the parameter functions 50 to 53 appears following the selection of the parameter functions in the main menu by pressing the fourth soft key ("Parameters"). You can branch to the parameter functions 54 to 60 by pressing the fifth soft key (...Continue).

50 Response Time 	You can use this function to set various time constants to reduce or suppress noise in the measured signal.

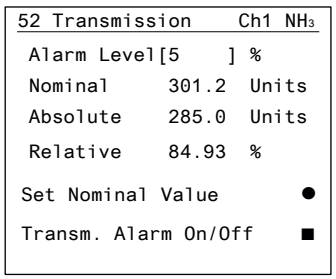
51 Limits



You can use this functions to set concentration limits. A limit alarm will be triggered when the value of a component exceeds the permissible range set in this screen. The alarm can be turned off here.

The limit alarm is displayed on the status line if this has been set up by function 53. The alarm is also signalled by a relay if one has been assigned using function 71. The triggering of a limit alarm is registered in the logbook (function 3).

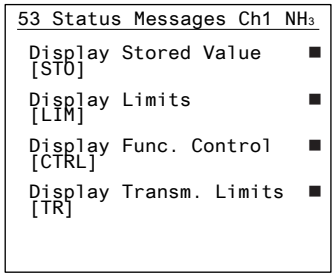
52 Transmission



You can use this function to set the transmission parameters. A transmission alarm is triggered when the transmission is outside a permissible range. The lower alarm level of the transmission for a channel is set as a percentage of the nominal transmission value, where the nominal value is registered when the fourth soft key is pressed. The upper alarm level is set to a fixed value and cannot be changed by the user.

The transmission alarm is displayed on the status line if this has been set up by function 53. The alarm is also signalled by a relay if this has been set up by function 71. The triggering of a transmission alarm is registered in the logbook
(function 3).

53 Status Messages

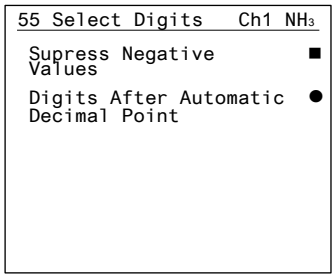


You can use this function to display - within the status line - up to four different statuses which can be assumed by the analyzer.

Table 4- 7 Op. 3

Function	Status
STO: Stored Value	Analog output connected to memory (see also function 77).
LIM: Limit	Upward or downward violation of limit (see also function 51).
CTRL: Function Control	Start-up mode - Service mode.
TR: Transmission	Upward or downward violation of transmission limit (see also function 52).

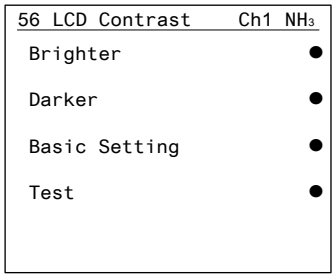
55 Select Digits



You can use this function to select the number of decimal digits. The number of digits, including the decimal point, is always five when setting the function to automatic.

You can also use this function to suppress the output of negative values on the measuring screen.

56 LCD Contrast



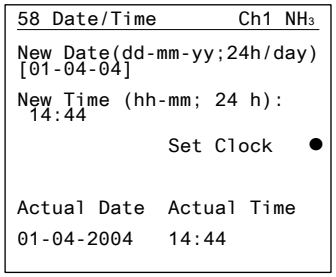
You can use this function to adjust the display contrast.

If the contrast is maladjusted you can re-establish the factory settings by pressing the third soft key ("Basic setting").

If the LCD contrast is extremely maladjusted, and if the analyzer is in measuring mode, you can also re-establish the basic setting by pressing the following key sequence: **8888 ENTER**

In addition you can carry out an LCD test by pressing the fourth soft key ("Test"). Various test patterns are then shown in succession. The test can be stopped by pressing ESC.

58 Date/Time



You can use this function to set the actual date and time.

The analyzer has a system clock which is not protected against power failure (not a real-time clock). The clock is set at 01-01-00 00:00 when the analyzer is started.

This function allows you to exactly set the date and time. This is particularly important when you need to assign a specific point in time to faults stored in the logbook. This can be helpful when troubleshooting.

After selection of this function an editing field appears in which you can enter day, month and year as "New date". Hours (24-hour system) and minutes are entered as "New time".

The set data are imported when you press the third soft key ("Set Clock"). The data then appear as an active display at the bottom of the screen.

Note

Date and time must be reset in case of a power failure.

60 Setup Logbook	You can use this function to delete or lock logbook entries (see also function 3).

60 Setup Logbook Ch1 NH_3

Clear logbook ●

Lock logbook ■

4.3.6 Configuration

All functions of this block are only accessible via the password for level 2 except function 89 -Ethernet On/Off which requires code level 3.

Input Menu	Following selection of the configuration functions in the main menu by pressing the fifth soft key ("...Continue"), you can branch to the further configuration functions.

Configuration Ch1 NH_3

70 Analog Output ►

71 Relay Outputs ►

72 Binary Inputs ►

73 Communication ►

...Continue ►

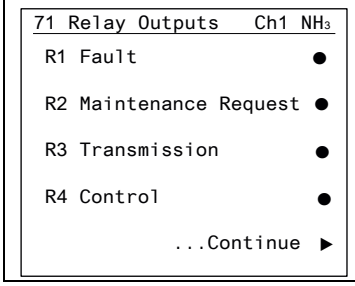
70 Analog Outputs	You can use this function to switch the mode of the analog output between NAMUR and non NAMUR . If the NAMUR mode is chosen in this screen, the lower and upper limits of the analog outputs are 3.8 and 21.5 mA respectively, according to the NAMUR standard. Otherwise the limits are 2 and 21 mA. For both modes function 41 is used to set the limits of the analog output range to 4 mA (start of scale) and 20 mA (full scale). This means that the wider output range permits recording of measured values outside the adjusted output range, but the scaling is identical to the 4 to 20 mA span. If the function "Suppress negative measurement values" is activated, negative measured values are set to the analog output value which corresponds to a measuring value of 0. This analog output value depends on the adjusted measuring range. If negative measured values have an unfavorable effect on further processing, activate this function. The correct measured value is still output in the display.

70 Analog Output Ch1 NH_3

4-20mA (NAMUR) ●

Suppress negative measurement values ■

71 Relay Outputs



You can use this function to configure relay outputs. The basic version contains six freely configurable relays per channel that can be used for signalling (maximum 24 V/1 A). Each relay can be assigned one of the functions listed in Table Op.4. The relay is normally energized and becomes de-energized upon an alarm.

Up to four relays can be configured in one menu. By pressing the fifth (last) soft key ("...Continue") you can switch to further menus - and thus to further relays.

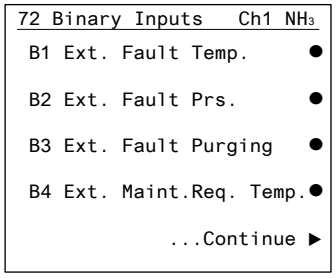
Note

Every change to the configuration of the relay outputs should always be stored in the user data memory using function 75. If this is not done, there is a risk that a previous (undesired) configuration is called when selecting "Load user data".

Table 4- 8 Op.4 Relay Assignments

Function	Remarks
Fault	Signaling for faults specified in Operation chapter.
Maintenance Request	Signaling for Maintenance Requests specified in Operation chapter.
Transmission Limit Alarm (TR)	Upward or downward violation of transmission limit (see also function 52).
Function Control (CTRL)	Signaling when analyzer is in start-up mode or in service mode (coded).
Limit Alarm Primary (LIM)	Upward or downward violation of limit for the primary gas/component (see also function 51).
Limit Alarm Secondary (LIM)	Upward or downward violation of limit for the secondary gas/component - if applicable (see also function 51).
Stored Value (STO)	Relay may be de-energized simultaneously with fault, transmission alarm or function control depending on the configuration of function 77.

72 Binary Inputs



You can freely configure the six floating binary inputs ["0" = 0 V (0...4.5 V); "1" = 24 V (13...33 V)] available in the basic version.

You can assign one of the control functions listed in Table Op. 5 to each input. The binary input should normally be energized. De-energizing the binary input will result in signalling of a fault.

Up to four relays can be configured in one menu. Switching to further menus - and thus to further relays - is always carried out by pressing the fifth (last) soft key ("...Continue").

Note

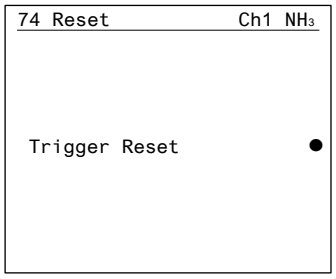
Every change to the configuration of the binary inputs should always be stored in the user data memory using function 75. If this is not done, there is a risk that a previous (undesired) configuration is called when selecting "Load user data".

Table 4- 9 Op.5 Binary Input Assignments

Function	Remarks
External Fault Temperature	Binary input should be de-energized upon fault signal from temperature transducer.
External Fault Pressure	Binary input should be de-energized upon fault signal from pressure transducer.
External Fault Purging	Binary input should be de-energized upon fault signal from purging equipment.
External Fault General	Binary input should be de-energized upon fault signal from unspecified equipment.
External Maintenance Request Temperature	Binary input should be de-energized upon maintenance request signal from temperature transducer.
External Maintenance Request Pressure	Binary input should be de-energized upon maintenance request signal from pressure transducer.
External Maintenance Request Purging	Binary input should be de-energized upon maintenance request signal from purging equipment.
External Maintenance Request General	Binary input should be de-energized upon fault maintenance request from unspecified equipment.

73 Communication	
73 Communication Ch1 NH_3 IP Address Type] :Static: Static IP Address :123.456.789.012: Static Subnet Mask :255.255.255. 0: Static Gateway :123.456.789.012: LDSComm Port Number :5100:	You can use this function to set communication parameters. This function should only be accessed by service personnel.

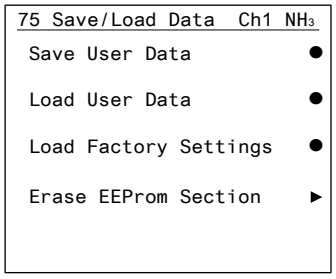
74 Reset



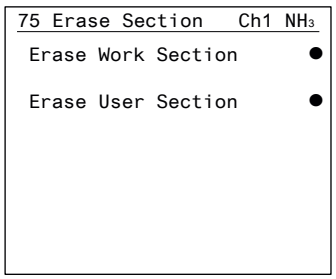
You can use this function to carry out a cold restart of the analyzer, i.e. in case of a fault in program execution.

You must wait for the start-up time to elapse, before trying to use the display. The analyzer will automatically start to measure and will be ready for use after 1 to 3 minutes.

75 Save/Load Data



You can use this function to save or load user-specific data in the user data memory on the EEPROM. Saving of data should always be carried out after a successful starting-up of the system. All individual settings are then saved and can be recalled if necessary (load user data). This is significant if repairs or maintenance are to be carried out on an analyzer or if new parameter settings are to be tried.



You can use this function to erase the working area data and the user data on the EEPROM. The factory data can never be erased.

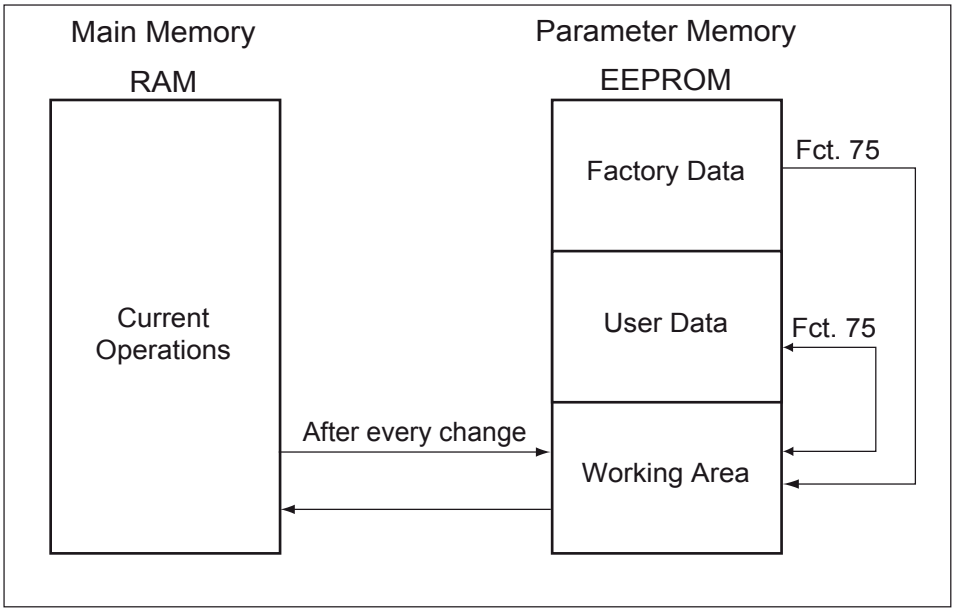


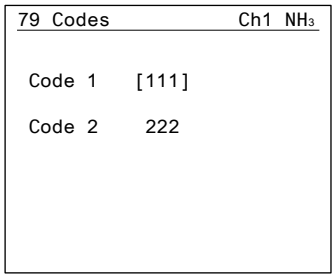
Figure 4-3 A summary of the interactions between RAM and EEPROM.

The basic status of the analyzer (factory settings) can be reestablished using the function "Load Factory Settings" (function 75).

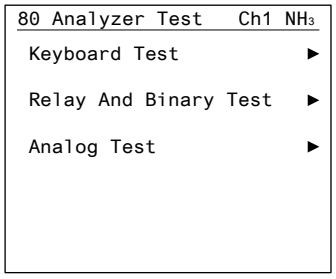
77 Store Analog Output 77 Store Ch1 NH_3 Store Fault ▶ Store Transmission ▶ Store Function Control ▶ Store Trans. Pending ▶ Default: [0.00] ppm	You can use this function to define the response of the analog output with certain alarms. The response for fault (**S**), transmission alarm (**TR**), for start-up, function control (**CTRL**) and transmission pending can be defined independently.

77 Store Fault Ch1 NH_3 Analog Output To: 3/1 mA●	You can use this function to set to one of the following modes: - default. This value has been set in the previous screen. - the latest measured value before the error occured - 3/1 mA. (3 mA if the NAMUR mode is active for the analog output in screen 70, and 1 mA otherwise) - off. This setting is used to ignore the current fault state for this error group. The analyzer continues to show the latest measured value. Use soft key 1 to switch between the different modes. When an alarm occurs and the analog output is set to the latest measured value or 3/1 mA, the display of the concentration value in the measuring screen will be suppressed.

79 Codes Input Levels	You can use this function to replace the factory-set codes ("111" for level 1 and "222" for level 2) with your own values. The value "000" disables all code settings and grants unrestricted access to the corresponding access level.



80 Analyzer Test	You can use this function to test some output functions of the analyzer. The analyzer test comprises: • Keyboard test – Analyzer-specific • Relay and binary test – Channel-specific • Analog test – Channel-specific



Keyboard Test

The keyboard test can be used to check various keys on the input panel. Pressing one of the five soft keys at the right margin will make the associated point disappear or appear. When the digit keys and the sign key are pressed, the corresponding digit is stored in the editing field in the bottom line of the display.

A message will be displayed in plain text as you press the INFO key; the MEAS and ESC keys retain their return functions.

Relay and Binary Test

Note

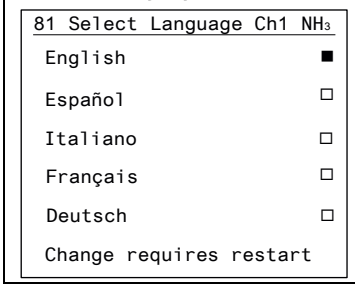
Before performing analog or binary I/O tests remove all data connectors.

The first display shows 6 of the relay and binary channels. Individual relays can be activated using the relay test. This is carried out by using the input field. A "1" activates the relay, a "0" releases it to the de-energized state. Digits other than 0 and 1 are not accepted by the input field. After leaving function 80, the relays reassume their former status, prior to selection of the relay and binary test. The column "Binary" shows the current status of the binary inputs in this display.

Analog Test

The analog test can be used to parameter the analog output with a constant current of 0 - 24 mA for test purposes. The analog input permanently shows the input currents in mA.

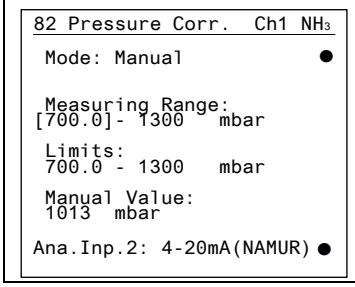
81 Select Language



You can use this function to switch the analyzer to a different dialog language. The new language will be effective in all screens only after having performed the following sequence:

1. Press the 'MEAS' key
2. Answer 'YES' in the following display
3. Restart the analyzer

82 Pressure Correction



You can use this function to select one of the following:

- Correction for pressure using an internal pressure sensor in the central unit;
- Correction for pressure using an external pressure sensor via analog input 2;
- Correction for pressure using a manual pressure value (example as shown on the adjacent display).

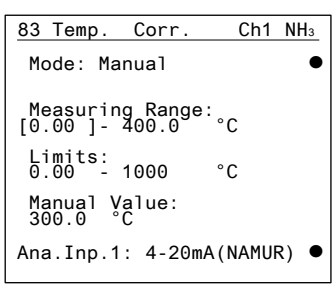
The pressure values are entered as absolute pressure values. The selected measuring range always corresponds to the analog input signal range of 4-20 mA. No other input signals can be used. If the pressure sensor is configured according to the NAMUR standard, the NAMUR mode should be selected for the analog input signal. In that case only input signals within the range of 3.8 - 21.5 mA are accepted. If the NAMUR mode is not selected, input signals within the range of 2 - 21 mA are accepted.

The limits normally mark the span in which pressure compensation is possible. If the pressure signal exceeds the specified limits, this will be signalled as a maintenance request.

The parameters for the pressure correction in the corresponding factory function are component-specific. Selection of the pressure mode in function 82 is channel-specific.

The pressure correction can be switched off.

83 Temperature Correction



You can use this function to select one of the following:

- Correction for temperature using an external temperature sensor via analog input 1 (example as shown on the adjacent display);
- Correction for temperature using a manual temperature value;
- Correction for temperature using the internally calculated process temperature. This is only possible if the LDS 6 is set up to measure the temperature of the measuring point.

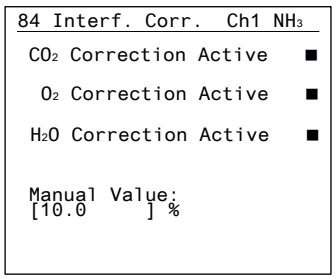
The selected measuring range corresponds to the analog input signal range of 4-20 mA. No other input signals can be used. If the temperature sensor is configured according to the NAMUR standard, the NAMUR mode should be selected for the analog input signal. In that case only input signals within the range of 3.8 - 20 mA are accepted. If the NAMUR mode is not selected, input signals within the range of 2 - 21 mA are accepted.

The limits normally mark the span in which temperature compensation is possible. If the temperature signal exceeds the specified limits, this will be signalled as a maintenance request.

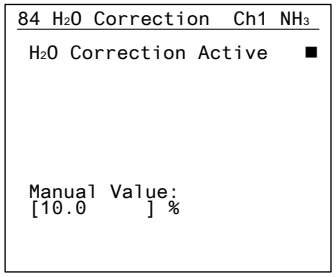
The parameters for the temperature correction in the corresponding factory function are component-specific. Selection of the temperature mode in function 83 is channel-specific.

The temperature correction can be switched off.

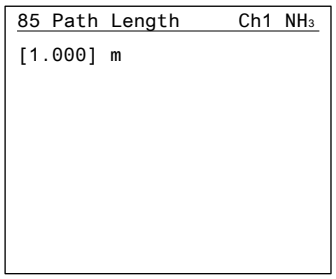
84 Interference Correction	You can use this function to activate or deactivate correction of cross interference from other gases. The gases that require corrective measures depend on the application and only the appropriate ones are visible in screen 84. The function should be turned off when calibrating dry gas. If the gas is not calculated by the instrument itself, a gas concentration value should be entered manually. This value should be the typical or average concentration of the interfering gas.



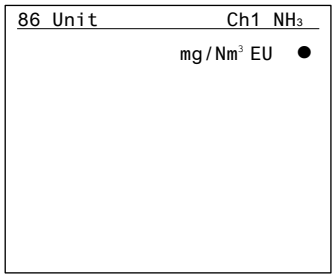
84 H2O Correction	You can use this function for applications where a water correction is indicated. If the water concentration is not measured by the instrument itself, a water concentration value can be entered manually, otherwise this function is blocked. In applications without water compensation, the function 84 is not accessible.



85 Path Length	You can use this function to set the length of the measuring path for the specific channel. Please refer to the sensor manual for more information on measuring the path length.

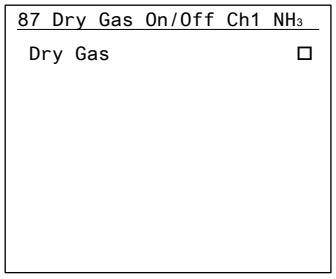


86 Measurement Unit



You can use this function to set the unit for a specific. Possible concentration units are: ppm, % (vol), mg/Nm³ EU or mg/Nm³ US (American standard component), possible temperature units are: °C, °F or K.

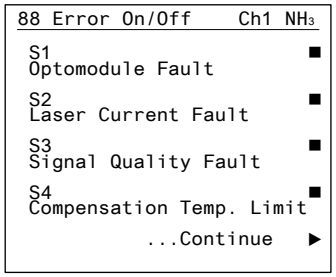
87 Dry Gas On/Off



You can use this function to display the dry value of a concentration following the subtraction of the water volume from the total volume of a gas.

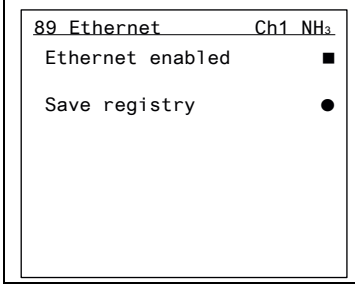
Activation of this function is available for both applications where water vapor is calculated internally in LDS 6 and applications where water vapor is set manually. If this function is available in the current LDS 6, it can be activated in the adjacent display, otherwise it is not possible to access function 87.

88 Error On/Off



You can use this function to individually switch off the indication of maintenance requests and faults so that neither an entry in the logbook, nor a status signal or external signal will take place.

89 Ethernet Chip On/Off



You can use this function to enable or disable a communication via ethernet. This action requires code level 3 and the setting must be saved to the registry to make it persistent.

See also

Maintenance Request Alarm (Page 67)

4.4 Watch Dog

In the unlikely event that the software in LDS 6 should crash it will reboot with the help of a watch dog. The instrument will be down for approximately 3 minutes if this should happen and then measure normally again. It is very unusual that this should happen but if it does the watchdog prevents the system from going down and stay down.

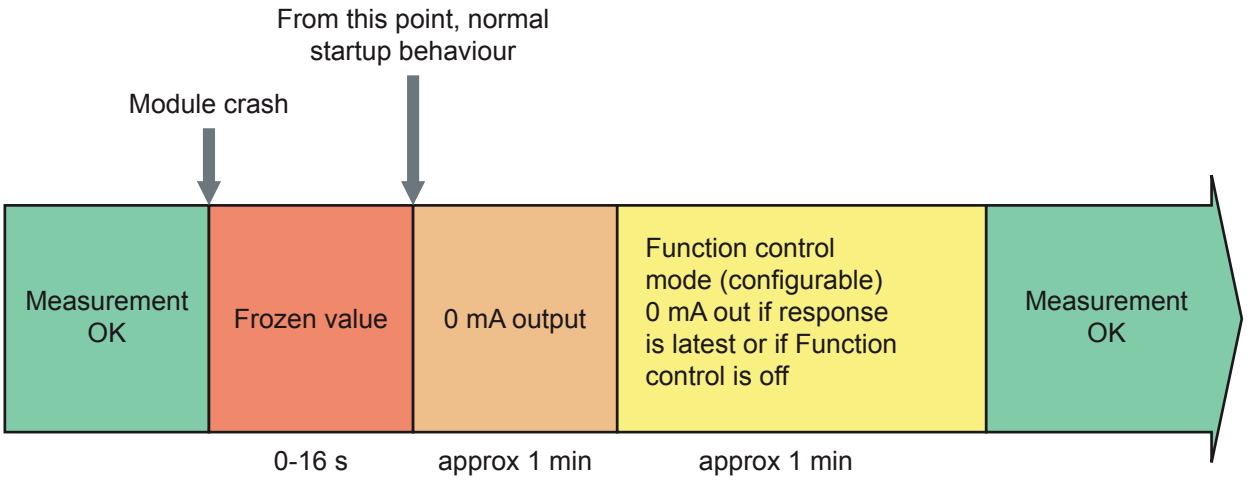


Figure 4-4 Illustration of the events during a software crash.

Alarms

5

5.1 Alarm Response

LDS 6 is able to recognize and alarm for irregularities in its functions. There are five types of alarms that can be triggered depending on the nature of the error:

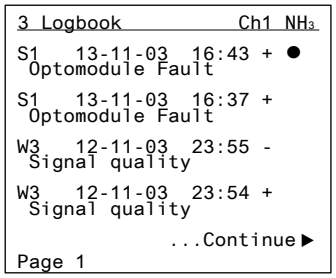
- Maintenance request alarm
- Faults alarm
- Transmission alarm
- Limit alarm
- Function control alarm

Status Row

When the alarms limit (**LIM**), transmission limit (**TR**) or function control (**CTRL**) occur, their corresponding square symbol in the status row will be lit (if this has been set up in function 53). If a Maintenance request or a Fault is triggered the text "Maintenance request" or "Fault" will appear on the status line. This message is output alternately with the status messages. "**STO**" and "**CODE**" may also appear in the status line, but these are not signaling for alarms (see the chapter "Operation").

Table 5- 1

Logbook	At the same time that an alarm is activated (marked with a "+" sign) and inactivated (marked with a "-" sign) a new message will appears in the logbook (function 3). The message will also show the time when it was recorded in the logbook together with a short text describing the alarm.



Faults are considered to be more severe than other alarms and are therefore treated somewhat different in the logbook. When a fault message first appears in the logbook it is marked with a filled circle to the right. To inactivate the fault alarm the fault message must be acknowledged by pressing the soft key next to it. This also removes the circle. The text in the status line as well as the response by functions 71 and 77 will not change until the fault message has been acknowledged. If the cause that triggered the fault alarm has not been corrected, a new message will appear directly as soon as the first fault message is acknowledged.

Every time a new message occurs, the report stored in the logbook is shifted by one memory location. A total of 40 locations are available, and the oldest of the 40 reports is deleted when a new one occurs. A power failure will delete all reports.

Function 60 can be used to switch off the logbook and also to delete the messages stored in it.

The output of messages can become inconvenient particularly during test runs. Therefore this function can be switched off using function 88. It is not recommended to use this facility during normal operation.

Relays

If the relay outputs of the analyzer have been configured accordingly, it is possible to output a signal when an alarm occurs.

Stored Value

The analog output can be set to the last measured value or to 3 mA when an alarm occurs (function 77). This response signal is only possible for "Fault alarm", "Transmission alarm", "Transmission pending" and "Function control alarm".

See also

Configuration (Page 55)

5.2 Maintenance Request Alarm

A "Maintenance request" alarm is set when a modification of the analyzer is needed. The measuring ability of the analyzer may not be affected during the time this alarm is active. However, to guarantee reliable measurement in the future, it may be necessary to carry out corrective measures.

The following table shows the different alarm messages signaling for maintenance request that can appear in the logbook. These can be individually deactivated using function 88.

Table 5- 2 Alarm messages

No.	Error Message	Possible Causes	Action
W1	Opto module	Laser damage. Leaking reference cell. Reference cell displacement. Electronics damage.	Contact service.
W2	Laser current	Change of laser current due to aging of laser.	Contact service.
W3	External maintenance request	Maintenance request from outside.	Check external equipment.
W4	Set clock	LDS 6 has been switched off.	Set date and time.
W5	Ambient Analyzer	Ambient temperature or pressure is beyond limits specified in technical data.	Make sure that the ambient temperature ranges between 5 °C - 45 °C and the ambient pressure corresponds to a place below 2000 m above the sea level.
W6	Ambient Channel	Ambient temperature is outside limits specified in technical data.	Make sure that the ambient temperature ranges between 5 °C - 45 °C.
W7	Analog Out	Error in calibration of analog output.	Re-calibration is necessary. Contact service.
W8	Error Handler Analyzer	Internal error log is full.	Contact service.
W9	Error Handler Channel	Internal error log is full.	Contact service.
W10	Data Flow Analyzer	Electronics failure in internal communication.	Contact service.
W11	Data Flow Channel	Electronics failure in internal communication.	Contact service.
W12	Compensation Temperature Limit	External temperature signal is outside the limits.	Check signal. Make sure that the temperature is within the limits specified in function 83.
W13	Compensation Pressure Limit	External pressure signal is outside the limits.	Check signal. Make sure that the pressure is within the limits specified in function 82.

5.3 Faults Alarm

Any faults in the hardware that makes the analyzer unable to carry out measurements, result in a "fault alarm". The measured value flashes, and then it is always necessary to take corrective measures.

The faults listed in the following table lead to a fault alarm message in the logbook. These can be individually deactivated by using function 88.

Table 5- 3 Fault alarm messages

No.	Error Message	Possible Causes	Action
S1	Opto module	Laser damage. Leaking reference cell. Reference cell displacement. Electronics damage.	Contact service.
S2	Laser Current	Change of laser current due to ageing of laser.	Contact service.
S3	Signal Quality	Signal amplitude too high due to high component concentration.	Contact service.
		Signal amplitude too low when measuring temperature.	Contact service.
S6	External Fault	External signaling.	Check external equipment.
S7	Supply Voltage Channel	Internal power failure.	Contact service.
S8	Supply Voltage Analyzer	Internal power failure.	Contact service.
S9	Serial EEProm	Internal EEProm failure.	Contact service.
S11	FPGA Channel	Electronics failure in data acquisition unit.	Contact service.
S12	CAN Analyzer	Electronics failure in internal communication.	Contact service.
S13	CAN Channel	Electronics failure in internal communication.	Contact service.
S14	Data Flow Analyzer	Electronics failure in internal communication.	Contact service.

5.4 Transmission Alarm

The alarm (TR) appears either if the transmission falls below a limit defined by function 52 or if it exceeds a fixed limit. The following table shows the possible reasons that can set it:

Table 5- 4 Transmission Alarms

Possible Causes	Action
Dirty windows.	Clean windows.
Sensors not aligned.	Align sensors.
Purging not working.	Make sure purging is working. Clean purging tubes.
Transmission too high.	Adjust the potentiometer of the detector.

5.5 Limit Alarm

The limit alarm (**LIM**) appears if the signal exceeds the limits set by function 51.

5.6 Function control alarm

The function control (**CTRL**) is activated when the analyzer performs an action during which the measurement value may be incorrect. The triggering of **CTRL** should normally not require an action from the user. The following list shows some possible causes to why **CTRL** is activated:

Possible Causes

- Start-up procedure is active.
- Analyzer is de-coded.
- Analyzer is communicating with external service software.
- Analyzer is shutting down.
- Analyzer is saving data to EEProm or Flash memory.

Maintenance and Service

6

6.1 General about Maintenance and Service

During normal use, the central unit LDS 6 requires no service. The sensor with its optical surfaces will need regular maintenance. Depending on application and purging method, the interval of maintenance may vary from 1 to 12 months.

If the transmission in a channel drops below the level set by the user, the transmission alarm will be activated. The sensor in this channel needs to be serviced by cleaning the wedge windows or realigning the optical path. For details on Maintenance and service of the sensor delivered with your system, please refer to the corresponding sensor manual.

6.2 Cleaning the Central Unit

CAUTION
Always make absolutely sure that no water gets into the unit during cleaning. Failure to do so may result in a breakdown of the unit!

Use only a dry cloth without any cleaning agents. Since the central unit contains optical surfaces great care should be taken when cleaning. Only outer surfaces may be cleaned.

6.3 Cleaning the Wedge Windows

Before the sensors are removed make sure that:

- no purging is active

⚠ WARNING
Steam purging Particularly when using steam for purging it is absolutely mandatory to turn it off since overheated steam is not visible! Failure do do so may result in severe burn damages!

- No hazardous or hot gases can escape from the process.
- Appropriate protection against hot surfaces on and around the sensor is used.

To clean the wedge windows proceed as follows:

1. Release the lock ring closest to the process – use an appropriate tool – and pull the sensor out.
2. Clean the window on the wedge tube. If the optical lens needs cleaning the second lock ring needs to be released. Extra care should be taken since the lens is anti-reflection coated and sensitive to scratches.
3. Clean the optical surface with a soft cloth or window cleaner containing ammonia. Soap water also works fine in many cases. Start at the centre and work with circular movements towards the rim.
4. Remove all dust particles using pressurized air or flushing water.
5. When the sensor is re-installed make sure that the guide pin fits the hole on the purging flange. Screw on the lock ring and tighten it gently with the tool.

If this operation is performed properly, it will not affect the alignment of the sensor.

6.4 Calibration Verification

For ammonia (NH_3) a calibration check of LDS 6 analyzer can be done using a reference cell arrangement containing a mixture of the measurement gas and nitrogen. The unit should be used in conjunction with the 2 meter hybrid cable that is delivered with each calibration verification kit. This calibration check is described in a specific instruction.

6.5 Reconfiguration of Temperature Compensation

Manual to External

1. Starting from "Measuring Window", navigate to the component or channel for which you want to change the compensation mode. Press the soft key for "Configuration". Enter the password for privilege level 2 (the password is factory-set to the value "222", but may have been replaced by a new one). Press "Continue" twice and then select function 83 "Temperature Correction".
2. Press the first soft key to change the text "Manual" to "External Analog In".
3. Set the measuring range to the temperatures that correspond to the analog input signal 4 mA and 20 mA respectively.
4. Set the limits to suitable values. If the temperature signal exceeds the limits a fault will be triggered. Note that the limits cannot be set outside a certain range.
5. Press MEAS to return to measurement screen. Press MEAS again to loose privileges.
6. Hardware connections: Connect the 4-20 mA wires to pins 3 and 11 on the 15 pin trapezoidal plug (D-SUB plug) at the rear. The conductor cross-section should be >0.5 mm^2.
7. The procedure has to be repeated for other channels. It is not necessary to repeat it for more than one component per channel since it is a channel specific function.

External to Manual

1. Starting from "Measuring Window", navigate to the component or channel for which you want to change the compensation mode. Press the soft key for "Configuration". Enter the password for privilege level 2 (the password is factory-set to the value "222", but may have been replaced by a new one). Press "Continue" twice and then select function 83 "Temperature Correction".
2. Press the first soft key to change the text "External Analog In" to "Manual".
3. Set the manual value to the preferred value.
4. Press MEAS to return to measurement screen. Press MEAS again to loose privileges.
5. The procedure has to be repeated for other channels. It is not necessary to repeat it for more than one component per channel since it is a channel specific function.

6.6 Reconfiguration of Pressure Compensation

Manual to External

1. Starting from "Measuring Window", navigate to the component or channel for which you want to change the compensation mode. Press the soft key for "Configuration". Enter the password for privilege level 2 (the password is factory-set to the value "222", but may have been replaced by a new one). Press "Continue" twice and then select function 82 "Pressure Correction".
2. Press the first soft key to change the text "Manual " to "External Analog In".
3. Set the measuring range to the pressures that correspond to the analog input signal 4 mA and 20 mA respectively.
4. Set the limits to suitable values. If the temperature signal exceeds the limits a fault will be triggered. Note that the limits cannot be set outside a certain range.
5. Press MEAS to return to measurement screen. Press MEAS again to loose privileges.
6. Hardware connections: Connect the 4-20 mA wires to pin 4 and 12 on the 15 pin trapezoidal plug (D-SUB plug) at the rear. The conductor cross-section should be >0.5 mm^2.
7. The procedure has to be repeated for other channels. It is not necessary to repeat it for more than one component per channel since it is a channel specific function.

External to Manual

1. Starting from "Measuring Window", navigate to the component or channel for which you want to change the compensation mode. Press the soft key for "Configuration". Enter the password for privilege level 2 (the password is factory-set to the value "222", but may have been replaced by a new one). Press "Continue" twice and then select function 82 "Pressure Correction".
2. Press the first soft key to change the text "External Analog In" to "Manual".
3. Set the manual value to the preferred value.
4. Press MEAS to return to measurement screen. Press MEAS again to loose privileges.
5. The procedure has to be repeated for other channels. It is not necessary to repeat it for more than one component per channel since it is a channel specific function.

6.7 Reconfiguration of the Path Length

1. Starting from "Measuring window", press the soft key next to the component for which you want to change the path length. Press the soft key for "Configuration". Enter the password for privilege level 2 (the password is factory-set to the value "222", but may have been replaced by a new one). Press "Continue" twice and then select function 84 "Path Length".
2. Press first soft key to edit the path length. Enter the new path length and press ENTER.
3. Press MEAS to return to measurement screen. Press MEAS again to loose privileges.
4. The procedure has to be repeated for other channels. It is not necessary to repeat the procedure for more than one component per channel since this function is a channel-specific function.

Spare Parts List

7

7.1 Compatibility of detectors with central units

For all gases except O_2, LDS6 exists in two versions as a consequence of a major upgrade. Three of the LDS6 spare parts are affected by the change and will consequently exist in two different versions. The "Sensor electronic" spare parts consist of one detector and one detector PCB (A5E00681433) respectively. The PCB is not affected by the modification but the detector is different. This spare parts list corresponds to the technical state of February 2009.

7.1.1 Detector Labels

The detector A5E-number indicates if a sensor is to be used with a Version 2 central unit. Besides the example in the following picture also A5E1033996 (HCl) and A5E1030124 (CD 6C) are used with version 2.

The detector revision number (e.g. ES01) is only important if selecting a spare part that has been stored for some time. To avoid degraded performance, do not use a spare part with a lower revision number to replace a detector with higher revision number.

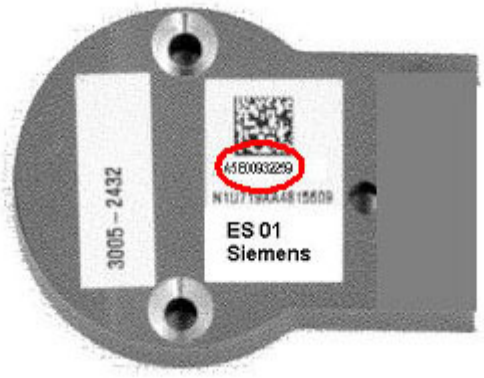


Figure 7-1 Labeling on the detector unit

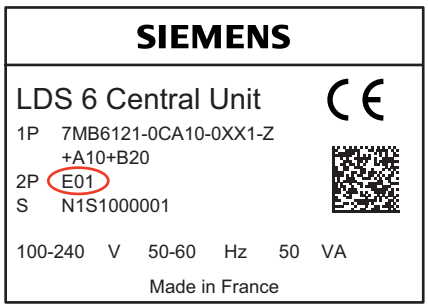
See also

Spare Parts Lists (Page 79)

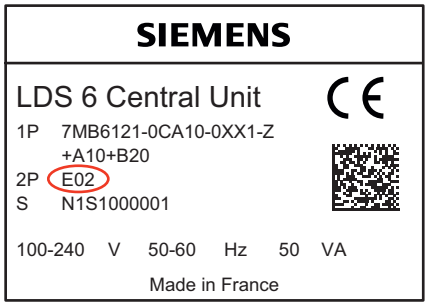
7.1.2 Central Unit Labels

Starting February 2009 all version 1 units with MLFB number 7MB6121- (Made in France) are labelled 'E04'.

Former version 1 units with MLFB number 7MB6121- (Made in France) are labeled "E01":



All Version 2 units with MLFB number 7MB6121- (Made in France) are labeled "E02" or higher:



Almost all units with MLFB number 7MB6021- (Made in Sweden) were delivered as Version 1. Only a few of these have been delivered with version 2 electronics. There is no label indicating this exception but it applies to the following serial numbers:

LRN/U9 000011
LRN/U9 000013
LRN/U9 000014
LRN/U9 000016
LRN/U9 000017
LRN/U0 000001
LRN/U0 000002
LRN/U0 000005
LRN/U0 000007
LRN/U0 000008
LRN/U0 000010
LRN/U0 000014
LRN/U0 000015
LRN/U0 000016
LRN/U0 000017
LRN/U0 000018
LRN/UD 000002

7.2 Spare Parts Lists

All spare parts are identified by an order number. For example the order number **A5E00854188** corresponds to a 3 channel external power supply.

Table 7- 1 Spare parts central unit

Product description	Order no.
LDS 6, CU_PCB1 w. CAC_PCB (spare part), software < R20	A5E00928615
LDS 6, CU_PCB1 w. CAC, software R20 or higher	A5E00338478
LDS 6, CU_PCB2 (spare part), software < R20	A5E00928875
LDS 6, CU_PCB2, software R20 or higher	A5E00338485
LDS 6, CU_PCB2 for ATEX, software R20 or higher	A5E00902930
LDS 6, CU_PCB2 for ATEX, software < R20	A5E00980288
LDS 6, Front plate with display	A5E00290645
LDS 6, Power supply for central unit	A5E00290646
LDS 6, Fuse for central unit 100 - 240 V, T2.5L250V	A5E00854185
LDS 6, 3 Channel external power supply	A5E00854188
LDS 6, Fuse for external power supply 100 - 240 V, T1.25L250V	A5E00854190
LDS 6, D-sub 15pin with cable entry	A5E00338618
LDS 6, D-sub 25pin with cable entry	A5E00338622

Table 7- 2 Spare parts cables

Product description	Order no.
Standard hybrid cable LW 5 m	A5E00818626001
Standard hybrid cable LW 10 m	A5E00818626002
Standard hybrid cable LW 25 m	A5E00818626003
Standard hybrid cable LW 40 m	A5E00818626004
Standard hybrid cable LW 50 m	A5E00818626005
Standard hybrid cable SW 5 m	A5E00818619001
Standard hybrid cable SW 10 m	A5E00818619002
Standard hybrid cable SW 25 m	A5E00818619003
Standard hybrid cable SW 40 m	A5E00818619004
Standard hybrid cable SW 50 m	A5E00818619005
Standard loop cable 5 m	A5E00818640001
Standard loop cable 10 m	A5E00818640002
Standard loop cable 25 m	A5E00818640003
Hybrid cable SW 2m	A5E00814073
Hybrid cable LW 2m	A5E00814171
Hybrid cable LW customized length (please specify length in order)	A5E00856746
Hybrid Cable SW customized length (please specify length in order)	A5E00856745
Loop Cable customized length (please specify length in order)	A5E00856744

Table 7- 3 Spare parts CD 6 sensor

Product description	Order no.
CD 6, Launcher, complete	A5E02359462
CD 6, Filter for air blower	A5E00853935
CD 6, Window module, quartz	A5E00338487
CD 6, Window module engine, no purging	A5E00338490
CD 6, Purging tube 400mm, sintered filter	A5E00858612
CD 6, Purging tube 400mm air blower adapter	A5E00858615
CD 6, Purging tube 800mm, sintered filter	A5E00858611
CD 6, Purging tube 800mm, air blower adapter	A5E00858614
CD 6, Purging tube 1200mm, sintered filter	A5E00338496
CD 6, Purging tube 1200mm, air blower adapter	A5E00858580
CD 6, Sensor box transmitter LW	A5E00902914
CD 6, Sensor box transmitter SW	A5E00902916
CD 6, Sensor box receiver SW	A5E00902917
CD 6, Sensor box receiver LW	A5E00902918
CD 6, High pressure with flange, 1.4404 stainless steel, DN65/PN6	A5E00534662
CD 6, High pressure with flange, 1.4404 stainless steel, DN80/PN16	A5E00534663
CD 6, High pressure with flange, 1.4404 stainless steel, ANSI 4"	A5E00534664
CD 6, Air blower 115 V	A5E00829150
CD 6, Air blower 230 V	A5E00829151
CD 6, Alignment kit	A5E00253142
CD 6, Entry seal for sensor	A5E00853911

Table 7- 4 Spare parts CD 6C sensor

Product description	Order no.
CD 6C, Sensor box transmitter	A5E00854163
CD 6C, Sensor box receiver	A5E00905117
CD 6C, High pressure window DN80/PN16	A5E00534671
CD 6C, Alignment kit	A5E00534673

Table 7- 5 Spare parts sensors electronics

Product description	Order no.
CD 6, Sensor electronic LW InGaAs (Version 1)	A5E00338540
CD 6, Sensor electronic LW InGaAs NEL (Version 2)	A5E01090409
CD 6, Sensor electronic LW HCl only (Version 1)	A5E00338552
CD 6, Sensor electronic LW HCl only NEL (Version 2)	A5E01090413
CD 6, Sensor electronic SW, O_2 only	A5E00338533
CD 6C and FT 6, Sensor electronic lppm H_2O (Version 1)	A5E00854159
CD 6C and FT 6, Sensor electronic lppm H_2O NEL (Version 2)	A5E01090420
FT 6, Sensor FT 6 electronics	A5E00338540

Please note that three of the LDS 6 sensor electronic spare parts are version-dependent. (The PCBs are not affected but detector electronics are different).

Table 7- 6 Spare parts ATEX

Product description	Order no.
LDS6, Barrier box 1 channel	A5E00902922
LDS6, Barrier box 2 channels	A5E00902926
LDS6, Barrier box 3 channels	A5E00902927
CD 6, Sensor electronic ATEX SW	A5E00338563
CD 6, Sensor electronic ATEX HCl	A5E00853896
CD 6, Sensor electronic ATEX NH_3, CO, CO_2, HF, H_2O	A5E00338572
CD 6C and FT 6, Sensor electronic lppm H_2O ATEX	A5E00924868
Window module, quartz, ATEX CD 3002	A5E00338594
LDS6, Entry seal for barrier box	A5E00979661

See also

List of Abbreviations (Page 95)

7.3 Ordering Instructions

All orders should specify the following:

1. Quantity.
2. Product description.
3. Order number.
4. MLFB number and serial number of the instrument to which the spare part will be used.
5. For sensor electronics, A5E and revision numbers of the detector to be replaced

7.4 Repair/Upgrade

Faulty equipment should be sent to the repair department with details of the fault and its origin. When ordering replacement equipment, please specify the serial number of the original equipment. Your will find the serial number on the rating plate.

Address of the responsible repair location, your contact, list of spare parts etc. can all be found on Internet:

http://www.siemens.com/automation/service&support or
http://www.automation.siemens.com/partner

Technical Data

8

8.1 Central Unit

All critical components are housed in the central unit which can be placed several hundred meters away from the measurement point.

Table 8- 1 Analytical performance
(The exact performance can be obtained from the individual analyzer data sheet)

Analytical performance	
Measuring ranges	Internally adjustable
Detection limit	at 25 °C, 1000 hPa, 1 m path length and ambient air. Calculation based on VDI 2449 with measurement on each supplied analysis device during temperature test (between +5 ... +45 °C) according to VDI 4203
HF	0.1 ppm
HCl	0.6 ppm (0.2 ppm for TÜV/MCerts analyzers)
NH_3	1 000 ppm
H_2O (top measuring range)	1 000 ppm
O_2	1 000 ppm
CO (one component)	300 ppm
CO_2 (one component)	300 ppm
CO/CO_2	600 ppm/1.500 ppm
Smallest recommended measuring range	
HF	0 ... 5 ppm
HCl	0 ... 10 ppm
NH_3	0 ... 10 ppm
H_2O (top measuring range)	0 ... 5 vol %
O_2	0 ... 5 vol. %
CO (one component)	0 ... 1.5 vol. %
CO_2 (one component)	0 ... 1.5 vol. %
CO/CO_2	0 ... 3 vol. % / 0 ... 7.5 vol. %

The maximum applicable measuring ranges can be found in the table of standard combinations. These can only be applied if the individual process conditions allow. We recom mend to contact our Technical Support for checking the applicability.

Table 8- 2 Analytical performance
(The exact performance can be obtained from the individual analyzer data sheet)

Analytical performance (continued)	
Accuracy	2% of the measured value or minimum detection limit (whichever is largest) for: - NH_3 (all versions) - O_2 (not with combination with temperature) - CO (all versions) - CO_2 (all versions) 5% of the measured value or minimum detection limit (whichever is largest) due to calibration gas uncertainties for: - HF (all versions) - HCl (all versions) - H_2O - O_2 (combination with temperature)
Linearity	Better than 1 %
Precision	2 % of the measured value or minimum detection limit (whichever is largest)
Zero point drift	Negligible
Measured-value drift	Negligible
Calibration interval	No calibration required due to internal reference cell

Table 8- 3 General

General	
Concentration units	ppmv, % vol., mg/Nm^3 EU, mg/Nm^3 US
Display	Digital concentration display (5 digits with floating decimal point)
Laser protection class	Class 1, safe to the eye
Certificates	CE marking, TÜV, MCERTS

Table 8- 4 Design

Design, enclosure	
Degree of protection	IP20 to EN 60529
Dimensions	177 x 440 x 380 mm
Weight	Approx. 13 kg
Mounting	horizontal

Table 8- 5 Electrical characteristics

Electrical characteristics	
Power supply	100 ... 240 V AC 50 ... 60 Hz, automatically adapted by the system; with a 3-channel central unit, an additional external power supply +24 V DC, 50 VA is included in the scope of delivery
Power consumption	50 W
EMC	According to EN 61326 and standard classification of NAMUR NE21
Electric safety	According to EN 61010-1, overvoltage classification II
Fuse specifications	100 ... 240 V: T2.5L250V

Table 8- 6 Dynamic response

Dynamic response	
Warm-up time at 20 °C ambient air temperature	Approx. 15 min.
Response time	Better than 3 sec., dependent on application
Integration time	1 ... 100 sec., selectable

Table 8- 7 Influencing variables

Influencing variables	
Ambient temperature of measured value	< 0.5 %/10 K
Atmospheric pressure	Negligible
Gas pressure compensation	Recommended for all gases except O_2/low pressure
Pressure compensation - oxygen, high pressure - CO/CO_2 - all other gases except O_2/low pressure	 0.1 ... 0.5 kPa 0.095 ... 0.14 kPa 0.095 ... 0.105 kPa
Power supply changes	< 1 %/30 V
Tilting	< 1 % for non-horizontal mounting of the central unit < 15°

Table 8- 8 Electrical inputs and outputs

Electrical inputs and outputs	
Number of measurement channels	1 ... 3, optional
Analog outputs	2 per channel, 4 ... 20 mA, floating, ohmic resistance max. 750 Ω
Analog inputs	2 per channel, designed for 4 ... 20 mA
Binary outputs	6 per channel, with changeover contacts, configurable, 24 V AC/DC/1 A, floating
Binary inputs	6 per channel, designed for 24 V, floating, configurable
Communication interface	Ethernet 10BaseT (RJ-45)

Table 8- 9 Climatic conditions

Climatic conditions	
Temperature range - during operation - during transportation and storage	 5 ... 45 °C (41 ... 113 °F) -40 ... +70 °C (-40 ... +158 °F)
Atmospheric pressure	80 ... 110 kPa
Humidity	< 85 % RH, above dew point

8.2 Hybrid and Sensor Cables

Table 8- 10 General

General	
Configuration hybrid cable	Two optical fibers and two twisted copper wires in one cable for 24 V DC. Single-mode optical fiber configured at both ends with E2000 angle connectors. Multimode optical fiber configured at both ends with SMA connectors.
Cable sheath	Oil-resistant polyurethane
Dimensions - Diameter - Length	 < 8 mm, up to 1 000 m for lengths > 500 m, an external power supply must be additionally ordered for installations in Ex zones, non-intrinsically-safe cables have to be spatially separated from intrinsically-safe lines, lengths <600 m
Impact resistance	200 N/cm
Maximum tensile strength	500 N
Minimum bending radius	10 cm

Table 8- 11 Climatic conditions

Climatic conditions	
Ambient temperature	-40 ... +80 °C during operation
Rel. humidity	< 95 % rel. humidity, above dew point

8.3 Purging

Conditions of purging media

As medium nitrogen is permissible for purging the sensor side. Nitrogen, steam, air and gases which are not subject to the pressure equipment directive Cat. 2 are permissible as purging gases for the process side.

Table 8- 12 Purging with air and nitrogen

Purging with instrument air, N2	
Pressure at purging inlet	200 ... 800 kPa
Maximum overpressure in the sensor	< 500 hPa
Quality - Instrument air - Nitrogen	 free of oil and water Purity better than 99.7 %. For oxygen measurements, an O_2 content < 0.01 % is recommended in the purging gas (optical path length ≥ 1 m, min. 5 % oxygen in the process gas)
Maximum flow rate	500 l/min
Dew point	Benchmark: ≤10 °C, condensation on the optics must be avoided

Table 8- 13 Blower purging

Blower purging	
Maximum counter pressure	4 kPa
Maximum flow rate	350 l/min
Power consumption	370 W
Degree of protection (fan)	IP54

Table 8- 14 Steam purging

Steam purging	
Steam conditioning	Overheated
Maximum temperature	240 °C
Minimum pressure	> 400 kPa
Maximum pressure	1 600 kPa, refers to a volume flow of approx. 1 100 l/min

Dimensional Drawings

9

Central unit

The central unit will fit in a standard 19" rack. The dimensions are shown below.

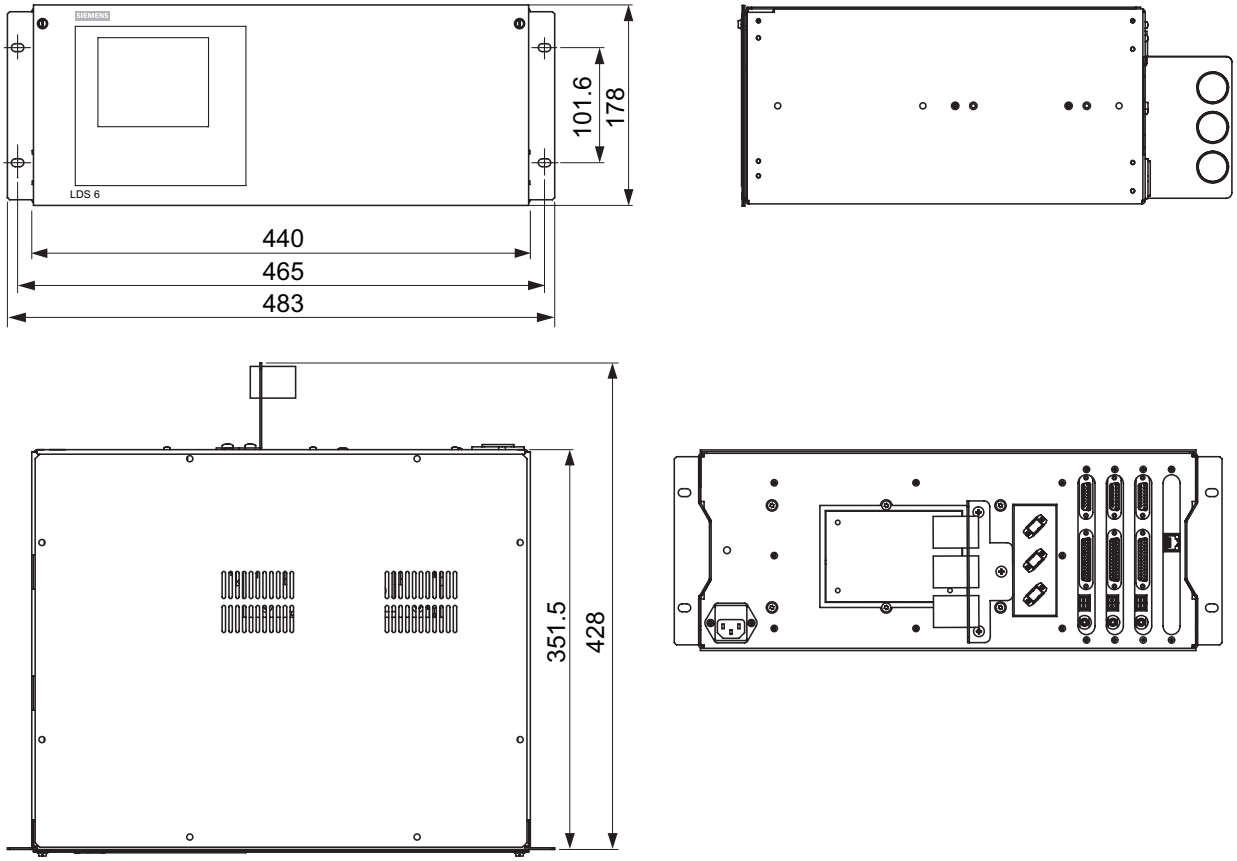


Figure 9-1 Dimensional drawings of the central unit – LDS 6

Connections

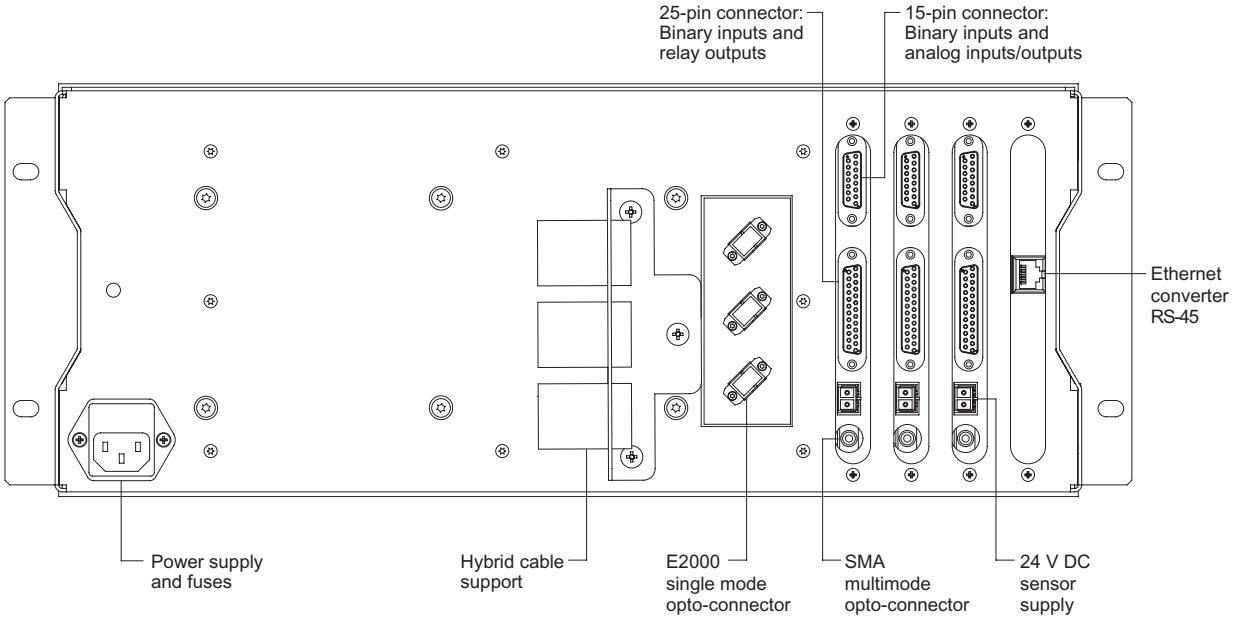


Figure 9-2 LDS 6, three-channel 19" central unit, optical and electrical connections

Pin assignment

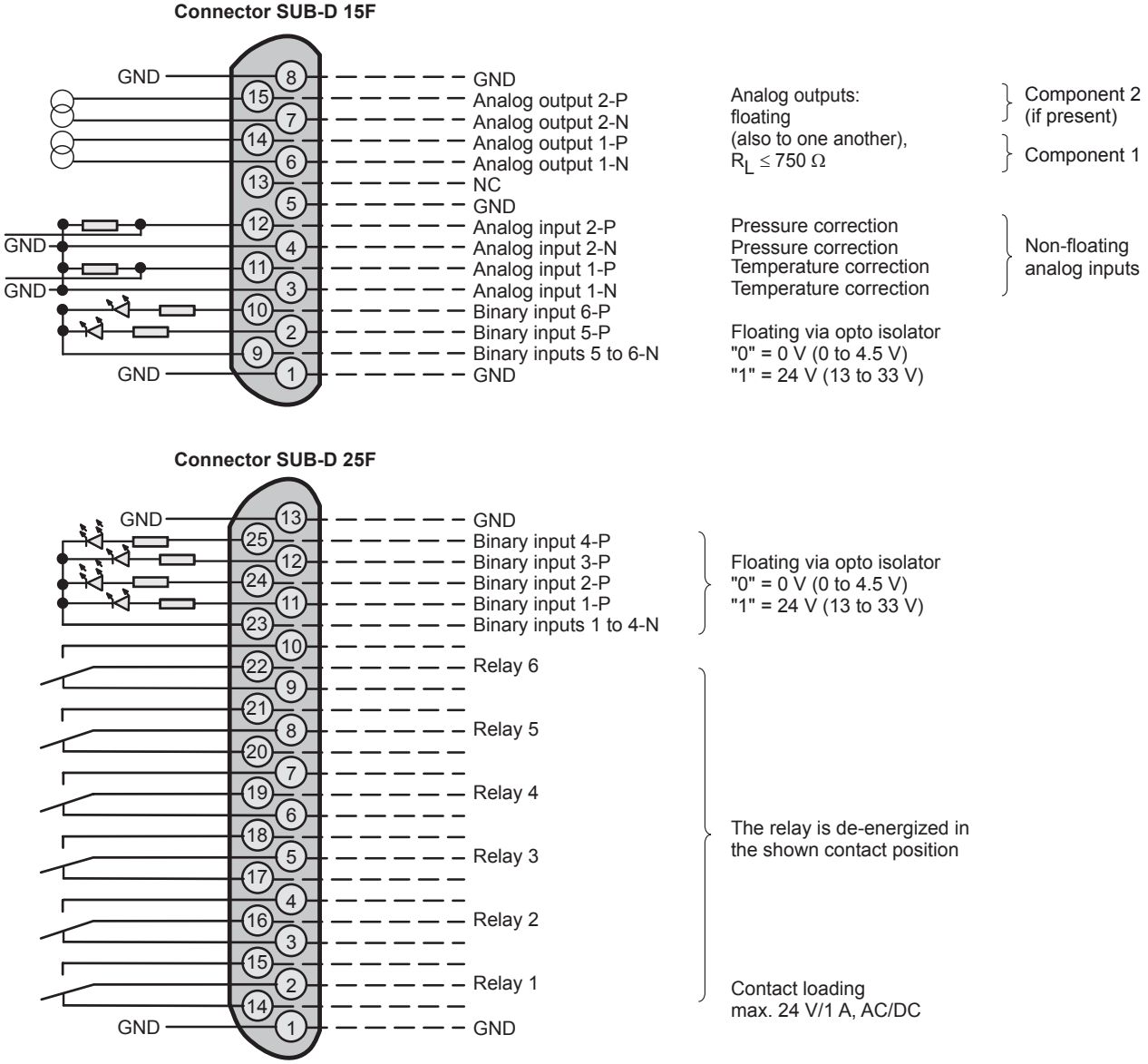


Figure 9-3 Pin assignment of the LDS 6 central unit

ESD guidelines

A

A.1 ESD guidelines

Definition of ESD

All electronic modules are equipped with large-scale integrated ICs or components. Due to their design, these electronic elements are highly sensitive to overvoltage, and thus to any electrostatic discharge.

The electrostatic sensitive components/modules are commonly referred to as ESD devices. This is also the international abbreviation for such devices.

ESD modules are identified by the following symbol:

CAUTION
ESD devices can be destroyed by voltages well below the threshold of human perception. These static voltages develop when you touch a component or electrical connection of a device without having drained the static charges present on your body. The electrostatic discharge current may lead to latent failure of a module, that is, this damage may not be significant immediately, but in operation may cause malfunction.

Electrostatic charging

Anyone who is not connected to the electrical potential of their surroundings can be electrostatically charged.

The figure below shows the maximum electrostatic voltage which may build up on a person coming into contact with the materials indicated. These values correspond to IEC 801-2 specifications.

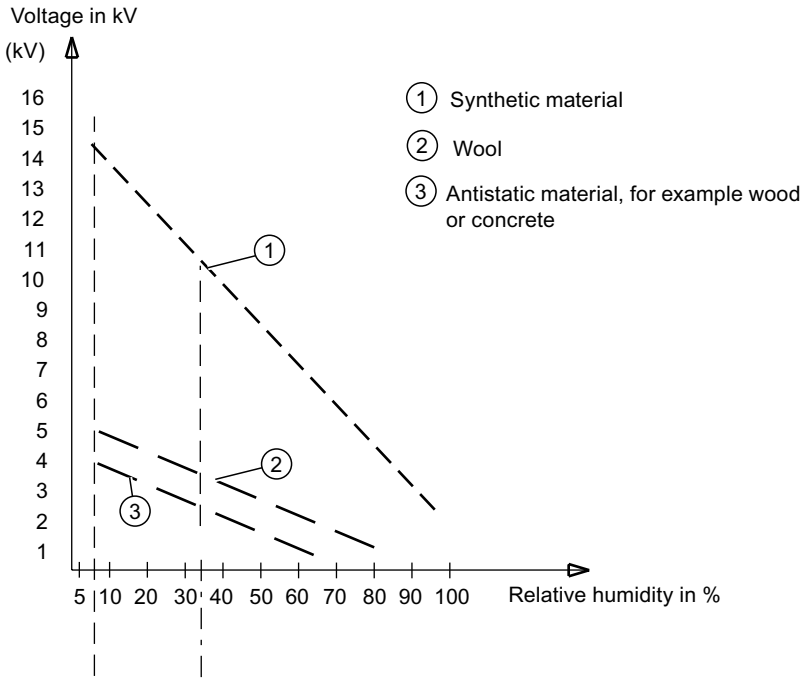


Figure A-1 Electrostatic voltages on an operator

Basic protective measures against electrostatic discharge

- Ensure good equipotential bonding:
  When handling electrostatic sensitive devices, ensure that your body, the workplace and packaging are grounded. This prevents electrostatic charge.
- Avoid direct contact:
  As a general rule, only touch electrostatic sensitive devices when this is unavoidable (e.g. during maintenance work). Handle the modules without touching any chip pins or PCB traces. In this way, the discharged energy can not affect the sensitive devices.

  Discharge your body before you start taking any measurements on a module. Do so by touching grounded metallic parts. Always use grounded measuring instruments.

List of Abbreviations

B

B.1 List of Abbreviations

Abbreviation / symbol	Explanation
″	Inch - 1″ ≙ 25.4 mm
<	Less than
>	Greater than
≤	Less than or equal to
≥	Greater than or equal to
°	Degrees
°C	Degrees Celsius - 1 °C ≙ 1.8 °F
°F	Degrees Fahrenheit - 1 °F ≙ 0.555... °C
AC	Alternating Current
ANSI	American National Standards Institute
ATEX	**AT**mosphères **Ex**plosibles (French for Explosive atmosphères)
CAC	Communication and Analytical Control
cm²	Square centimeters
CO_2	Carbondioxide
CU	Central Unit (of the analyzer)
DC	Direct Current
DN	Diameter nominal
EEPROM	Electrically-Erasable Programmable Read-only Memory
EEx	European Energy Exchange
e.g.	For example
EMC	Electromagnetic compatibility
ESD	Electrostatic Discharge
EU	European Union
Ex	Energy Exchange
FPGA	Field-programmable Gate Array
H_2O	Water
HCl	Hydrogen chloride
HF	Hydrogen fluoride
hPa	Hectopascal
HU	Height unit for computer housings, 1 HU ≙ 1¾" ≙ 44.45 mm
K	Kelvin
kHz	Kilohertz
kΩ	Kiloohms
kPa	Kilopascal

Abbreviation / symbol	Explanation
LAN	Local Area Network
l	Liters
lb	Pound (0.45359237 kilograms)
lbf	Pound-force (≈ 4.448222 Newton)
LCD	Liquid Crystal Display
LD	Laser Diode
LDS	Laser Diode Spectrometer
LDSComm	Laser Diode Spectrometer Communication software
LED	Light Emitting Diode
LVC	Low Voltage Directive
LW	Long Wave Fibre (for oxygen analyzers)
mA	Milliamperes
max.	Maximum
mba, MBA	Start of measuring range
mbar	Millibars
mbe, MBE	End of measuring range
mg	Milligrams
mg/Nm³ EU	Milligrams per dry standard cubic meter (European standard) The concentration is based on the following conditions according to DIN EN 1343: - 0°C ambient temperature - 1 013 hPa barometric pressure
mg/Nm³ US	Milligrams per dry standard cubic meter (US standard) The concentration is based on the following conditions according to SATP: - 25°C ambient temperature - 1 013 hPa barometric pressure
min	Minute, or minimum
ml	Milliliters
MLFB	German for Machine-Readable Product Code
mm	Millimeters
mm²	Square millimeters
MPa	Megapascal
mΩ	Milliohms
MΩ	Megaohms
NAMUR	Standards working committee for measuring and control technology in the chemical industry
NH_3	Ammonia
Nm³	(dry) Standard Cubic meter
O_2	Oxygen
PA	Process Automation
PC	Personal Computer
PCB	Printed Circuit Board
PDM	Process Device Manager

Abbreviation / symbol	Explanation
pF	Picofarad (10^{-12} Farad)
PLC	Programmable Logic Controller
PN	Pressure Nominal
ppm	Parts per million
Pt	Platinum
PTFE	Polytetrafluoroethylene (plastic, commercial name, e.g. Teflon)
QAL	Quality Assurance Level
RAM	Random Access Memory
s	Seconds
SELV	Safety Extra Low Voltage
SMA	Sub-Miniature A, a coaxial connector type
SW	Short Wave Fibre (for oxygen analyzers)
TCP/IP	Transmission Control Protocol/Internet Protocol; a reference model for communication on the Internet
uC	Microcontroller
V	Volts
Vol %	Volume percent
Δ	Difference (delta)
Ω	Ohms

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Siemens AG
Industry Automation (IA)
Sensors and Communication
Process Analytics
76181 KARLSRUHE
DEUTSCHLAND

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