Supplement to the operating instructions for the optional Display and Control unit

LT 1 Lambda Transmitter

LAMBDA TRANSMITTER LT1

Measure

O2 output [vol.%]

20.9

Li 1   Li 2 ↓ Li 3   Li 4

| meas | cal | par | diag |

ENTER

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Measure

O2 output	20.9	vol.%
Abs. press.	980	mbar
Current LS1	467	mA
O2 int. cmp	20.9	vol.%

Li 1   Li 2 ↓   Li 3   Li 4

| meas | cal | par | diag |

Measure

Calibrating

Start auto. calibration
Start auto. check up
Start manual calibration
    with cal.pump
Start manual calibration
    without cal.pump

| exit | | | |

Measure

Display

Contrast
P. 970:   38
Brightness
P. 971:   10
Language
P. 972:   English

| exit | s/l | group- | group+ |

Measure

At present no
faults/warnings

Li 1   Li 2 ↓   Li 3   Li 4

| exit | maint. | | hist |

Sensors and Systems for Combustion Engineering

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Safety notes

The following symbols are used in these operating instructions as important safety notes for the user. They appear within each chapter where the information is required. The safety notes, in particular the warnings, must always be observed and followed.
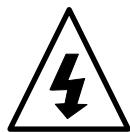
	WARNING **Identifies possible hazards to personnel, especially through electric power.**

	WARNING **Indicates possible hazards to personnel caused by improper handling of system parts.**

	ATTENTION! **Indicates risk to system parts or a possible adverse effect on functions.**

	NOTE: **Contains important additional information for the user about the system or system parts, and offers further tips.**

Appears in texts containing instructions for carrying out an action.

In this context the user is urged to observe the statutory accident prevention measures during all works, and to do everything in accordance with the situation to prevent damage to persons and property.

Contents

1. Introduction

1. Introduction

These operating instructions describe how to use the optional display and control unit for the lambda transmitter LT 1; they do not replace the operating instructions for the LT 1 transmitter.

Fig. 1 shows the display and control unit for the lambda transmitter LT 1.
It consists of an LCD display, the cursor keys, the Enter key and the menu keys.

- The cursor keys serve to select measured values, parameters or functions within the display readout. The keys also position the cursor for Input and for Editing (amendments).

- The Enter key activates the editing mode and confirms and ends

- The menu keys correspond to the menu item shown above them.

In Fig. 1, the menu keys have the following functions, from left to right:
Measurement **[meas]**, Calibration **[cal]**, Parameter setup **[par]**,
Diagnostics **[diag]**.

Fig. 1
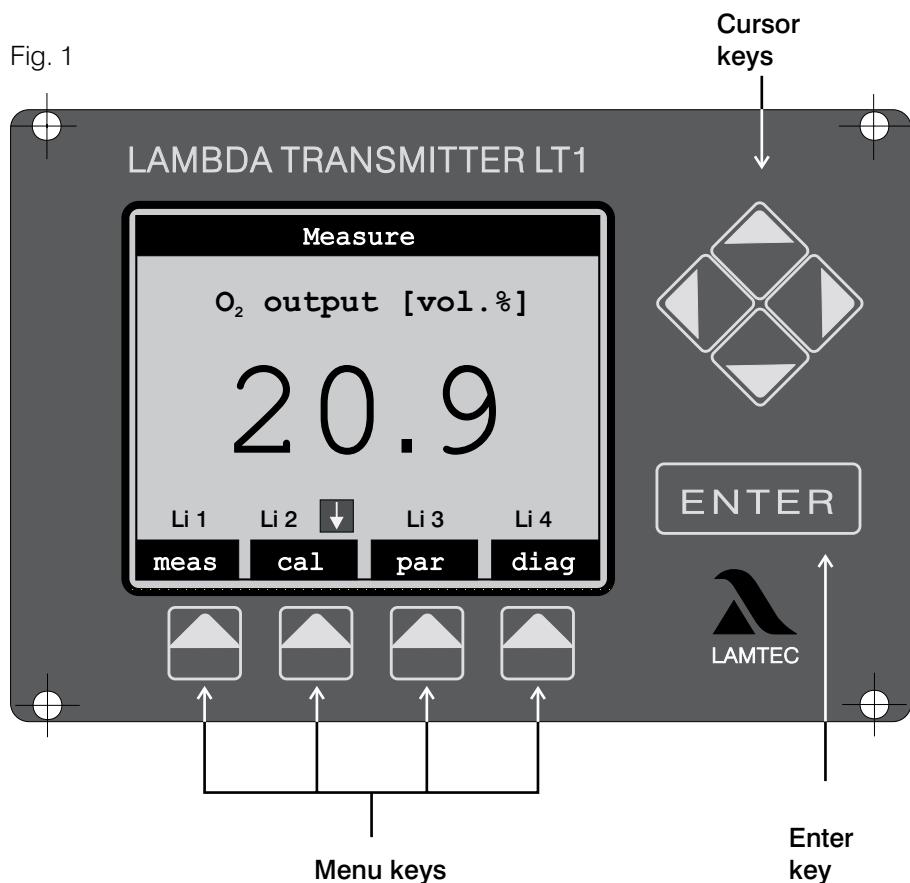
The menu keys are identified by the LT 1 Lambda Transmitter's functions, in abbreviated English form:

measurement, **cal**ibration, **par**ameter setup, **diag**nostics

Note: The limit values are only displayed if they were activated via parameters 930 / 940 / 950 / 960 ("Service" clearance level).

2. Display

2. Display

The display is divided into three areas (Fig. 2):

1. The status row at the top of the display. It shows:

- On the left, whether the maintenance mode is activated.
- At the centre, the current operational status.
- On the right, whether warnings or faults are present in the system.
- Faults are also indicated by the status row flashing.

2. The measured value is shown at the centre of the display area.

3. The menu bar, whose input is controlled by the menu key located underneath.

```
            Measurement

      O₂ output [vol.%]


          20.9


  meas    cal    par    diag
```
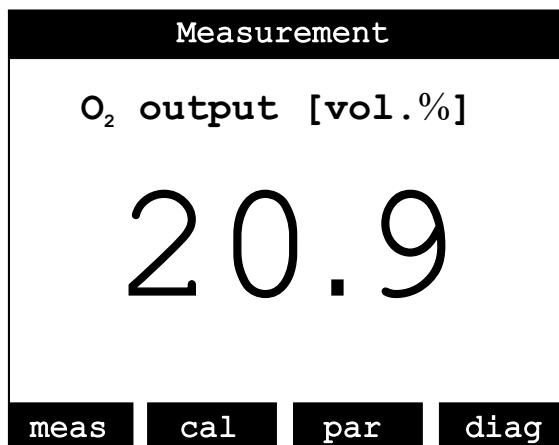
Fig. 2

2.1. The menu bar

```
  meas    cal    par    diag
```

The menu bar illustrated above is activated when the LT 1 is switched on.
The functions shown on the menu bar are interpreted as follows:

- **[meas]**   alternates between indication of all measured values in tabular form, and a large display of the selected value. This value is selected with the up/down cursor keys.

- **[cal]**   opens the calibration functions menu.

- **[par]**   opens the menu for viewing and amending the parameters.

- **[diag]**   alternates between displaying the O_2 value, and displaying warnings and/or faults.

The first function shown in the menu bar of opened submenus is **[exit]**. This function serves to quit the submenu and return to the higher-level menu.

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Note: Menu overview in the Appendix → fold-out page

2. Display

2.2 The menu function **meas**

Pressing the **[meas]** key switches the display to a large representation (shown in Fig. 2, page 5) of the value selected via the up/down cursor keys. Pressing the **[meas]** key repeatedly switches the display back to a listing of all the measured values.

LAMBDA TRANSMITTER LT1

```
            Measure

O2 output      20.9 vol.%
Abs. press.     980 mbar
Current LS1     467 mA
O2 int. cmp    20.9 vol.%

  Li 1      Li 2 ↓    Li 3      Li 4
  meas      cal       par       diag
```

ENTER

LAMTEC
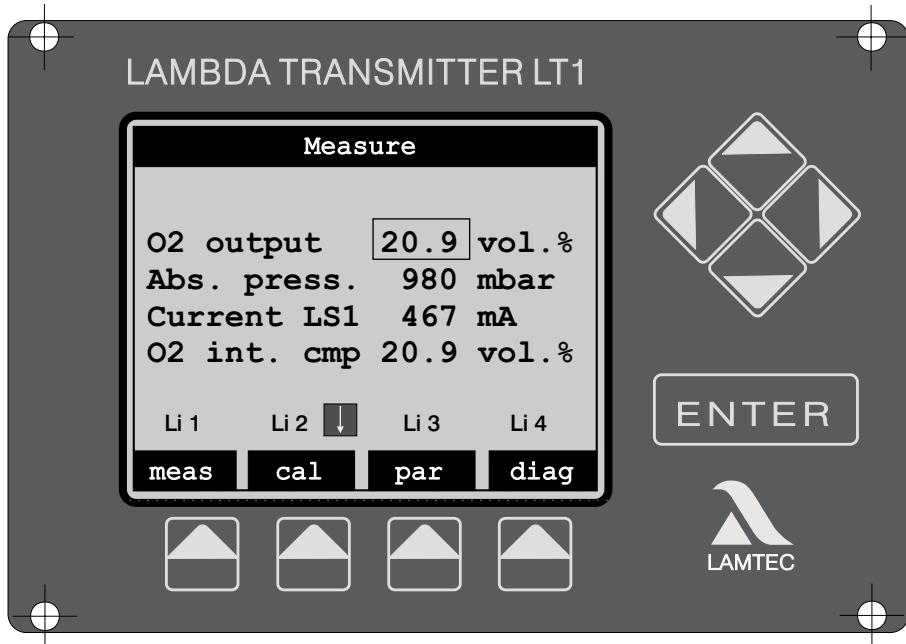
2.3 The menu function **cal**

Pressing the **[cal]** menu key displays four calibration functions (Fig. 3):

- Start autom. calibration
- Start autom. Check up
- Start manual calibration with cal. pump
- Start manual calibration without cal. pump

The required calibration function is selected via the up/down cursor keys. The ENTER key confirms the selected function and triggers this calibration procedure.
The automatic calibration modes can be interrupted via the menu function:
Interrupt calibration, return to measurement function.

During manual calibration, the calibrated value can be changed via the menu function:
Change calibrated value, LS1 probe (Fig. 4).

```
          Measure

       ***Calibrating***

Start auto. calibration
Start auto. check up
Start manual calibration
      with cal.pump
Start manual calibration
      without cal.pump

 exit
```

```
          Man. Cal.

       ***Calibrating***

End calibration, return
 to normal operation
Change of cal. value LS1
 probe




 exit
```
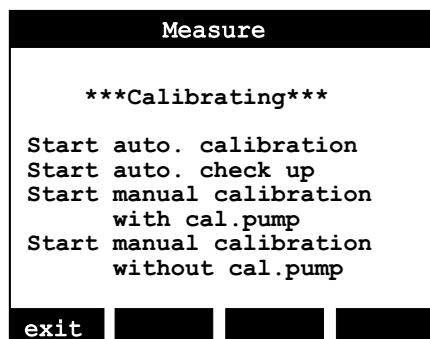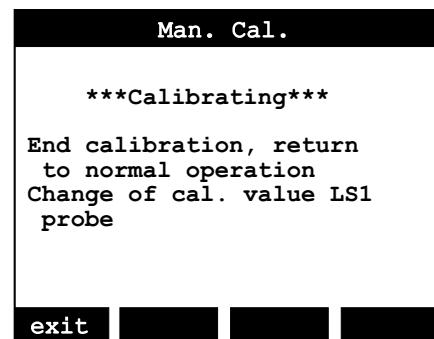
Fig. 3   Fig. 4

2. Display

After calling up this menu function, the amendment procedure in the displayed submenu can be terminated with the **[cancel]** key. Alternatively, the amended O_2 value can be accepted with the **[OK]** key.
Manual calibration is interrupted or ended with **End calibration, return to measurement function** (the amended O_2 value is preserved).

Note: The Manual calibration mode remains active for a maximum of 15 minutes (this is set at the factory). This is followed by switching back automatically to the measurement mode. The maximum manual calibration time can be changed via parameter 288 at service level.

If the **[cal]** menu is called up during cold start, the measurement gas pump can be switched on.

A substitute O_2 value is displayed during calibration procedures. Measurement or display of a meaningful O_2 value is only possible in the operational mode, i.e. after the end of calibration.

ATTENTION: The operating instructions of the lambda transmitter LT 1 must always be observed !

2. Display

2.4 The menu function `par`

After calling up the **[par]** menu, the menu opens up for the parameters (Fig. 5). Access to the parameter menu is divided into the following clearance levels:

- Operational level
- Customer level
- Service level } (only accessible via password)
- Factory level

> **Note:** The customer level password can be set freely by the customer, see 3.2.

The current clearance level is shown on the display. The available menu functions are displayed in the menu bar:

- **[exit]**   returns to start menu.
- **[psw]**   allows changing the clearance level via password input.
- **[view]**   displays the parameter settings. All the parameters are displayed, regardless of clearance level.
- **[change]** allows the changing of parameters: only the parameters accessible at the clearance level are displayed.

> **Note:** Over 2000 parameters can be changed via the various clearance levels. In order to avoid confusion, use of the [change] function is recommended.

```
        Measure


***Parameter setup***

Released customer level


 meas    psw    view   change
```
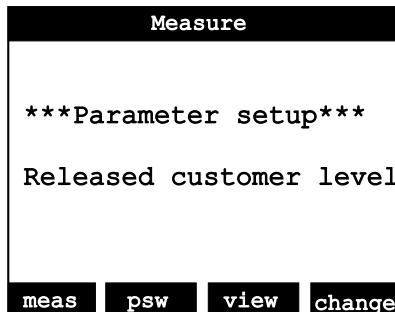
Fig. 5

2.4.1 The menu function `psw`

[psw] calls up the password input menu. The operational clearance level* is displayed. The functions visible in the menu bar mean:

- **[exit]**   returns to the **[par]** menu.
- **[clear]**   resets the clearance level to operational level*
- **[----]**   shifts to the alphabetically previous input letter.
- **[++++]** shifts to the alphabetically next input letter.

The up/down cursor keys act similarly to [++++] and [----]. Left/right move the input point along the password.
Once the correct password is entered, the corresponding clearance level is displayed and is retained on leaving the menu with **[exit]**.
If no key is pressed for some time, the clearance level is reset to the operational level.*

* If the customer clearance level is still at the factory setting, the customer level is set.

2. Display

2.4.2 The menu function **view**

[view]   opens the parameter menu. The menu bar is interpreted as follows:

[exit]   returns to the menu function **[par]**

[s/l]   toggles between display formats:

Short: only the parameter number and the current value are displayed.
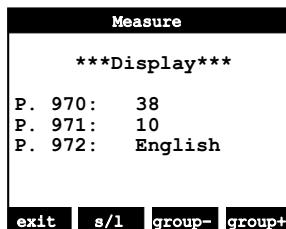
```
            Measure

         ***Display***

P. 970:    38
P. 971:    10
P. 972:    English


  exit   s/l  group-  group+
```
Fig. 6

Medium: the parameter number and the current value are accompanied by a short description.
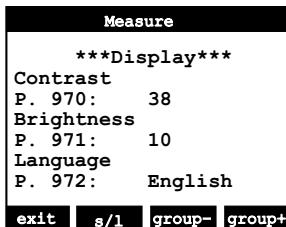
```
            Measure
         ***Display***
Contrast
P. 970:    38
Brightness
P. 971:    10
Language
P. 972:    English
  exit   s/l  group-  group+
```
Fig. 7

Long: as **Medium**, but with an additional parameter status row displayed.
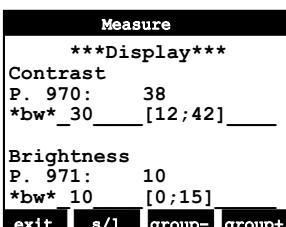
```
            Measure
         ***Display***
Contrast
P. 970:    38
*bw*_30____[12;42]____

Brightness
P. 971:    10
*bw*_10    [0;15]
  exit   s/l  group-  group+
```
Fig. 8

[group-]   scrolls back one parameter group.

[group+]   scrolls forward one parameter group.

All available parameter groups are summarised in the appendix.
The left/right cursor keys correspond to the key-functions of:
[group-] and [group+] respectively.

If not all the parameters in a group are visible in the readout, this is indicated by flashing arrows in the right-hand margin. The up/down cursor keys can be used to shift the parameters and make them visible.

As an example, we explain below the status row shown in the **Long** format:

- ●   ***kw*_30____[12 ; 42]____**
  The asterisks and underline characters (* and _) are fillers.

- ●   **K**   indicates the customer clearance level
  (b = operation, k = customer, s = service, f = manufacturing)

- ●   **W**   indicates the parameter type
  (write = revisable, read = read only).

- ●   **30**   is the default value (base value in EPROM)

- ●   **[12 ; 42]** is the possible range within which the parameter can be changed

For some parameters there is no default value and interval!

2.4.3 The menu function

change

[change] allows parameter values to be amended. The menu bar for the submenu is the same as the **[view]** menu (see 2.4.2).

However, here the parameter to be changed is shown inverted (light characters on a dark background). The required parameter can be selected via the up/down cursor keys. The edit mode (change mode, Fig. 9) for that parameter is activated with the [ENTER] key. The parameter's value flashes during editing.

The parameter can now be changed via the up/down cursor keys (and left/right for multidigit parameters). The menu bar functions are interpreted as follows:

- **[esc]**   returns to the **[change]** menu without accepting the changed parameter.
- **[dflt]**   sets the default value.
- **[OK]**   accepts the changed value and returns to **[ENTER]** or **[change]** menu.

This procedure leads back to the **[change]** menu. Further parameters can be called up and changed.
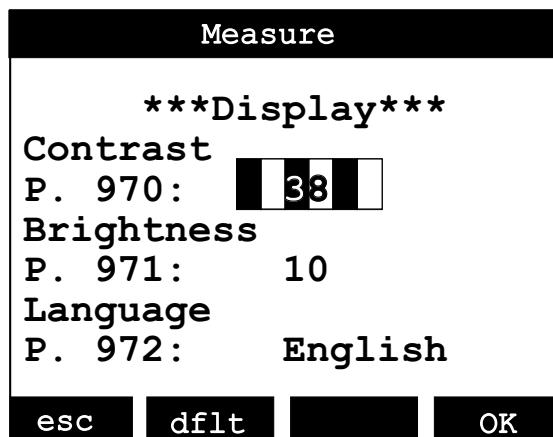
```
┌─────────────────────────────┐
│          Measure            │
├─────────────────────────────┤
│                             │
│       ***Display***         │
│  Contrast                   │
│  P. 970:      38            │
│  Brightness                 │
│  P. 971:      10            │
│  Language                   │
│  P. 972:      English       │
│                             │
│  esc   dflt          OK     │
└─────────────────────────────┘
```
Fig. 9

Selected parameters are indicated in three ways:

1. **Inverted representation**   → parameter can be changed

2. **Outlined representation**   → parameter cannot be changed

3. **Flashing representation**   → active editing mode (change mode)

2. Display

2.5 The menu function `diag`

On pressing the **[diag]** key, the display switches to show warnings and faults. The up/down cursor keys can be used to select individual warnings or faults, or limit values.

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> **Note :** Llimit values are only displayed if they were activated via parameters 930/940/950/960 (Service level).

The selected warning or fault, shown in reverse video, can now be acknowledged or reset via the ENTER key.

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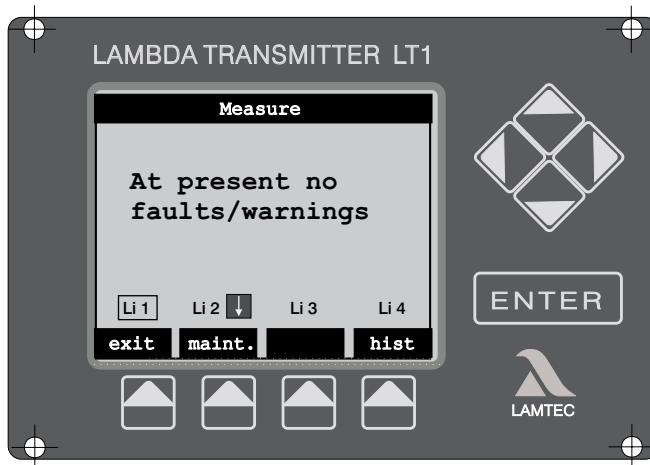
> **Note:** Not all warnings or faults can be reset by means of an acknowledgement. The cause of the warning or fault may need to be rectified first.

If a limit value is selected and then the ENTER key pressed, the display switches to the limit value menu.

```
        Measure
Limit 1
LS1  02
Max. value:        100
Act. value:         67
Min. value:         30
Dimension :   0.1 vol.%
State     :         ON

 Li 1    Li 2 ↓   Li 3 ↑   Li 4
 exit                     reset
```
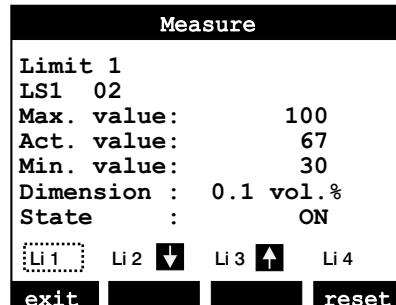
Explanation: Limit value 1 is parameterised to the O_2 measured value.
Switching points: Crossing upwards   10.0 Vol.% O_2
Crossing downwards   3.0 Vol.% O_2
Current O_2 measured value   6.7 Vol.% O_2
Llimit value is not set.

Li 2 ↓   - means: limit value 2 was triggered → to crossing downwards

Li 3 ↑   - means: limit value 3 was triggered → to crossing upwards

The right/left cursor keys can now be used to select each limit value in succession.
As soon as reset mode "Manual" or "Acknowledge" has been selected, the limit value can be reset via "Reset".
Use "Exit" to leave the limit value menu.

3. Display Parameters

3.1 Brightness, contrast and language

The parameter group ***Display*** controls the LT 1 Lambda Transmitter's Display and Control unit, with the following parameters:

> P. 970   Contrast
> This parameter serves to set the display contrast.
>
> P. 971   Brightness
> This parameter controls the display's background brightness.
>
> P. 972   Language
> The language of the output text (German, English) can be selected.
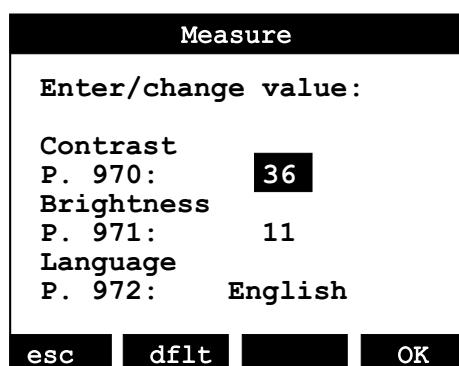
Fig. 10

3.1.1 Brightness and contrast via the cursor keys

Brightness and contrast can also be changed via the cursor keys, as follows:

Contrast +   →   Keys 1 & 2
Contrast −   →   Keys 3 & 4
Brightness +   →   Keys 1 & 4
Brightness −   →   Keys 2 & 3
Press the appropriate two keys simultaneously

3. Display Parameters

3.2 Customer password input

Parameter 1472

The password for the customer level can be selected individually by the customer. In order to enter a new password, at least the customer clearance level must be activated.
The new password must be entered as parameter 1472 (see Fig. 11).

ATTENTION: The password is accepted by the system a few seconds after input, and is displayed as "####". Thus, an entered password can never be read out.

```
           Measure
***Password/serial no.***


 Password, customer level

    P. 1472:   ####


 exit    s/l   group-  group+
```
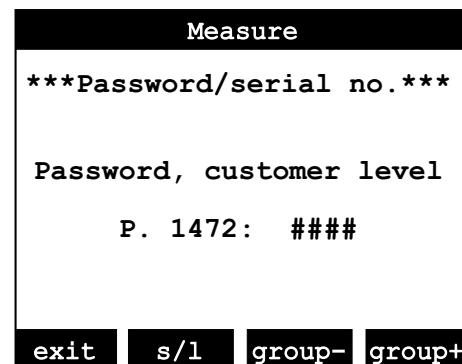
Fig. 11

Note: The password is set to "0000" at the factory. Since this corresponds to the password input default setting, the customer level can be activated by switching briefly to password input and leaving it again without making any changes.

4. Limit values

4. Limit values

Measured data can be monitored with the help of limit values. The LT 1 Lambda Transmitter comes with 4 fixed limit values as standard, that can be freely configured. Load-dependent limit curves and fuel-specific limit values are available as option 657R0920.

4.1 Standardconfiguration (4 fixed limit values)

Monitoring takes place by comparing the current value with a lower limit (Min. comparison value) and with an upper limit (Max. comparison value).
If the monitored value falls outside the range (window), i.e. it is smaller than the Min. comparison value or greater than the Max. comparison value, the limit value output is set.
Parameters 910 to 914 indicate whether the limit value is set.
The limit values 1 - 4 can be used to switch the LT 1 transmitter's relay outputs. The settings that need to be made are described in the chapter about digital outputs (chapter 5). The limit value configurations, the display and resetting of limit values are described below. When using the display, these items can be found in the parameter groups limit value config. and limit values. The relevant parameter numbers are listed in the Appendix, table on page 19.

4.1.1 Limit value configuration

Each of the 4 limit values has seven parameters, used for configuration (e.g. for limit value 1):
1. **Li 1 acts on** (see 4.1.1)
2. **1: Max. comparison value** (see 4.1.1.2)
3. **1: Min. comparison value** (see 4.1.1.2)
4. **1: Const. limit max.** (see 4.1.1.3)
5. **1: Const. limit min.** (see 4.1.1.3)
6. **1: Reset mode** (see 4.1.4)
7. **1: Triggering delay** (see 4.1.5)

The parameters are preceded by the number of their corresponding limit value.

4.1.1.1 Limit value 1 (2,3,4,) acts on

Parameters: 930/940/950/960

This parameters specifies which value is to be monitored. The following values are available for monitoring:

- **Off** - the limit value is not in use at the moment.
- **O_2 measured value**
- **Values available for configuration:** one of 6 measured values definable by the user is being monitored.
- **Temperature LS 1***
- **Absolute pressure***
- **Current LS 1**
- **Voltage LS 1**   (* optional)

4.1.1.2 Min. comparison value Max. comparison value

Parameters: 931/932
941/942
951/952
961/962

Three possible settings are available for the upper and lower comparison values:

Off:	The comparison value is not activated.
Constant value:	A constant reference value is chosen to serve as a comparison value, see 4.1.1.3.
Calculated Analogue value:	A value calculated from the actual O_2 value or from an analogue input serves as a reference value. In the LT 1 lambda transmitter, one of 12 available reference values can be selected. Configuration of the analogue values to be calculated: see separate instructions.

4. Limit values

4.1.1.3 Constant limit max.
Constant limit min.

Parameters: 933/934
943/944
953/954
963/964

If a constant value is selected to serve as the reference value, this constant is stored in Li Max. or Min. Please note that only integers can be entered. If the constant reference value is displayed with decimal places, the sequence of digits should be entered but the decimal point ignored.

Example 1:
The measured O_2 value needs to be monitored. The limit value output is set as follows:
If dropping below 5.5 or exceeding 15.6 vol.% O_2.
A constant value is specified for the Min. and Max. reference values:
- For the constant Li Max.: 156
- For the constant Li Min.: 55

i	**Note:** If the measured value is to be monitored only for exceeding the maximum or only dropping below the minimum, the threshold should be set such that it is never encountered. Example: The measured O_2 value needs to be monitored only for falling below the minimum. Set the Max. limit value to 30% (300).

Example 2:
The probe temperature (optional) needs to be monitored. The temperature is shown on the display in °C. The limit values should be specified as integers in °C. An input of 380 corresponds to 380°C.

4.1.4 Reset mode

Parameters: 935/945/955/965

If the limit value is set as a result of the reference value being crossed (in either direction), this parameter describes the limit value's resetting mode. Three possibilities are available:

Automatic: If the monitored value is changed so that once again it lies within the limit min. and limit max. range, the limit value output is reset *automatically* to *off*.

Manual: The limit value output must be reset manually via the display, via one of the digital inputs or via the remote software (s. Limit values). In this resetting mode, limit values can only be reset if the monitored value lies within the acceptable range.

Acknowledge: The limit value output must be reset either manually via the display, via one of the digital inputs or via the remote software (s. limit values).
If the monitored reference value is still outside the acceptable range it is only acknowledged to begin with, and disappears on entering the acceptable range.

4.1.5 Triggering delay

Parameters 936/946/956/966

This parameter can be used to set a triggering delay in the range 0 to 600 seconds. The limit value output is only set if the monitored reference value lies outside the limit min. and limit max. range for longer than the specified period. If the reference value is once again within the limit min. and limit max. limitmits, the time counter is reset. The triggering delay starts to count again from 0 when limit min. or limit max. is exceeded in the relevant direction.

4. Limit values/curves

4.2 Load-dependent limit curves, fuel-specific limit values (option 657R0920)

\- Load-dependent limit curves,
The load value (burner load) or some other measured value is switched on via analogue input 4. Instead of fixed limit values, fuel-specific curves of 2 to a maximum of 8 checkpoints can be entered.
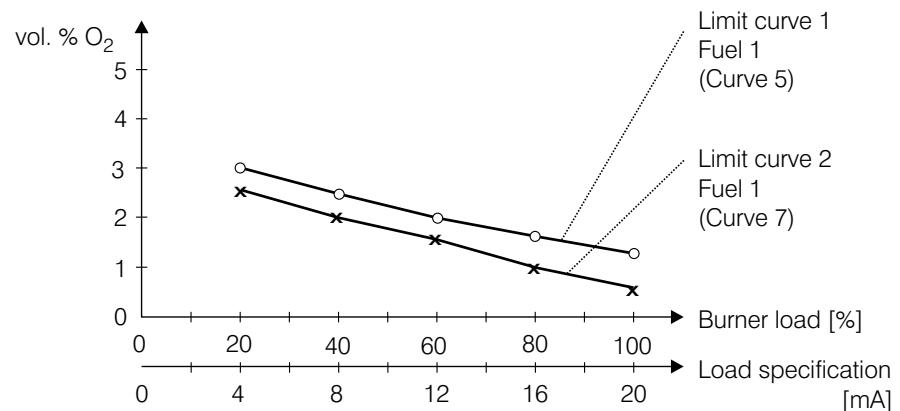
Limit curves (factory setting), with parameters set for distinguishing between situations

Possible combinations

Alternatively

- 2 fuels à 4 limit curves / limit values per fuel
- 4 fuels à 2 limit curves / limit values per fuel

4.2.1 2 fuels à 4 limit curves / limit values per fuel

Limit values 1 to 4 are used (Li 1 ... Li 4)

Allocation of limit curves / limit values

Curve	Function	Fuel	Calculated analogue value
5	LiC1/Li1	1	9
6	LiC1/Li1	2	9
7	LiC2/Li1	1	10
8	LiC2/Li2	2	10
9	LiC3/Li3	1	11
10	LiC3/Li3	2	11
11	LiC4/Li4	1	12
12	LiC4/Li4	2	12

LiC → Limit curve

Li → Limit

4. Limit values

4.2.2	*4 fuels à 2 limit curves* / *limit values per fuel*	Limit values 1 and 3 are used (Li 1 and Li 3)

Allocation of limit curves / limit values

Curve	Function	Fuel	Calculated Analogue value
5	LiC1/Li1	1	9
6	LiC1/Li1	2	9
7	LiC1/Li1	3	9
8	LiC1/Li1	4	9
9	LiC3/Li3	1	11
10	LiC3/Li3	2	11
11	LiC3/Li3	3	11
12	LiC3/Li3	4	11

LiC → Limit curve

Li → Limit

4.2.3 Parameter setup (factory settings)

4.2.3.1 Analogue input 4

Par. 602: "Analogue input 4"
Par. 603: "Curve 4"
Par. 604: 3,9 mA
Par. 605: 20,1 mA
Par. 606: "Off"
Par. 607: "Off"

Display of the load value via configurable measured value 6
Par. 800: "Calc. Analogue value 4"
Par. 801: "Burner load"
Par. 809 : "%"
Par. 812: "XXXX"
Par. 813: "0,4s"

Conversion 4...20 mA $\triangleq$ 0...100% for load specification (burner load) via curve 4, as follows:

Parameter		Value	
2150	x1	4000	[4 mA]
2151	y1	20	[20 %]
2152	x2	20 000	[20mA]
2153	y2	100	[100%]

4. Limit values/curves

4.2.3.2 Limit curves /
Limit values

(!)

Parameter setup for the 4 limit curves takes place via the analogue
calculations 9 to 12.

> **Attention:** Fuel selection "Par. 836 Digital inputs" must be switched on.

Limit curve 1   Analogue calc. 9:
                              Par. 652: "<u>Calculates analogue val. 4</u>"
                              Par. 653: "Curve 5"
                              Par. 654: "Off"
                              Par. 657: "Curve +BS" (at manufacturing level)

Limit curve 2   Analogue calc. 10:
                              Par. 662: "<u>Calculates analogue val. 4</u>"
                              Par. 663: "Curve 7"
                              Par. 664: "Off"
                              Par. 667: "Curve +BS" (at manufacturing level)

Limit curve 3   Analogue calc. 11:
                              Par. 672: "<u>Calculates analogue val. 4</u>"
                              Par. 673: "Curve 9"
                              Par. 674: "Off"
                              Par. 677: "Curve +BS" (at manufacturing level)

Limit curve 4   Analogue calc. 12:
                              Par. 682: "<u>Calculates analogue val. 4</u>"
                              Par. 683: "Curve 11"
                              Par. 684: "Off"
                              Par. 687: "Curve +BS" (at manufacturing level)

If, instead of the limit curves, fixed limit values are to be specified, then
parameters 930, 931, 940, 941, 950, 951, 960, 961 should be adjusted
accordingly, see 4.1.1.2 and 4.1.1.3.
The following settings are made at the factory:

Limit value 1 / limit curve 1
Par. 930: "<u>O2 measured value</u>" or some other measured value to be monitored
Par. 931: "Off" (upper limit value)
Par. 932: "Calc. analogue value 9"
Par. 935: Resetting mode "Automatic"
Par. 936: Triggering delay to 0 seconds

Limit value 2 / limit curve 2
Par. 940: "<u>O2 measured value</u>" or some other measured value to be monitored
Par. 941: "Off" (upper limit value)
Par. 942: "Calc. analogue value 10"
Par. 945: Resetting mode "Automatic"
Par. 946: Triggering delay to 0 seconds

Limit value 3 / limit curve 3
Par. 950: "<u>O2 measured value</u>" or some other measured value to be monitored
Par. 951: "Off" (upper limit value)
Par. 952: "Calc. analogue value 11"
Par. 955: "Automatic" resetting mode
Par. 956: Triggering delay to 0 seconds

Limit value 4 / limit curve 4
Par. 960: "<u>O2 measured value</u>" or some other measured value to be monitored
Par. 961: "Off" (upper limit value)
Par. 962: "<u>Calc. analogue value 12</u>"
Par. 965: Resetting mode "Automatic"
Par. 966: Triggering delay to 0 seconds

4. Limit values/curves

4.2.4 Input of limit values/ limit curves

See also tables in 4.2.1 and 4.2.2

Factory settings − Direct triggering in the event of falling below these values after a delay of 0 seconds

Limit curve 1 / Fuel 1

x1 --- x5 Burner load
y1 --- y5 O_2 limit values (curves)

Max. 8 curve-points possible
Distribution can be freely chosen!

Parameter		Value	
2200	x1	20	[20 %]
2201	y1	30	[3,0 % O_2]
2202	x2	40	[40 %]
2203	y2	25	[2,5 % O_2]
2204	x3	60	[60 %]
2205	y3	20	[2,0 % O_2]
2206	x4	80	[80 %]
2207	y4	18	[1,8 % O_2]
2208	x5	100	[100%]
2209	y5	15	[1,5 % O_2]

Limit value curve 2 / Fuel 1

Parameter		Value	
2300	x1	20	[20 %]
2301	y1	25	[2,5 % O_2]
2302	x2	40	[40 %]
2303	y2	20	[2,0 % O_2]
2304	x3	60	[60 %]
2305	y3	15	[1,5 % O_2]
2306	x4	80	[80 %]
2307	y4	10	[1,0 % O_2]
2308	x5	100	[100%]
2309	y5	5	[0,5 % O_2]

4. Limit values

4.3 Limit values
Display and resetting

The limit values' current status as well as resetting limit values, make use of the display in the limit values group; the relevant parameter numbers are shown in the Appendix, table on page 19.

Parameters 910 to 914

The parameters limit value 1, limit value 2, limit value 3 and limit value 4 indicate the limit values' current settings and status. **Off** means that either the corresponding limit value is not in use, or the monitored reference value is within the limits Li Min. and Li Max. If a limit value is shown as "set", the monitored reference value is or was outside those limits.

Parameters 914 to 917

Resetting the limit value output proceeds with the help of the parameters Reset Li 1, Reset Li 2, Reset Li 3 and Reset Li 4, provided that the manual or acknowledge reset mode was selected. In order to reset a limit value, "Reset" must be entered in the corresponding parameter. However, resetting in the manual mode is only possible if the monitored reference value is within the limits Li Min. and Li Max.

Off: Off means either that the relevant limit value is not in use, or the monitored reference value is within the limits Li Min. and Li Max.

Acknowledged: If Acknowledged is shown for a limit value, the monitored reference value is outside the acceptable range and the deviation from the limit values has already been acknowledged.

Set: If a limit value is shown as "set", the monitored reference value lies outside the limits Li Min. and Li Max.

4.3.1 *Display of limit value crossing (In preparation)*
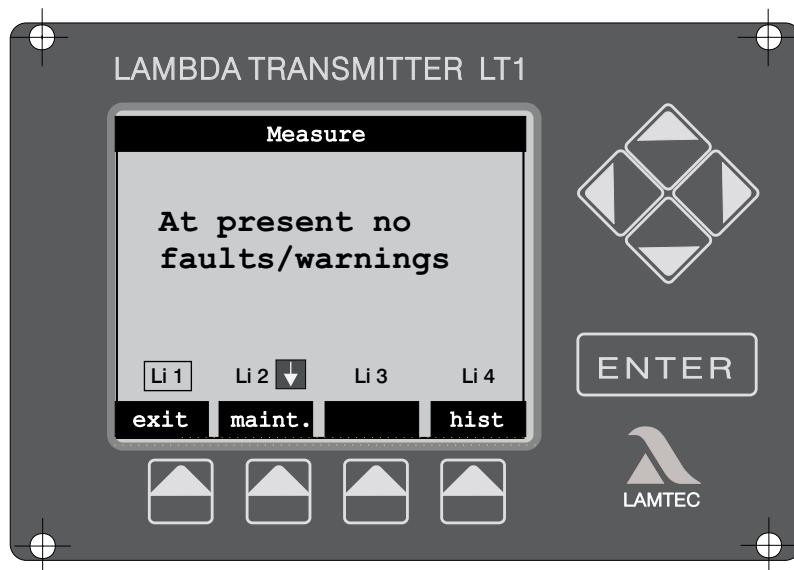
Following activation of the limit value parameters 930/940/950/960, "Service" clearance level, the display shows Li1, Li2, Li3, Li4 depending on which limit value has just been activated.

Crossing the limit value in either direction is shown as follows:
- Li 1 ⬆ ———— means limit value 1 has been crossed upwards
- Li 2 ⬇ ———— means limit value 2 has been crossed downwards

4. Limit values

4.3.2 Calling up limit
value settings
(in preparation)

● Press the "diag" (Diagnostics) key
Use the cursor keys to select the appropriate limit value
The selected limit value is highlighted by a frame

| Li 1 | ↑ | Li 2 | ↓ | Li 3 | Li 4 |

↑

Limit value selected
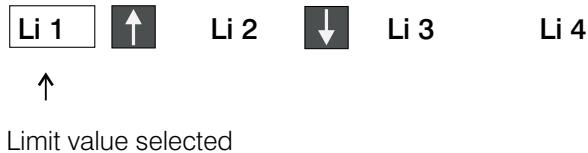
● Press the ENTER key
The limit value's current setting appears on the display, see illustration.

```
                    Measure

      Limit 1
  ①  LS1   02
  ②  Max. value:         100
  ③  Act. value:          67
  ②  Min. value:          30
      Dimension : 0.1 vol.%
  ④  State      :          ON

      Li 1     Li 2  ↓  Li 3  ↑  Li 4

      exit                      reset
```

Limit
value ·········▶
selected
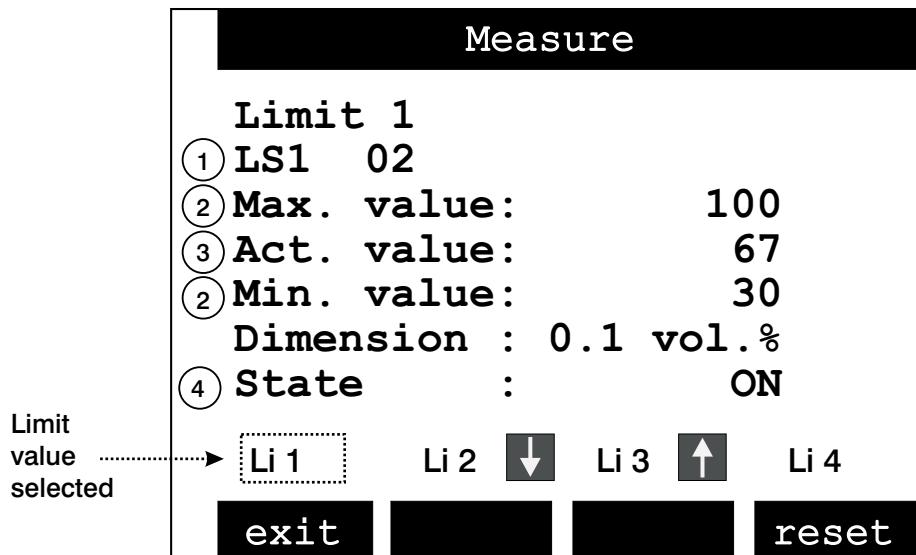
Explanation: ① Limit value 1 is parameterised for the measured O_2 value

② Switching points: Upward crossing   10.0 vol.% O_2
                      Downward crossing   3.0 vol.% O_2

③ Currently measured O_2 value 6.7 Vol.% O_2

④ limit value not set.

Possible states:

set	→ Limit value was triggered
Off	→ Measured value in acceptable range
acknow-ledged	→ Limit value crossing has already been acknowledged

4.3.3 Resetting limit values
via the display

Proceed as described in 4.3.2, and in addition press the Reset key.

4.3.4 Return to main menu

Press the Exit key x2.

5. Digital outputs (Relays)

5. Digital outputs (Relays)	Up to 7 digital outputs can be freely configured in the LT 1 lambda transmitter. The same parameters are available for the configuration of each digital output. These are:

- Idle state (see 5.1)
- Four functions that trigger a switching procedure; the four functions are OR-ed (see 5.2)
- Display of the current relay position (see 5.3)

Factory assignment of the digital outputs

Output 1 $\rightarrow$ Accumulated faults
Output 2 $\rightarrow$ Accumulated warnings
Output 3 $\rightarrow$ Calibration
Output 4 $\rightarrow$ Maintenance
Output 5 $\rightarrow$ Not configured
Output 6 $\rightarrow$ Not configured
Output 7 $\rightarrow$ Not configured

5.1 Idle state

Parameters: 1030/1040/1050/1060

This is where the idle state is set. This state is present if none of the four functions triggers a switching procedure. The setting Diagnostics allows the idle state to be changed via the parameter Position (see below).
Idle state (see 5.1)

- Low   (operating current principle)
- High (idle current principle)
- Diagnostic operation

5.2 Function A,B,C,D

Parameters 1031 bis 1034
            1041 bis 1044
            1051 bis 1054
            1061 bis 1064

The four functions are structured almost identically; an operational state can serve as a switching criterion. If a *Limit value* (Li 1-4) is selected as a switching criterion, the output switches if the limit value's output is set. E.g., if *Calibration* is chosen as a switching criterion, the output is not in the idle state during calibration.
Each function (A, B, C, D) can have all operational states as the switching criterion; however, the allocation of limit values Li 1-4 and/or test gases is restricted to individual functions. *Limit value 1* and *Test gas 1* are only possible with *Function A*, analogously *Limit value 2* and *Test gas 2* with *Function B* etc. However, all combinations can be set by OR-ing the four functions.

The following operational states can be selected as switching criteria:
- Warning
- Fault
- Calibration
- Checking
- Cold start
- Measurement
- Standby
- Maintenance
- Limit values 1 - 4
- Test gas 1 - 2
- No measurement

5.3 Position

Parameters: 1039/1049/1059/1069

This parameter indicates the current switching state. Manual switching of the output is possible by changing the parameter via diagnostic operation.

6. Digital inputs

6. Digital inputs

8 digital inputs can be configured for the LT 1 Lambda Transmitter. The inputs switch position according to the applied voltage: **High** (voltage = 24 V) or **Low** (input open or voltage = 0 V).

Depending on this position, the LT 1 transmitter can carry out certain actions. All 8 digital inputs are identical with regard to structure and functionality. The inputs' configuration is controlled by the following parameters:

Factory assignment of the digital inputs

input 1 → Pump on

Input 2 → Calibration triggering

Input 3 → Check triggering

Input 4 → Cyclic calibration triggering

Input 5 → Fault reset

Input 6 → [1] Fuel 2

Input 7 → [1] Fuel 3

Input 8 → [1] Fuel 4

[1] Parameter 836 Service level must be set to "Digital inputs" .
If no signal preset → Heating oil EL .

6.1 Idle state

Parameters 1170/1180/1190/1200 1210/1220/1230/1240

This is where the digital inputs' idle state is set. If the position differs from that set here, the actions specified by the functions (A, B, C, D) is carried out. If **Diagnostic operation** is set here, the functions (A, B, C, D) can be triggered for the appropriate digital input via the parameter Position.

● Low (operating current principle)
● High (idle current principle)
● Diagnostic operation

6. Digital inputs

<table>
<tr><td>

6.2 Functions A, B, C, D

Parameters 1171 - 1174
1181 - 1184
1191 - 1194
1201 - 1204
1211 - 1214
1221 - 1224
1231 - 1234
1241 - 1244

</td><td>

The four functions are structured almost identically. However, the allocation of limit values Li 1-4 and/or fuels is restricted to the individual functions (A, B, C, D). Resetting of limit value 1 and Fuel 1 are only possible with function A; analogously, resetting of limit value 2 and Test gas [sic] 2 only with function B, and so on.

The following actions are possible:
</td></tr>
</table>

- **None**
- **Pump on**   activates the measurement gas pump*
- **Calibration**   triggers an automatic calibration
- **Checking**   triggers an automatic check
- **Cyc. Cal.**   increments an internal counter; when it reaches a particular value (parameter 272), an automatic calibration is triggered and the counter is reset.
- **Fault reset**   acknowledges present faults
- **Warning reset**   acknowledges present warnings
- **Reset Li 1 - 4**   (function A) resets limit value 1; functions B, C, D reset limit values 2, 3, 4
- **Fuel 1**   (only function A) selects fuel 1; functions B, C, D select fuels 2, 3, 4
- **No cal.**   as long as a signal is applied to this input, the system cannot carry out calibration. If a calibration is still in progress, it is immediately terminated.
- **PID control unit on / off**   Provided the PID control unit option is activated, this function allows the PID control unit to be turned off.

> **(!)**
>
> *** Warning:** Never draw exhaust gas across the cold probe. This could lead to a blockage in the critical nozzle.
> Observe waiting times:
> With gas and heating oil El   1 hr
> With coal and heating oil S   2 hrs
> with refuse burning   3 hrs
> If the pump is switched on by mistake, switch mains voltage off and back on!

<table>
<tr><td>

6.3 Status

Parameters 1175
1185
1195
1205
1215
1225
1235
1245

</td><td>

This parameter indicates the digital input's state.
The three possible states are ***inactive*** (idle state) and ***active***; the set functions (A, B, C, D) are triggered.
The digital input's state can be set manually with this parameter, provided the parameter Idle level is set to ***Diagnostic operation.***

</td></tr>
</table>

Appendix: Tables

Parameters associated with digital inputs		
Parameter group digital input 1, 2, 3		
Parameter number	**Description**	**Access**
1170, 1180, 1190,...	Idle level, digital input 1, 2, 3,.. (0 = low, 1 = high, 2 = Diagnostic operation)	variable
1171, 1181, 1191,... 1172, 1182, 1192,... 1173, 1183, 1193,... 1174, 1184, 1194,... etc.	Function A, B, C, D of digital input 1, 2, 3, 4 0 = None 1 = Pump on 6 = Warning reset 2 = Calibration 7 = Reset Li1 / Li2 / Li3 / Li4 3 = Check 8 = Fuel 1 / 2 / 3 / 4 4 = Cycl. calibr. 9 = No calibration (blocked) 5 = Faults reset 10 = PID control unit off	variable
1175, 1185, 1195,...	State of digital input 1,2,3,... (0=Off, 1=Active)	variable

Parameters associated with limit values		
Parameter group limit values		
Parameter number	Description	Access
910 - 913	Display of state of limit value 1/2/3/4, 0 = Off, 1 = Active	read only
914 - 917	Manual reset of limit value 1/2/3/4, set to 1 or trigger to reset	variable
Parameter group limit value configuration		
Parameter number	Description	Access
930 (940, 950, 960)	Selection of the monitored quantity for limit value 1 (2, 3, 4) 0 = None, 1 = O2 value, 2...7 = configurable measured value 1 [sic]... 7, 8 = LS1 temperature, 9 = LS1 pressure, 10 = LS1 current, 11 = LS1 voltage	
931 (941, 951, 961)	Form for comparison value Max with Li 1 (2, 3, 4) 0 = Off, 1 = Const. value, 2...13 = Calculated analogue value 1...12	variable
932 (942, 952, 962)	Form for comparison value Min with Li 1 (2, 3, 4) 0 = Off, 1 = Const. value, 2...13 = Calculated analogue value 1...12	variable
933 (943, 953, 963)	Constants for comparison value Max with Li 1 (2, 3, 4) (only with 931, 941, 951, 961 = fixed value) variable	variable
934 (944, 954, 964)	Constants for comparison value Min with Li 1 (2, 3, 4) (only with 931, 941, 951, 961 = fixed value) variable	variable
935 (945, 955, 965)	Reset mode for limit value 1 (2, 3, 4) 0 = Automatic, 1 = Manual, 2 = Acknowledge	variable
936 (946, 956, 966)	Triggering delay for limit value 1, 2, 3, 4 (in sec)	variable

Parameters associated with digital outputs			
Parameter group digital outputs 1 (2, 3 … 7)			
Parameter number	Description	Clearance for	Access
1030, 1040, 1050, ...	Idle level 0 = Down, 1 = Up, 2 = Diagnostic operation	Service	variable
1031, 1041, 1051, ...	Function A 0 = Off, 1 = Warning, 2 = Fault, 3 = Calibration, 4 = Check, 5 = Cold start, 6 = Measurement, 7 = Standby, 8 = Maintenance, 9 = Li 1, 10 = Probe 1,2,3,4, 11 = No measurement	Service	variable
1032, 1042, 1052, ...	Function B As function A, but 9 = Li 2, 10 = Probe 2	Service	variable
1033, 1043, 1053, ...	Function C As function A, but 9 = Li 3, 10 = Probe 3	Service	variable
1034, 1044, 1054, ...	Function D As function A, but 9 = Li 4, 10 = Probe 4	Service	variable
1039, 1049, 1059, ...	Momentary position (can be changed in diagnostic operation) 0 = Down, 1 = Up	Service	variable

Appendix: Parameter groups

Meas.values	Analogue output 1
1	530
Operational data	Analogue output 2
40	540
Counters and times	Analogue output 3
70	550
Commands	Analogue output 4
104	560
Hardware options	Analogue input 1
120	570
LS1 Sliding voltage	Analogue input 2
130	580
LS1 Probe heating	Analogue input 3
150	590
Meas.gas pump	Analogue input 4
170	600
Norm. cold start	Analogue calculation 5
200	610
Int. cold start	Analogue calculation 6
220	620
LS1 Checks	Analogue calculation 7
250	630
LS1 Calibration	Analogue calculation 8
270	640
Ageing compensation	Analogue calculation 9
300	650
Test gases	Analogue calculation 10
330	660
O2 meas.value config.	Analogue calculation 11
360	670
Monitor output	Analogue calculation 12
380	680
MEV heating	Measured value config.
400	700
Pressure compensation	Fuel config.
420	835
Pressure measurement	Limit values
440	910
Temperature compensation	Limit value config.
450	930
Modbus RS232	Display
480	970
	Software version
	985

Anhang: Parametergruppen

Relay 1	Parameter CRC 16
1030	1490
Relay 2	Probe data
1040	1500
Relay 3	Cal. history 1
1050	1600
Relay 4	Cal. history 2
1060	1620
Relay 5	Cal. history 3
1070	1640
Relay 6	Cal. history 4
1080	1660
Relay 7	Cal. history 5
1090	1680
Magnetic valves	Cal. history 6
1100	1700
Pump diagnostics	Cal. history 7
1150	1720
Digital input 1	Cal. history 8
1170	1740
Digital input 2	Cal. history 9
1180	1760
Digital input 3	Cal. history 10
1190	1780
Digital input 4	Table Ri LS1
1200	1800
Digital input 5	Faults history
1210	1900
Digital input 6	Curve 1
1220	2000
Digital input 7	Curve 2
1230	2050
Digital input 8	Curve 3
1240	2100
Service times	Curve 4
1260	2150
LS1 linearisation	Curve 5
1280	2200
Bus interface	Curve 6
1300	2250
LS1 Dynamic monitoring	Curve 7
1330	2300
PID Control unit	Curve 8
1350	2350
PID Control unit config.	Curve 9
1361	2400
PID Control unit status	Curve 10
1380	2450
Password/serial no.	Curve 11
1472	2500
	Kurve 12

LT 1 MENUE CHART

MEASURE

O2 output [vol.%]

20.9

Li1 Li2 Li3 Li4

ENTER

---

meas | cal | par | diag

MEASURE

O2 output	20.9	vol. %
Abs. pressure	962	mbar
Current LS 1	424	mA
O2-Intern. cmp.	20.9	vol. %

ENTER

meas | cal | par | diag

*** Calibrating ***

Start auto. calibration
Start auto. check up
Start manual calibration
with cal. pump
Start manual calibration
without cal. pump

ENTER

exit

*** Calibrating ***

Brake off calibration,
return to normal operation

Status of calibration:
1. Calibration

exit

**** Parameter Setup ****

Operation level

exit | psw | view | change

**** Parameter Setup ****
SN: 000108LA - 11328
0 * * *
Released customer level

ENTER

exit | clear | - | +

*** Parameter ***
LS 1 O2 output
P. 001:   20.9
%
P. 001:   20.9
%
LS 1 O2 output
P. 001:   20.9
%
br *_209   [0; 1000]

ENTER

exit | s / l | group - | group +

MEASURE

*** Display ***
Contrast
P. 970:   30
Brightness
P. 971:   10
Language
P. 972:   English

ENTER

esc | dflt | OK

*** Warnings ***

Don't draw stack gas through
cold LS 1
Run-time definition flue gas pump
actives

ENTER

*** Faults ***

Fault of vacuum pressure
(flue gas pump)

ENTER

Remark: Not all warnings or faults can be
reset. In this case eliminate the cause of
the warnings or faults!

Operation Level

Test data	P 0001 - 0016
Operating data	P 0046 - 0056
Counter & time	P 0070 - 0072
O2 Test data configuration	P 0360
Test data configuration	P 0713 - 0813
Limits	P 0910 - 0917
Display	P 0970 - 0972
Software version	P 0985 - 0990
BUS Interface	P 1301
PID controller	P 1350 - 1357
PID controller status	P 1381
Parameter CRC 16	P 1490 - 1493

ENTER

Customer Level

Test data	P 0001 - 0016
Operating data	P 0040 - 0056
Counter & time	P 0070 - 0072
Commands	P 0104 - 0110
Flue gas pump	P 0183
LS1 check up	P 0250
LS1 calibration	P 0270 - 0288
Test gas	P 0330 - 0345
O2 Test data configuration	P 0360 - 0362
MEV heating	P 0400 - 0403
Pressure measurement	P 0441 - 0442
Analog output 1	P 0532 - 0534
Analog output 2	P 0542 - 0544
Analog output 3	P 0552 - 0554
Analog output 4	P 0562 - 0564
Analog input 1	P 0570 - 0578
Analog input 2	P 0580 - 0588
Analog input 3	P 0590 - 0598
Analog input 4	P 0600 - 0608
Analog calculation 5	P 0610 - 0618
Analog calculation 6	P 0620 - 0628
Analog calculation 7	P 0630 - 0638
Analog calculation 8	P 0640 - 0648
Analog calculation 9	P 0650 - 0658
Analog calculation 10	P 0660 - 0668
Analog calculation 11	P 0670 - 0678
Analog calculation 12	P 0680 - 0688
Test data configuration	P 0713 - 0813
Fuel configuration	P 0835
Limits	P 0910 - 0917
Limit configuration	P 0933 - 0966
Display	P 0970 - 0972
Software version	P 0985 - 0990
Digital input 1	P 1175
Digital input 2	P 1185
Digital input 3	P 1195
Digital input 4	P 1205
Digital input 5	P 1215
Digital input 6	P 1225
Digital input 7	P 1235
Digital input 8	P 1245
Service	P 1260 - 1261
LS1 compensation	P 1280 - 1281
BUS Interface	P 1300 - 1318
Dynamic test LS1	P 1330 - 1331
PID controller	P 1350 - 1357
PID controller configuration	P 1361 - 1367
PID controller status	P 1381
Password / Serialno.	P 1472
Parameter CRC 16	P 1490 - 1493
Probe data	P 1500 - 1563
Calibration 1 - 10 history	P 1600 - 1793
Ri table LS1	P 1800 - 1898
Curve 1 - 12	P 2000 - 2565

ENTER

Service Level

Test data	P 0001 - 0016
Operating data	P 0040 - 0056
Counter & time	P 0070 - 0072
Commands	P 0104 - 0110
Hardware options	P 0121 - 0124
LS 1 glide voltage	P 0140 - 0142
Probe heating	P 0150
Flue gas pump	P 0183 - 0190
Cold start normal	P 0204
LS1 check up	P 0250 - 0252
LS1 calibration	P 0270 - 0288
Test gas	P 0330 - 0345
O2 Test data configuration	P 0360 - 0362
Monitor output	P 0380 - 0383
MEV heating	P 0400 - 0403
Pressure measurement	P 0441 - 0442
Modbus RS232	P 0480 - 0483
Analog output 1 - 4	P 0530 - 0564
Analog input 1 - 4	P 0570 - 0608
Analog calculation 5 - 12	P 0610 - 0688
Test data configuration	P 0700 - 0813
Fuel configuration	P 0835 - 0899
Limits	P 0910 - 0917
Limit configuration	P 0930 - 0966
Display	P 0970 - 0972
Software version	P 0985 - 0990
Relay 1 - 7	P 1030 - 1099
Solenoid valve	P 1109 - 1129
Digital input 1 - 8	P 1170 - 1245
Service	P 1260 - 1261
LS1 compensation	P 1280 - 1283
BUS Interface	P 1300 - 1318
Dynamic test LS1	P 1330 - 1334
PID controller	P 1350 - 1357
PID controller configuration	P 1361 - 1372
PID controller status	P 1380 - 1391
Password / Serialno.	P 1472
Parameter CRC 16	P 1490 - 1493
Probe data	P 1500 - 1563
Calibration 1 - 10 history	P 1600 - 1793
Ri table LS1	P 1800 - 1898
Fault history	P 1900 - 1978
Curve 1 - 12	P 2000 - 2565

ENTER