**Instructions Manual release 05/2002**

# gas analysis

Thermal Conductivity Gas Analyzers
CALOMAT 6
7MB2511, 7MB2521, 7MB2517, 7MB2527

SIEMENS

Siemens AG
Automation and Drives Group
Process Instrumentation Division
D-76181 Karlsruhe

Siemens Aktiengesellschaft



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# Information for the User

# 1


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## 1.1 Information for our Customers

Please read this Manual before you start work!
It contains important information and data whose observance will guarantee correct functioning of the analyzer and also save you servicing costs. The information will significantly help you when using the equipment and will lead to reliable results.

## 1.2 General Information

The product described in this Manual has left the factory in a perfect and tested condition as regards safety. In order to retain this state and to achieve correct and safe operation of this product, it must only be used in the manner described by the manufacturer. In addition, correct and safe operation of this product is dependent on proper transport, storage and installation as well as careful operation and maintenance.

This Manual contains the information required for approved use of the product described in it. The Manual has been prepared for technically qualified personnel who have been specially trained or who possess appropriate knowledge in the field of instrumentation and control, referred to further as automation technology.

Knowledge of the safety information and warnings present in this Manual and their technically correct implementation are prerequisites for danger-free installation and commissioning and for safety during operation and maintenance of the described product. Only a qualified person possesses the required specialist knowledge to correctly interpret the general safety information and warnings present in this Manual and to apply them to the specific case.

This Manual is included in the delivery of the analyzer, even if separate ordering has been made possible for logistic reasons. For clarity reasons this Manual cannot cover all possible details for all versions of the described product and cannot describe every possible case in connection with installation, operation, maintenance or the use in systems. Should you require further information, or should particular problems occur which are not handled in sufficient depth in this Manual, help can be requested through your local Siemens office or representative.

**Note**

When considering use of the analyzer for new research and development applications, we recommend that you discuss your application with our specialist department.

## 1.3 Notes on Using this Manual

This Manual describes the applications of the equipment and how you can start it up, operate and service it.

Of particular importance are the **warning and information texts.** These are separated from the remaining text, specially identified by appropriate pictograms (see examples on left), and provide valuable tips on how to avoid maloperations.

## 1.4 Danger Information

The following information serves on the one hand for your personal safety and also to protect the described product or connected devices from damage.

Safety information and warnings to prevent danger to the life and health of users or maintenance personnel or to prevent damage to property are emphasized in this Manual by the terms defined here. They are additionally identified by warning symbols (pictograms) matched to the significance of the accompanying text and which may therefore deviate from the examples shown here. The terms used in this Manual and the information on the product itself have the following meaning:

**Danger**
means that death, severe personal injury and/or substantial damage to property **will occur** if the appropriate safety precautions are not observed.

**Warning**
means that death, severe personal injury and/or substantial damage to property **can occur** if the appropriate safety precautions are not observed.

**Caution**
with a warning triangle means that slight personal injury **can occur** if the appropriate safety precautions are not observed.

**Caution**
without a warning triangle means that damage to property **can occur** if the appropriate safety precautions are not observed.

**Attention**
means that an undesirable effect or state can occur if the corresponding information is not observed.

**Note**
is important information on the product itself, the handling of the product or the respective part of the Manual to which particular attention should be paid.

## 1.5 Approved Use

Approved use in the sense of this Manual means that this product may only be used for the applications described in the Catalog and in the Technical Description (see also Chapter 3 of this Manual) and only in conjunction with other devices and components which have been recommended or approved of by Siemens.

The product described in this Manual has been developed, manufactured, tested and documented taking into account the appropriate safety standards. No danger therefore exists in the normal case with respect to damage to property or the health of persons if the handling guidelines and safety information described for configuring, assembly, approved use and maintenance are observed. This device has been designed such that safe isolation is guaranteed between the primary and secondary circuits. Low voltages which are connected must also be generated using safe isolation.

**Warning**

Following removal of the housing or guard, or after opening the system cabinet, certain parts of these devices/systems are accessible which may carry dangerous voltages. Therefore only suitably qualified personnel may work on this device. These individuals must be thoroughly acquainted with all sources of danger and the maintenance measures as described in this Manual.

## 1.6 Qualified Personnel

Severe personal injury and/or extensive damage to property may occur following unqualified work on the device/system or the failure to observe the warnings described in the Manual or on the device/system cabinet. Therefore only suitably qualified personnel may work on this device/system.

Qualified persons in the sense of the safety information present in this Manual or on the product itself are persons who

- are either familiar as configuring engineers with the safety concepts of automation technology
- or have been trained as operators in the use of automation technology equipment and are acquainted with the contents of this Manual which refer to operation
- or have been appropriately trained as commissioning and/or maintenance personnel for such automation technology equipment or are authorized to energize, ground and tag circuits and devices/systems in accordance with established safety practices.

## 1.7 Warranty Information

We wish to specifically draw your attention to the fact that the design of the product is exclusively and completely described in the sales contract. The contents of this product documentation are not part of a previous or existing agreement, commitment or statutory right and do not change these. All commitments on the part of Siemens are contained in the respective sales contract which also contains the complete and solely applicable warranty conditions. The warranty conditions in the contract are neither extended nor limited by the contents of this Instruction Manual.

## 1.8 Supply and Delivery

The respective scope of delivery according to the valid contract is listed on the shipping documents accompanying the delivery.

When opening the packaging, please observe the corresponding information on the packaging material. Check that the delivery is complete and undamaged. In particular, compare the Order Nos. on the labels (if present) with the ordering data.

Please retain the packaging material if possible so that you can reuse it if it is necessary to return the device. A form for this purpose can be found in Chapter LEERER MERKER.

## 1.9 Standards and Regulations

The harmonized European standards have been applied as far as possible to 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 apply (see also the technical data in Chapter 3).

When using this product outside the range of applicability of these standards and regulations, the appropriate standards and regulations in the country of use must be observed.

## 1.10 Conformity Declaration

EG-Konformitätserklärung
EC Declaration of conformity
Déclaration ”CE” de conformité
Declaración CE de conformidad
Declaração CE de conformidade
Dichiarazione CE di conformità

EG-Verklaring van overeenstemming
EF-konformitetserklæring
Δηλωση συμμορφωσησζ ΕΟΚ
EU Försäkran om överensstämmelse
EU-vaatimustenmukaisuusvakuutus

Hiermit erklären wir, daß unser Produkt, Typ:
We hereby declare that our product, type;
Nous déclarons par la présente que notre produit, type:
Por la presente declaramos que nuestro producto, tipo:
Com a presente, declaramos que o nosso produto, tipo:
Con la presente dichiariamo che il nostro prodotto tipo:
Hiermee verklaren wij dat ons produkt, type:
Hermed erklaerer vi, at vores produkt af typen:
Με την παρσυσα δηλωνουμε, οτι το προιον μαφ, τυπου:
Härmed försäkrar vi att var produkt, typ:
Taten vkuutamme, että tuotteemme, tyyppi:

| **CALOMAT 6E** | **CALOMAT 6F** |
|---|---|
| 7MB2521-xxxxx-xxxx | 7MB2511-xxxxx-xxxx |
| 7MB2527-xxxxx-xxxx | 7MB2517-xxxxx-xxxx |

folgenden einschlägigen Bestimmungen entspricht:
complies with the following relevant provisions:
correspond aux dispositions pertinentes suivantes:
satisface las disposiciones pertinentes siguientes:
esta em conformidade com as disposições pertinentes, a saber:
è conforme alle seguenti disposizioni pertinenti:
voldoet aan de eisen van de in het vervolg genoemde bepalingen:
overholder følgende relevante bestemmelser:
αυταποκπιεται στσυφ ακολουθουφ σξετικουφ κανονισμουφ:
uppfyller följande tillämpliga bestämmelser:
täyttää seuraavat asiaankuuluvat vaatimukset:

Niederspannungsrichtlinie (73/23/EWG und 93/68/EWG)
Low voltage guidlines (73/23/EEC and 93/68/EEC)
Directive sur les basses tensions (73/23/CEE et 93/68/CEE)
Reglamento de baja tensión (73/23/MCE y 93/68/MCE)
Directriz relativa à baixa tensão (73/23/EWG e 93/68/EWG)
Direttiva sulla bassa tensione (73/23/CEE e 93/68/CEE)
Laagspanningsrichtlijn (73/23/EEG en 93/68/EEG)
Lavspændingsdirektiv (73/23/EØF og 93/68/EØF)
Κατευθυτηπια οδηγα πεπι ξαμηλζ τασηζ (73/23/ΕΟΚ και 93/68/ΕΟΚ)
Lågspänningsdirektiv (73/23/EEG ja 93/68/EEG)
Pienjännitedirektivi (73/23/ETY ja 93/68/ETY)

EMV-Richtlinie (89/336/EWG, 91/263/EWG, 92/31/EWG, 93/68/EWG und 93/97/EWG)
EMC guideline (89/336/EWC, 91/263/EWC, 92/31/EWC, 93/68/EWC and 93/97/EWC)
Directive CEM (89/336/CEE, 91/263/CEE, 92/31/CEE, 93/68/CEE et 93/97/CEE)
Reglamento de compatibilidad electromagnética (89/336/MCE, 91/263/MCE, 92/31/MCE, 93/68/MCE y 93/97/MCE)
Directriz relativa à compatibilidade electro-magnética (89/336/EWG, 91/263/EWG, 92/31/EWG, 93/68/EWG e 93/97/EWG)
Direttiva sulla compatibilità elettromagnetica (89/336/CEE, 91/263/CEE, 92/31/CEE, 93/68/CEE e 93/97/CEE)
EMV-richtlijn (89/336/EEG, 91/263/EEG, 92/31/EEG, 93/68/EEG en 93/97/EEG)

Direktiv om elektromagnetisk forligelighed (89/336/EØF, 91/263/EØF, 92/31/EØF, 93/68/EØF og 93/97/EØF)
Κατευθυτηπια οδηγα πεπι ηλεκτπομαγνητικηζ σνμβατοτηταζ (89/336/EOK, 91/263/EOK, 92/31/EOK, 93/68/EOK και 93/97/EOK)
EMV-direktiv (89/336/EEG, 91/263/EEG, 92/31/EEG, 93/68/EEG ja 93/97/EEG)
Sähkömagneettisen mukautuvuuden direktivi (89/336/ETY, 91/263/ETY, 92/31/ETY, 93/68/ETY en 93/97/ETY)

Angewendete harmonisierte Normen, insbesondere:
Applied harmonized standards, in particular:
Normes harmonisées, notamment:
Normas armonizadas utilizadas, particularmente:
Nomas harmonizadas utilizadas, em particular:
Norme armonizzate applicate, particolarmente:
Grbruikte gehamiseerde normen, in het bijzondere:
Anvendte hasrmoniserede normer, især:
Εφαπμδσεθεντα εναπμονισμενα ππστν πα, ειδικοτεπα:
Tillämpade harmoniserade standarder, särskilt:
Käytetyt yhdenmukaiset standardit, etenkin:

**EN61326/A1**
**EN61010-1**

# SIEMENS

Siemens Aktiengesellschaft
Bereich Automatisierungstechnik
Geschäftsgebiet Prozeßanalytik
PI 2
D-76181 Karlsruhe

Karlsruhe, April 2002

gez. Dr. Diedrich
(GZ-Leitung)

gez. van Dycke
(Betriebsleitung)

Translation

(1) **STATEMENT OF CONFORMITY**

(2) Equipment or Protective System intended for use in potentially explosive atmospheres - **Directive 94/9/EC**

(3) Test certificate number

**TÜV 01 ATEX 1686 X**

(4) Equipment or Protective System: Gasanalysers types OXYMAT 6F and ULTRAMAT 6F

(5) Manufacturer: Siemens AG

(6) Address: Östliche Rheinbrückenstraße 50
D-76187 Karlsruhe

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV Hannover/Sachsen-Anhalt e.V., TÜV Certification Body N° 0032, notified body in accordance with Article 9 of the Council Directive 94/9/EC of March 23, 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report N° 01PX03510.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

**EN 50 021: 1999**

(10) If the sign "X" is placed after the certification number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination certificate relates only to the design and construction of the specified equipment or protective system according to Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and placing on the market of this equipment or protective system.

(12) The marking of the equipment or protective system shall include the following:

**II 3 G EEx n R II T6 resp. T4**

**TÜV Hannover/Sachsen-Anhalt e.V.**
**TÜV CERT-Zertifizierungsstelle**
**Am TÜV 1**
**D-30519 Hannover**

**Hanover, 2001-03-14**

**Head of the Certification Body**





(13) **SCHEDULE**

(14) **STATEMENT OF CONFORMITY N° TÜV 1686 X**

(15) Description of equipment or protective system

Gas analysers of the OXYMAT 6F and ULTRAMAT 6F types conforming to this Statement of Conformity serve the purpose of measuring the individual components in gas mixtures which are not explosive. They can be set up and operated in areas in which Category 3 apparatus are necessary.
Electronic analysis systems and a control unit are located in the left-hand part of the housing, and are virtually identical in all versions of the analyser. In the right-hand part of the housing there are specific sensor components for each type of gas analyser, and measurement gas pipes and connections.

The ambient temperature range is +5°C to +45°C.

The temperature class depends on the version of the analysers, and can be seen from the following table:

| Gas analyser type | Temperature class |
|---|---|
| OXYMAT 6F and ULTRAMAT 6F without heated measurement gas route | T6 |
| ULTRAMAT 6F with heated measurement gas route | T6 |
| OXYMAT 6F with heated measurement gas route | T4 |

Electrical data
(Connecting terminals for circuits in left-hand part of housing)

Power supply circuit ..... 100 ... 120 V a. c., 48 ... 63 Hz or
210 ... 240 V a. c., 48 ... 63 Hz
$U_m$= 264 V a. c.

Analogue output ..... 0/2/4 ... 20 mA, floating, impedance: 750
optionally
in type of protection intrinsic safety EEx ia/ib IIC/IIB
as shown on the test certificate of an associated apparatus

Relay outputs ..... 24 V, 1 A a. c. or 1 A d. c.
(6 switch-over contacts)

Serielle Schnittstelle ..... RS 485

Serial interface ..... RS 485

Option: ..... Profibus PA
optionally
in type of protection intrinsic safety EEx ia/ib IIC/IIB
according to the test certificate of a built in associated apparatus

Hint for the manufacturer

The test for the restricted breathing enclosure has to be carried out as a routine test in accordance with sub-section 27.2.3 of EN 50 021.

(16) Test documents are listed in the test report No. 01PX03510.

(17) Special conditions for safe use

1. Only devices non sparking in normal operation, which are suitable for the operation in explosion hazardous areas of the zone 2 and the conditions available at the place of operation, are allowed to be connected to non intrinsically safe circuits in the zone 2.
2. The analysers are only allowed to be used on media that are not inflammable. If they are inflammable, it must be ensured that their concentration in the air lies below the lower explosion limit (UEG).
3. The connections for a protection gas to the electronic part must be given gas-tight seals in case of the execution of the analysers in type of protection Pressurization "p".
4. It must be ensured that no potentially explosive atmosphere is present when the housing is opened.
5. When the analysers are being set up out of doors, sufficient protection from the sun must be installed.

(18) Essential Health and Safety Requirements

no additional ones

**Translation**

**1. SUPPLEMENT to**

**STATEMENT OF CONFORMITY No. TÜV 01 ATEX 1686 X**

of the company : Siemens AG
Östliche Rheinbrückenstraße 50
D-76187 Karlsruhe

The gas analysers according to the Statement of Conformity no. TÜV 01 ATEX 1686 X are supplemented by the type CALOMAT 6F.
The measurement gas pipe of the gas analyser type CALOMAT 6F is not heated.

The temperature class for the gas analyser type CALOMAT 6F is T6.

Electrical data
(Connecting terminals for circuits in left-hand part of housing)

Power supply circuit ..... 100 ... 120 V a. c., 47 ... 63 Hz or
200 ... 240 V a. c., 47 ... 63 Hz

All other details as well as the "Special conditions for safe use" and the "Hint for the manufacturer" remain unchanged for this 1. supplement.

The test documents are listed in the test report no. 02 YEX 166 332.

TÜV Hannover/Sachsen-Anhalt e.V.
TÜV CERT-Zertifizierungsstelle
Am TÜV 1
D-30519 Hannover

Hanover, 2002-04-19

Head of the
Certification Body

BA 02 03.02

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Translation

(1) # EC TYPE-EXAMINATION CERTIFICATE

(2) Equipment or protective system intended for use in potentially explosive atmospheres **- Directive 94/9/EC**

(3) EC-Type Examination Certificate Number

**TÜV 01 ATEX 1697 X**

| | | |
|---|---|---|
| (4) | Equipment or Protective System: | Gasanalysers types OXYMAT 6F and ULTRAMAT 6F |
| (5) | Manufacturer: | Siemens AG |
| (6) | Address: | Östliche Rheinbrückenstraße 50<br>D-76187 Karlsruhe |

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV Hannover/Sachsen-Anhalt e.V., TÜV CERT-Certification Body, notified body number N° 0032 in accordance with Article 9 of the Council Directive of the EC of March 23, 1994 (94/9/EC), certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential report N° 01PX06710.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

**EN 50 021: 1999 EN 60 079-14: 1997, Section 13 ZH 1/10, Sections 1.4.3.2; 2.3.1**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination certificate relates only to the design and construction of the specified equipment or protective system according to Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and placing on the market of this equipment or protective system.

(12) The marking of the equipment or protective system must include the following:

**II 2/3 G EEx n R P II T6 resp. T4 resp. T3 or**
**II 2/3 G EEx n P II T6 resp. T4 resp. T3**

**TÜV Hannover/Sachsen-Anhalt e.V.**
**TÜV CERT-Zertifizierungsstelle**
**Am TÜV 1**
**D-30519 Hannover**

**Hanover, 2001-04-06**

**Head of the Certification Body**





(13) **SCHEDULE**

(14) **EC-TYPE EXAMINATION CERTIFICATE N° TÜV 01 ATEX 1697 X**

(15) Description of equipment

Gas analysers of the OXYMAT 6F and ULTRAMAT 6F types serve the purpose of measuring the individual components in gas mixtures which may also be inflammable or occasionally form an explosive atmosphere when mixed with air.
Electronic analysis systems, which are virtually identical in all versions of the analyser, and a control unit are located in the left-hand part of the housing (This is the electronic part.). In the right-hand part of the housing there are specific sensor components for each type of gas analyser, and measurement gas pipes and connections (This is the physical part.).
The gas analysers are executed in type of protection Simplified Pressurization with continuous flow. The internal release from the Containment System (CS) can be regarded as limited if all the relevant technical safety precautions are taken.
The electronic part of the gas analysers may optionally be excluded from the Simplified Pressurization. According to the Statement of Conformity TÜV 01 ATEX 1686 X the electronic part is executed as a restricted breathing enclosure.
If required, a number of housings in type of protection Simplified Pressurization can connected pneumatically in sequence.
The monitoring system for the type of protection Simplified Pressurization with continuous flow does not form part of the EC-type examination certificate.
The gas analysers can be set up and operated in potentially explosive areas in which Category 3 apparatus are necessary.

The permissible ambient temperature range is +5°C to +45°C.

The temperature class depends on the version of the analysers, and can be seen from the following table:

| Gas analysers type | Temperature class | |
|---|---|---|
| | Without heated measurement gas route | With heated measurement gas route |
| ULTRAMAT 6F | T6 | T6 |
| OXYMAT 6F | T4 | T3 |

Elektrical data

(Connecting terminals for circuits in left-hand part of housing)

Power supply circuit ..... 100 ... 120 V a. c., 48 ... 63 Hz or
210 ... 240 V a. c., 48 ... 63 Hz
$U_m$= 264 V a. c.

Analogue output ..... 0/2/4 ... 20 mA, floating, impedance: 750
optionally
in type of protection intrinsic safety EEx ia/ib IIC/IIB
as shown on the test certificate of an associated apparatus

Relay outputs ..... 24 V, 1 A a. c. or 1 A d. c.
(6 switch-over contacts)

Serielle Schnittstelle ..... RS 485

Serial interface ..... RS 485

Option: ..... Profibus PA
optionally
in type of protection intrinsic safety EEx ia/ib IIC/IIB according to the test certificate of a built in associated apparatus

Data for the Simplified Pressurization with continuous flow

| | | |
|---|---|---|
| Free internal volume of the housing ..... | 50 | dm³ |
| Protective gas ..... | Inert gas | |
| Minimum over-pressure at the measurement point of the Ex-P monitoring device ..... | 50 | Pa* |
| Maximum over-pressure at the measurement point of the Ex-P monitoring device ..... | 165 | hPa* |
| Minimum volume flow for the continuous flow ..... | 1 | dm³/min |

Minimum values for a required purging with inert gas if necessary:

| | | |
|---|---|---|
| Minimum volume of protective gas: ..... | 250 | dm³ |
| Minimum volume flow of protective gas: ..... | 50 | dm³/min |
| Minimum purging time ..... | 5 | min |

* When more than one housing is being purged, these values have to be measured at the last one in the series.The minimum volume of protective gas and the minimum volume flow for the continuous flow have to be raised accordingly.

Measurement gas pressures

| | | |
|---|---|---|
| OXYMAT 6F ..... | min. | 500 hPa (absolute) |
| | max. | 3000 hPa (absolute) |
| ULTRAMAT 6F ..... | min. | 600 hPa (absolute) |
| | max. | 1500 hPa (absolute) |

Instructions for the manufacturer

The test to ensure that the electronic part is vapour-proof has to be carried out as a routine test in accordance with sub-section 27.2.3 of EN 50 021.
The pressure test on the containment systems has to be carried out as a routine test.

(16) Test documents are listed in the test report No. 01PX06710.

(17) Special conditions for safe use

1. The monitoring equipment for the Simplified Pressurization does not form part of this EC type-examination certificate. It is the responsibility manufacturer or the operator of the control unit to ensure that the monitoring of the minimum volume flow for the continuous flow meets the required safety standard (1-fault safety).





2. The monitoring unit for the Simplified Pressurization must be checked for function. The data for the parameters relevant to safety given in this EC type-examination certificate must be taken into account here.
3. Suitable flame barriers have to be built in to the measurement gas intake and outlet pipes on the OXYMAT 6F gas analyser if there is any possibility that the measurement gases could be potentially explosive.
4. If it can not be excluded, that the measurement gases could be potentially explosive, the comparison gas should be led in to the OXYMAT 6F before it is started up, and monitored thereafter.
5. It must be ensured that no higher absolute measurement gas pressure than 3 bar can occur on the OXYMAT 6F or 1.5 bar on the ULTRAMAT 6F.
6. After any installation or maintenance work has been carried out that could affect the Containment System, a check for leaks must be carried out in accordance with the manufacturer's operating instructions.
7. There will be no need to purge the housing(s) if it can be ensured that the atmosphere inside the housing and connected pipes is well below the lowest limited for a potential explosion (a maximum of 25% of the UEG). It is recommended that the measurement gas pipes should be closed if the analyser is to be out of use for any length of time without the housing being constantly flushed, as this can prevent any possibility of contamination of the interior of the housing by the Containment System.
8. The connections for protective gas to the electronic part must be given gas-tight seals in the case of the execution of the electronic part as a restricted breathing enclosure.
9. If the Simplified Pressurization fails, an alarm must be set off and the operator must take all remedial measures to maintain the safety of the system.
10. It must be ensured that no potentially explosive atmosphere is present when the housing is open, and if there is any danger a waiting period of 10 minutes must be observed.
11. Only devices non sparking in normal operation, which are suitable for the operation in explosion hazardous areas of the zone 2 and the conditions available at the place of operation, are allowed to be connected to non intrinsically safe circuits in the zone 2.
12. When the analysers are being set up out of doors, sufficient protection from the sun must be installed.

(18) Essential Health and Safety Requirements

| Section | Subject |
|---|---|
| 1.1 | Choice of substances |

The relevant requirements will be checked and the results recorded in the test report mentioned under (16).

**Translation**

**1. SUPPLEMENT to**

**EC TYPE-EXAMINATION CERTIFICATE No. TÜV 01 ATEX 1697 X**

of the company : Siemens AG
Östliche Rheinbrückenstraße 50
D-76187 Karlsruhe

The gas analysers according to the EC-Type Examination Certificate no. TÜV 01 ATEX 1697 X are supplemented by the type CALOMAT 6F.
The measurement gas pipe of the gas analyser type CALOMAT 6F is not heated.

The temperature class for the gas analyser type CALOMAT 6F is T4.

Electrical data
(Connecting terminals for circuits in left-hand part of housing)

Power supply circuit ..... 100 ... 120 V a. c., 47 ... 63 Hz or
200 ... 240 V a. c., 47 ... 63 Hz

For the gas analyser type CALOMAT 6F the "Special conditions for safe use" are supplemented as follows:

13. Suitable flame barriers have to be built into the measurement gas intake and outlet pipes of the CALOMAT 6F gas analyser if explosive atmosphere is likely to occur in the measurement gas pipes.

All other details remain unchanged for this 1. supplement.

The test documents are listed in the test report no. 02 YEX 166 294.

**TÜV Hannover/Sachsen-Anhalt e.V.**
**TÜV CERT-Zertifizierungsstelle**
**Am TÜV 1**
**D-30519 Hannover**

**Hanover, 2002-04-19**

**Head of the**
**Certification Body**

BA 02 03.05

**Page 1/1**

TÜV SÜDDEUTSCHLAND

# Test Certificate
**BB-NEG/01 Gr03X**

**Possibility to use the Gas Analyzer CALOMAT 6E without purging of the housing**

| | |
|---|---|
| **Certificate Holder** | Siemens AG<br>A&D PI 2CA<br>76181 Karlsruhe<br>Germany |
| **Test Unit** | Gas Analyzer CALOMAT 6E<br>Manufacturer Siemens |
| **Test Basis** | EN 50016 and EN 50079-14, actual versions; ExRL, Harzadous Area Regulations of the BG Chemie (ZH 1/10) |
| **Scope of the Test** | Evalution of the tightness of the Containment System in conjunction with the operation of the analyzer without purging |
| **Documents** | - Technical Description CALOMAT 6E (C 6E)<br>- Leak test of the C6 E with calculations<br>- Operating Manual C6 E<br>- Data sheet for O-Rings FKM resp. FFKM<br>- Decline measurement of $CO_2$ in the housing with no moving ambient air |
| **Test performed** | November 19, 2001 |
| **Test Results** | see page 2 |

Certified

K.-D. Greß

Technische Überwachung TÜ SW Bezirk SW

Bau und Betrieb

Niederlassung Karlsruhe

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Karlsruhe, 2001-11-28
BB-NEG-KAR/Gr/Wei
ColomatTestcertificate.doc

Das Dokument besteht aus:
2 Seiten

TÜV Süddeutschland
Bau und Betrieb GmbH
Aufsichtsratsvorsitzender:
Karsten Puell
Geschäftsführer:
Roland Ayx (Sprecher)
Dr. Kurt Vinzens
Sitz: München
Amtsgericht München
HRB 56 869



TÜV SÜDDEUTSCHLAND

## 1. Tests Results

The 19„ rack housing of the CALOMAT 6E does not need to be purged as

- the released amount of gases from the containment (gas path) can be regarded as limited, and
- the gas exchange rate of the housing is sufficiently high enough, so that
- any enrichment of the released gases above the LEL level is not possible.

Therefore flammable gases or gas mixtures can be used as sample gas.

## 2. Special Conditions

- Flammable sample gases or gas mixtures according to zone 2 conditions (i.e. rarely or potentially explosive for a short period of time) allow only the temperature class up to T3.
- If the 19„ rack housing is mounted in a rack a „natural„ air exchange with the ambient air must be guaranteed.
- To guarantee continuously the technical tightness of the containment system a leakage test must be performed regularly according to the specifications in the manual. The user is responsible for the frequency of this test; however, potentially negative effects of the sample gases to the containment system must be taken into account.

## 3. Others

- Detailed explanations to this test report and certificate BB-NEG/01 Gr03X are available on request.

Karlsruhe, November 19, 2001
BB-NEG-KAR Greß/Wei

# Installation Guidelines 2


| | | |
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## 2.1 Safety Information

**Warning**

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

**Electrical safety**
Certain parts in this analyzer carry dangerous voltages. The housing must be closed and grounded before switching on the analyzer. Death, personal injury and/or damage to property may result if this is not observed. Please also refer to Section 2.4.

**Materials of the gas path**
No aggressive gases must be passed into the analyzer, in particular those to which the wetted parts materials are **not** resistant.

**Purging of housing**
As a result of leakages in the sample gas path, a release of flammable components may occur which can be considered as limited in line with the Technical data. With the **CALOMAT 6E** rack-mounted analyzer, purging of the housing can be omitted if it can be guaranteed that natural ventilation takes place in the environment of the housing (see also report BB-NEG/01 Gr03X from the TÜV Süddeutschland (Southern German Technical Inspectorate)). This consideration only applies to a limited extent when using toxic sample gases. The maximum threshold limit value (TLV) must be considered as the basis for judgement in such cases.

With the **CALOMAT 6F** wall mount analyzer, purging of the housing must always be provided in such cases, and the flow should be approx. 1 l/min. Purging may only be omitted if toxic gases or gas mixtures below the lower explosion limit (LEL) are passed into the analyzer. The gas displaced by purging must be connected using suitable equipment, and routed for environmentally friendly disposal via an exhaust line.

**Flammable sample gases**
Flammable gases or gas mixtures up to temperature class **T3** may only be passed into the analyzer if they are only not explosive or only seldom and briefly explosive (see also report BB-NEG/01 Gr03X from the TÜV Süddeutschland (Southern German Technical Inspectorate)).
With occasionally explosive sample gases, the sample gas inlet and outlet must be provided with flame lock-outs. Frequently or permanently explosive gas mixtures must not be used!

**Warning**

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

**Ex protection**
The **CALOMAT 6E** may only be used in potentially explosive atmospheres if particular protective measures are observed. These must be clarified with the responsible Ex authorities. Conformity and type examination certificates according to EG 94/9 (ATEX 100) are available for the **CALOMAT 6F**, confirming its use as equipment for potentially explosive atmospheres of zone 2 or 1 (device category II3G, II2/3G or II2G). It is absolutely essential to observe the “Special conditions” of the certificates.

**Liability**
Following commissioning, the total responsibility is finally in the hands of the owner.

## 2.2 Installation Requirements

### 2.2.1 General Information

**Mounting conditions**

A location should be selected which is as free as possible from vibration.

Make sure during operation that the permissible ambient temperature of 5 °C to 45 °C is retained (see Section 3.7 ”Technical data”). Also ensure that the analyzer is not exposed to direct solar radiation.

A **CALOMAT 6E** rack-mounted analyzer must be placed on supporting rails if it is to be fitted in a cabinet or desktop housing. Assembly only at the front is insufficient because the weight of the analyzer would place too great a load on the chassis. Ensure there is sufficient ventilation between rack-mounted analyzers.

When installing the CALOMAT 6F wall mount analyzer, use a bracket which is sufficiently dimensioned for the weight of the analyzer. The housing must be securely anchored at all four mounting points.

**Cable glands**

Required torques and permissible cable diameters for the PG screwed glands:

PG 13.5: 3.8 $\pm$ 0.2 Nm; cable diameter: 6...12 mm
PG 16: 5.0 $\pm$ 0.2 Nm; cable diameter: 10...14 mm

**Gas connections**

**CALOMAT 6E rack-mounted analyzer:**
Couplings with a pipe diameter of 6 mm or 1/4”

**CALOMAT 6F wall mount analyzer:**
Screwed glands for a pipe diameter of 6 mm or 1/4”

Refer to the dimensional drawing (Fig. 2–10) for the assignments of the gas connections.

**Sample gas line**

Select a material which is suitable for the sample gas for the inlet and outlet piping. When tightening the union nuts on the gas couplings or screwed glands, always use an appropriate spanner for correct counterlocking, otherwise it is possible that the gas path will leak.

**Purging gas connection**

Purging is not necessary for the **CALOMAT 6E** if there is a sufficient exchange of gas between the housing and the environment. You can find details in the report BB–NEG/01 Gr03X from the TÜV Süddeutschland (Southern German Technical Inspectorate).

The **CALOMAT 6F** is equipped with four purging gas couplings (10 mm or 3/8"). The positions are shown in Fig. 2–10. If necessary, the housing can be purged with inert gas (e.g. $N_2$). Depending on the density of the sample gas, purging of the housing should be upwards or downwards in order to avoid accumulation of explosive or toxic gases in the housing.
It is recommendable to commence with purging of the left half of the housing. The purging gas must be connected for environmentally friendly disposal using a hose of appropriate cross-section. The purging gas pressure in the housing must not permanently exceed 165 hPa, or short-term 250 hPa.

### 2.2.2 Special Conditions for Analyzers of Category II3G

#### 2.2.2.1 Degree of Protection EEx nR

**Application**

In **gas-proof analyzers** (degree of protection EEx nR), only sample gases may be used whose composition is always below the lower explosion limit (LEL).
Connection of flammable or occasionally explosive gas mixtures is not permissible for this Ex degree of protection!

**Installation information**

The wetted parts materials must be resistant to the sample gas.

The requirements of **EN 60079-14** (VDE 0165) must be observed for the installation of gas-proof analyzers. Particular care must be taken with the cable inlets (PG screwed glands) since carelessness may make the analyzer no longer gas-proof.

The purging gas couplings must be closed gas-tight.

If signals (e.g. analog output 4...20 mA) are to be connected to a potentially explosive atmosphere of zone 1, they must be intrinsically-safe. This requires additional retrofitting of the analyzer with energy limiting modules. The Ex identification of these modules must be applied clearly-visible on the housing.

**Notes on operation**

The control panel (window and keyboard) must only be cleaned with a moist cloth.

The keyboard must only be used for servicing purposes (diagnostics, calibration/adjustment).

Before opening the analyzer, make sure that there is no explosion hazard.

### 2.2.2.2 Degree of Protection EEx nP

**Application**

Flammable gases or gas/air mixtures (sample gases) whose composition is only occasionally above the lower explosion limit (LEL) may be connected to **simplified pressurized analyzers** (degree of protection EEx nP).
Connection of frequently or permanently explosive gas mixtures is not permissible with this Ex degree of protection!

**Installation information**

The regulations for the installation of electrical equipment in potentially explosive atmospheres according to **EN 60079-14** (DIN VDE 0165), especially Section 13, must be observed. Furthermore, the statements ("Special conditions") made in the EC-Type Examination Certificate must be observed.

**Flame lock-outs**

Appropriate flame lock-outs must be provided at the sample gas inlet and outlet when connecting occasionally explosive gas mixtures.

**Protective gas**

When connecting flammable gases, an inert gas (e.g. $N_2$) must be used as the protective gas.
Depending on the density of the sample gas, the inlet for the protective gas on the right half of the housing must be selected as follows:
Density of sample gas > density of protective gas:
inlet 8, outlet 7
Density of sample gas < density of protective gas:
inlet 7, outlet 8.

**Pressurized enclosure**

Before starting up, preliminary purging must be carried out with at least five 5 times the housing volume (approx. 50 l). This preliminary purging can also be started and terminated manually.

To achieve a pressurized enclosure, permanent purging of the housing must be carried out with an excess pressure of at least 50 Pa; the flow rate of the protective gas must be at least 1 l/min. Monitoring of the excess pressure must be carried out for reliability, and the flow rate for fail-safety (redundant), using appropriate equipment. Measures must be taken immediately in the event of a failure in order e.g. to guarantee system safety. The minimum internal diameter and length of the protective gas exhaust lines must be dimensioned such that an internal housing pressure of 165 hPa is **not exceeded** on the one hand, and that the flow rate of the protective gas is at least 1 l/min on the other.

It is always possible to connect several analyzers in series. The preliminary purging duration and the flow rate for continuous purging must be matched to the number of analyzers. Furthermore, the volumes of the protective gas lines must also be considered. The flow rate of the protective gas must be monitored at the purging gas outlet of the **last** analyzer.

It is additionally possible to only purge the right-hand half (approx.
25 l) of the housing in which the analyzer section is present. The left-hand half is a gas-proof enclosure and does not require purging; the additional information on the gas-proof function must be observed (see type of protection EEx nR).

If signals (e.g. analog output 4...20 mA) are to be routed in 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.

**Maintenance**

The analyzer should be subject to annual maintenance to check the electrical safety and functionality, especially the checking for leaks in the containment system.

A leak test must also be carried out following servicing work on the containment system (see Section 4.2).

Owners can judge whether the maintenance interval can be extended in individual cases if no negative influences are expected as far as chemical corrosion of the gaskets wetted by the sample gas is concerned.

All gaskets of the containment system must be replaced if the leak test is negative.

**Notes on operation**

The control panel (window and keyboard) must only be cleaned with a moist cloth.

The keyboard must only be used for servicing purposes (diagnostics, calibration/adjustment).

Before opening the analyzer, make sure that there is no explosion hazard.

## 2.3 Gas Conditioning

The sample gas must be sufficiently conditioned to prevent contamination of the parts through which it flows and the associated errors in measurement. It should particularly be ensured that the dew point of the sample gas is always at least 1 K below the lowest ambient temperature of the analyzer.

The sample gas inlet is usually preceded by the following devices (see also Fig. 2-1):

- Gas sampling device
- Sample gas cooler
- Filter
- Gas suction pump.

Depending on the composition of the sample gas, additional equipment may be necessary such as e.g. a washbottle, additional filters and a pressure regulator.

**Caution**

**Insufficient gas conditioning may lead to contamination and/or failure of the analyzer cell.**

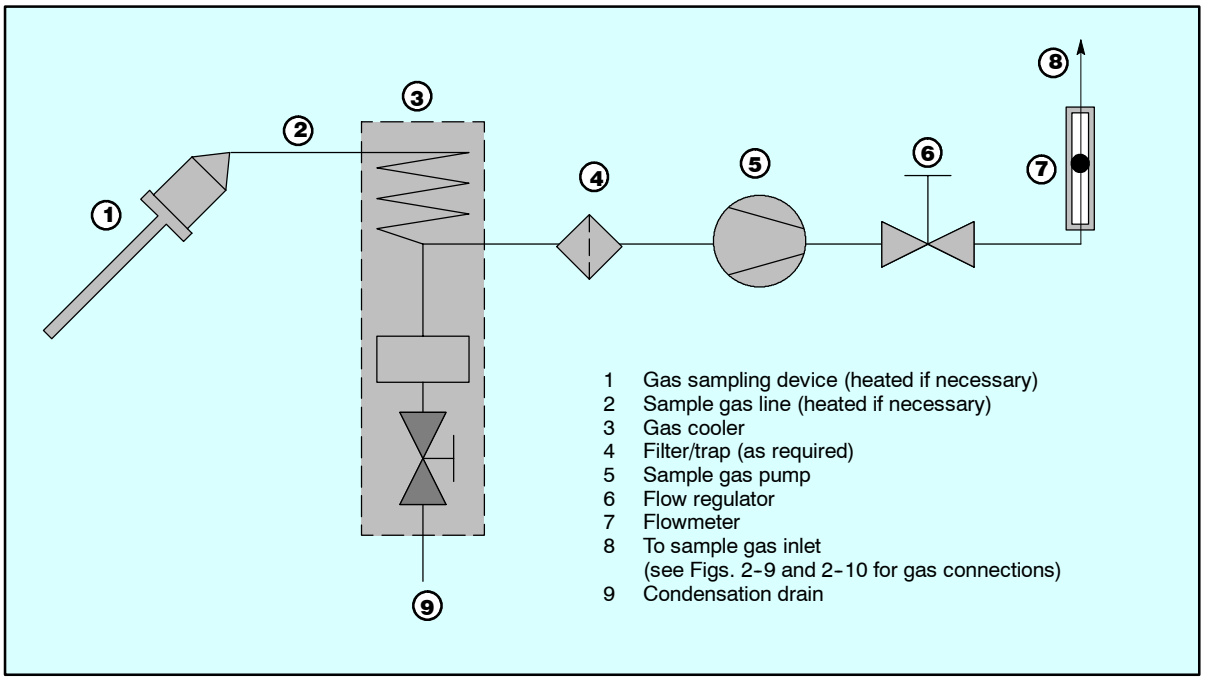


Fig. 2-1 Gas conditioning, example (not included in delivery)

## 2.4 Electric Connection

**Warning**

The respective country-specific standard for the installation of power systems with rated voltages below 1000 V (in Germany: VDE 0100).

Failure to observe these regulations may result in death, personal injury and/or damage to property.

### 2.4.1 Power Supply Connection

- The analyzer is supplied with an appliance plug which may only be connected to the power supply by qualified personnel (see Section 1.5). The power supply cable must include a protective earth conductor which must be connected to the chassis potential. The cross-section of the conductors must be ≥1 $mm^2$. The phase conductor must be connected to the identified position (L).
- The power cable must be routed separately from the signal cables.
- A circuit-breaker must be provided in the immediate vicinity of the analyzer (see rating plate for loading capacity). It must be readily accessible in this case.
- Check that the local mains voltage agrees with that specified on the label on the analyzer.
- Equipotential bonding must be provided on the housing of the **CALOMAT 6F** at the envisaged position (PE, Fig. 2-10).

### 2.4.2 Connection of Signal Cables

**Caution**

The signal voltages must be electrically isolated extra-low voltages (SELV).

- The signal cables in the rack-mounted analyzer **(CALOMAT 6E)** are connected to the DSUB plugs at the rear.
- In the wall mount analyzer **(CALOMAT 6F)**, the signal cables are connected using the terminal blocks A and B (option). These are located on the flange plate on the base of the left side of the housing (see also Fig. 2-10).
- RC elements must be connected according to Fig. 2-2 as a measure to suppress the generation of sparks across the relay contacts (e.g. limit relays). Note that the RC element results in a dropout delay for an inductive component (e.g. solenoid valve).
- Additionally make sure at you only use a non-polarized capacitor C.

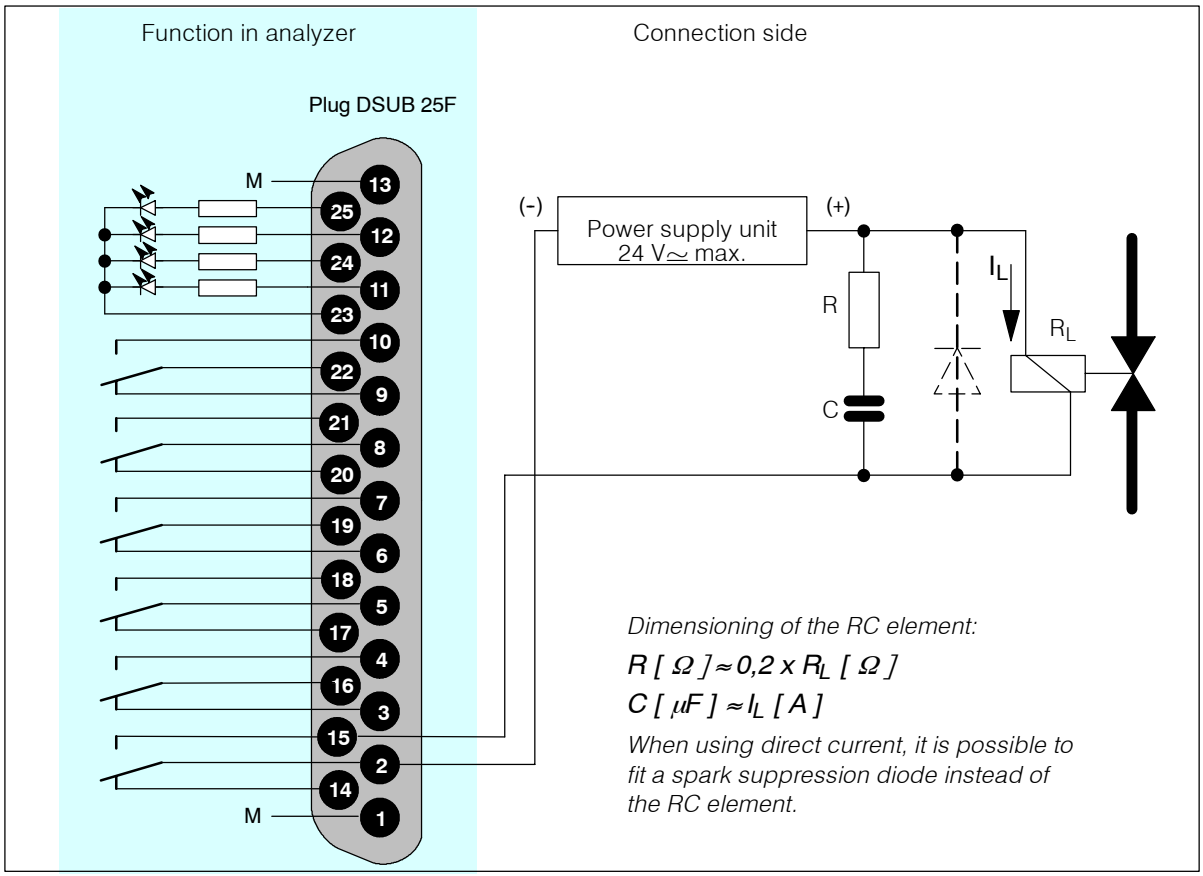


Fig. 2-2 Example of measure to suppress sparks on a relay contact

- The reference ground of the analog inputs is the housing potential.
- All signal cables must be shielded. Their shields must be connected to the shield of the DSUB plugs using a large-area contact, and applied to the housing potential.
- **CALOMAT 6E:**
  The cables to the relay outputs and binary inputs, the analog inputs and outputs, and the interface cable must be connected to the corresponding trapezoidal plug (DSUB plug) according to the pin assignment diagrams (Figs. 2-3 and 2-4). The conductor cross-section must be ≥0.5 $mm^2$. Cables of type JE-LiYCY ... BD are recommended. The cable length of the analog outputs depends on the load.
- **CALOMAT 6F:**
  The shield of the signal cables must be connected with a large-area contact and without interruptions to the respective PG screwed glands. The cable cores must be connected to the corresponding terminals according to the pin assignment diagrams (see Figs. 2-5 and 2-6). The conductor cross-section must be ≥0,5 $mm^2$. Cables of type JE-LiYCY ... BD are recommended. The cable length of the analog outputs depends on the load.

Details on the interface cable are described in Section 2.4.3.5 and in the ELAN interface description (Order No. C79000-B5274-C176).

### 2.4.3 Pin Assignments

#### 2.4.3.1 CALOMAT 6E Motherboard

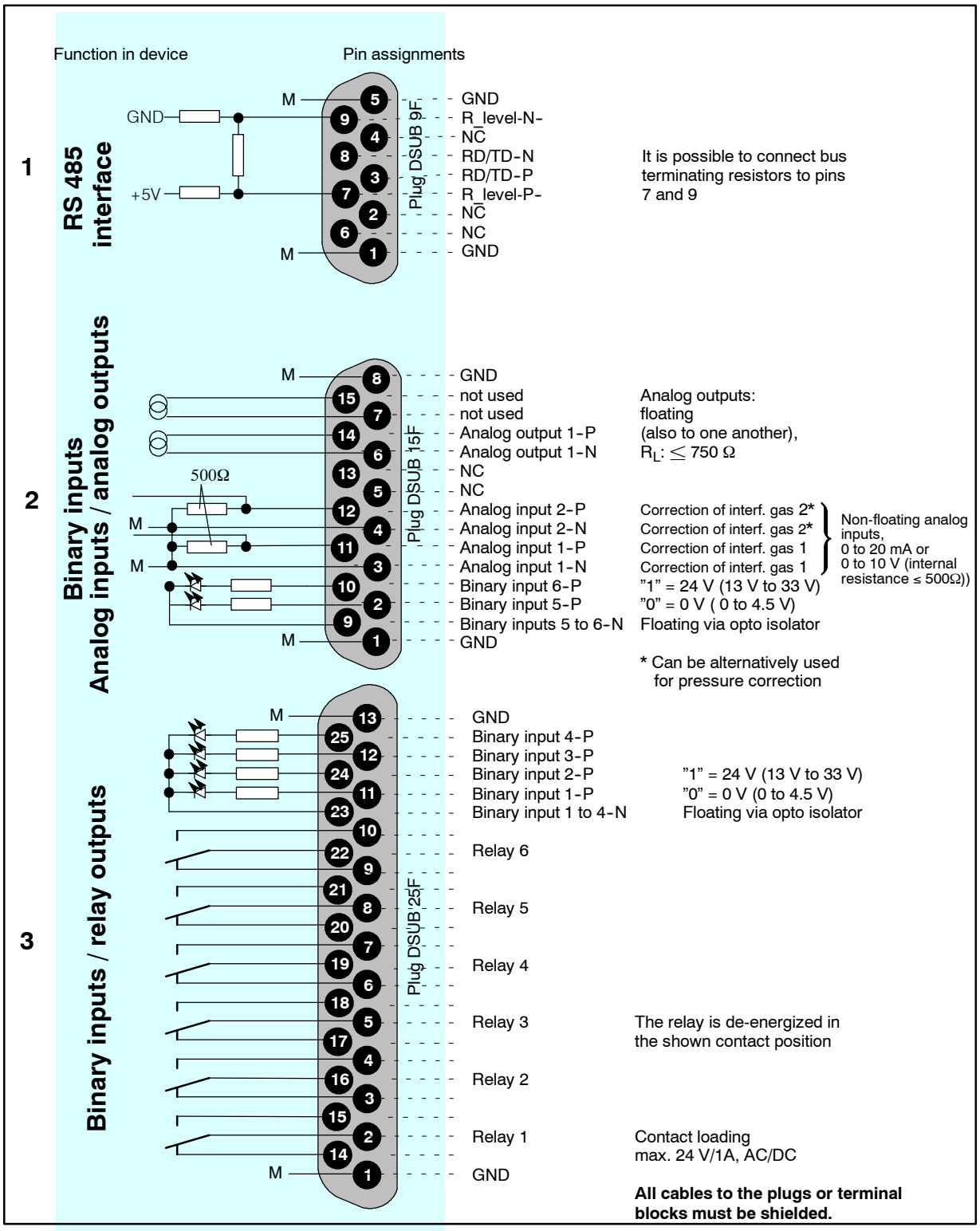


Fig. 2-3 Pin assignments of the CALOMAT 6E motherboard

### 2.4.3.2 CALOMAT 6E AUTOCAL Module

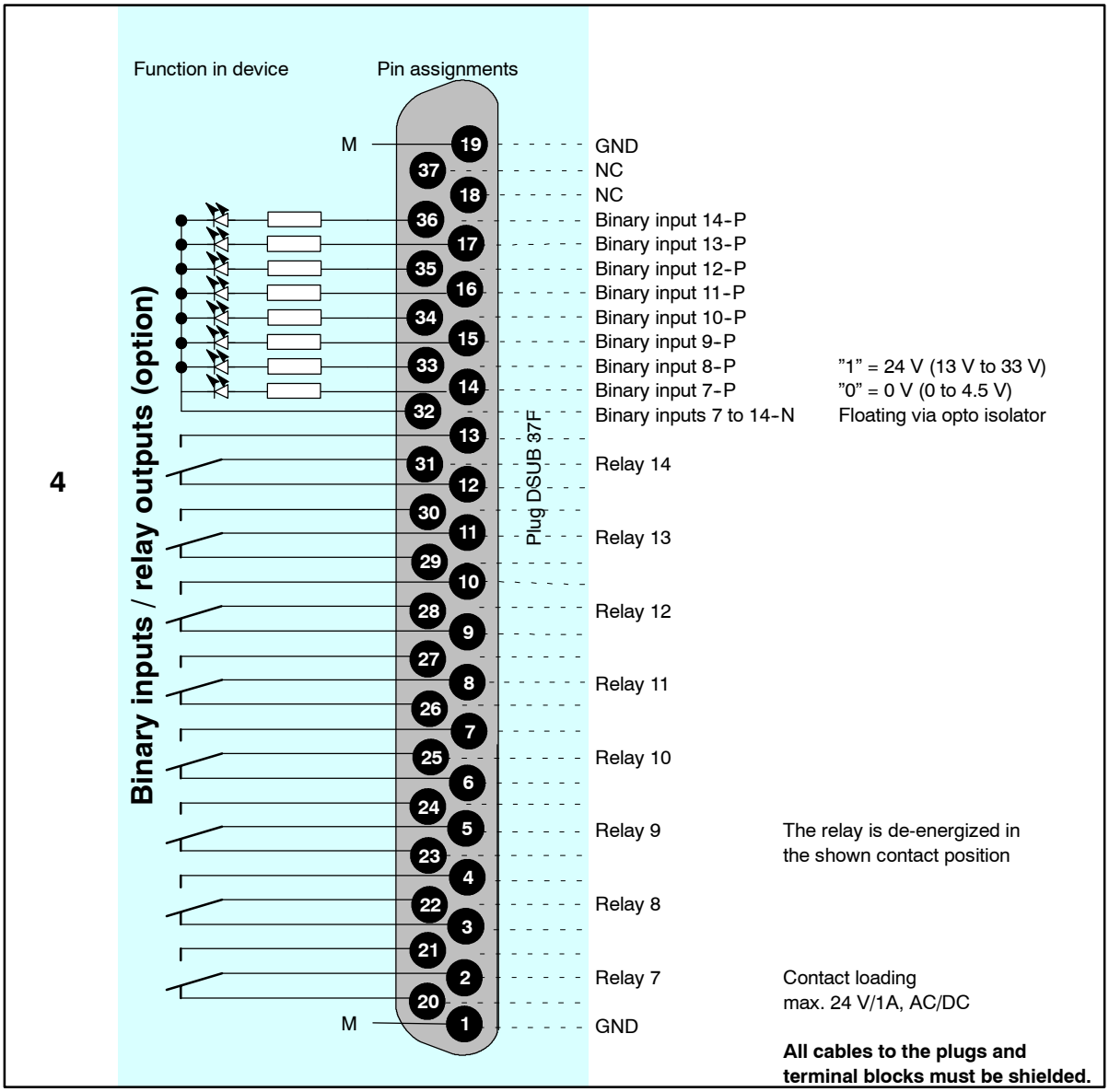


Fig. 2-4 Pin assignments of Autocal module

Other supplementary electronics (AK interface, Profibus, ...) are described in the supplied documents.

### 2.4.3.3 CALOMAT 6F Motherboard

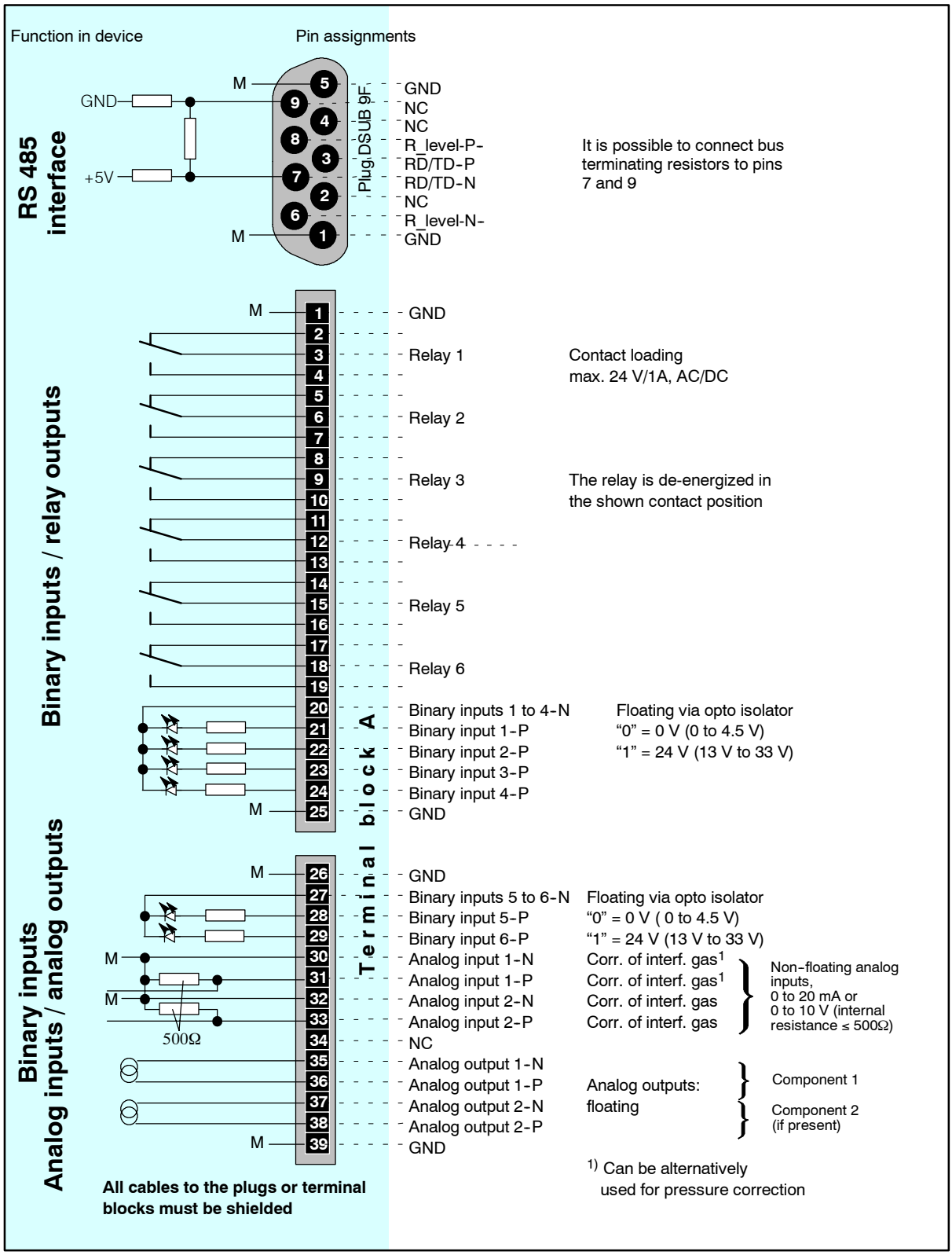


Fig. 2-5 Pin assignments of the **CALOMAT 6F**

### 2.4.3.4 CALOMAT 6F AUTOCAL Module

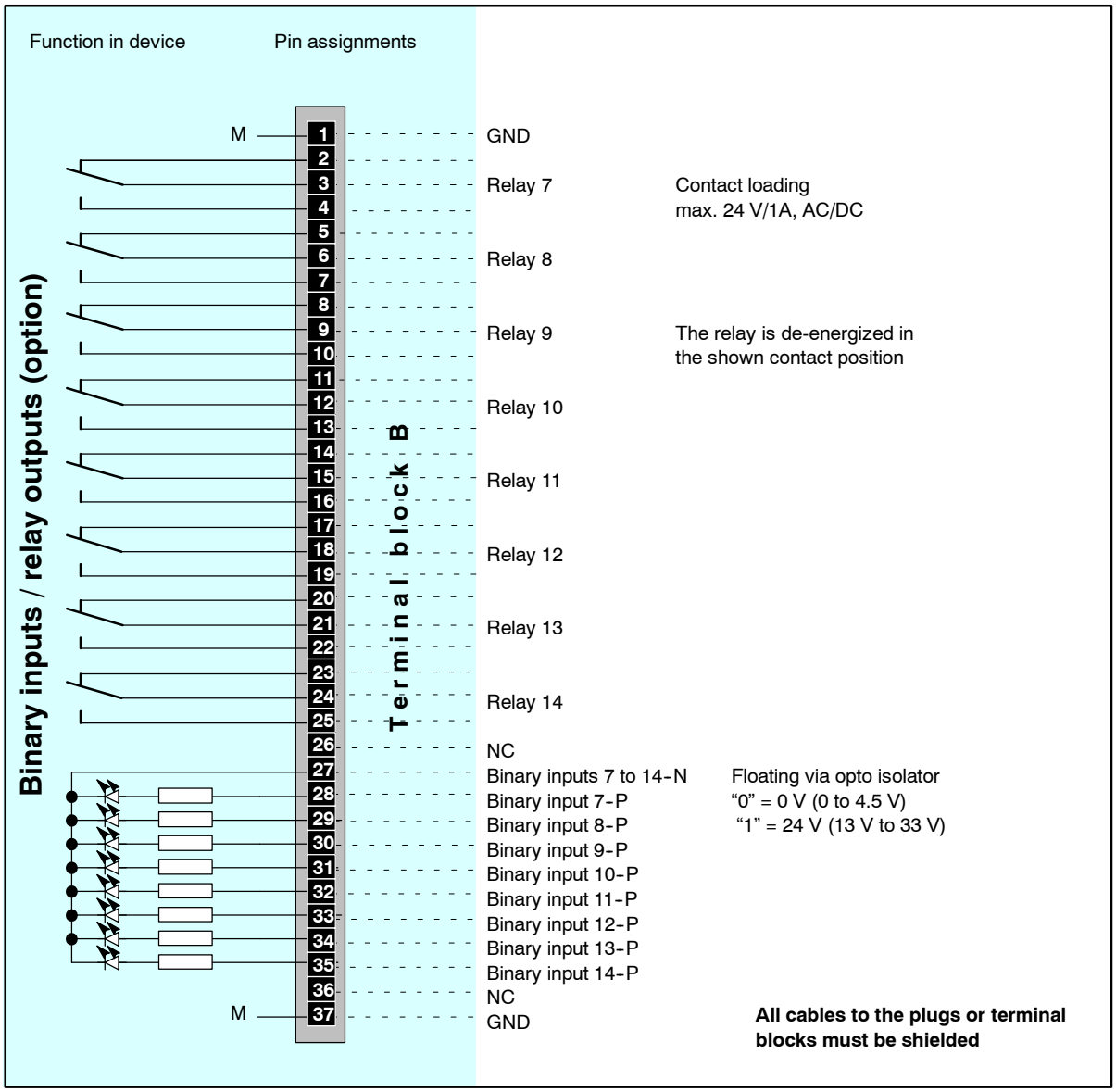


Fig. 2-6 Pin assignments of the **CALOMAT 6F** AUTOCAL module

Other supplementary electronics (AK interface, Profibus, ...) are described in the supplied documents.

### 2.4.3.5 ELAN Interface Cable

**Interface cable specification**

| | |
|---|---|
| Characteristic impedance | 100 ... 300 Ω, with a test frequency >100 kHz |
| Cable capacitance | Typically < 60 pF per meter |
| Conductor cross-section | > 0.22 $mm^2$, corresponds to AWG 23 |
| Cable type | Twisted in pairs, 1 x 2 conductors |
| Signal attenuation | Max. 9 dB throughout the complete length of the cable cross-section |
| Shielding | Copper braiding or braided shield and foil screen |

**Bus terminators**

To connect bus terminators, **pin 3** must be connected to **pin 7**, and **pin 8** to **pin 9**, in the first and last plugs of a bus line (see Fig. 2-7).

**Note**
With a cable length above 500 m, or with high interferences, it is advisable to install a repeater.
For further information, see *Function 73* (”ELAN configuration”) Section 5.2.5.

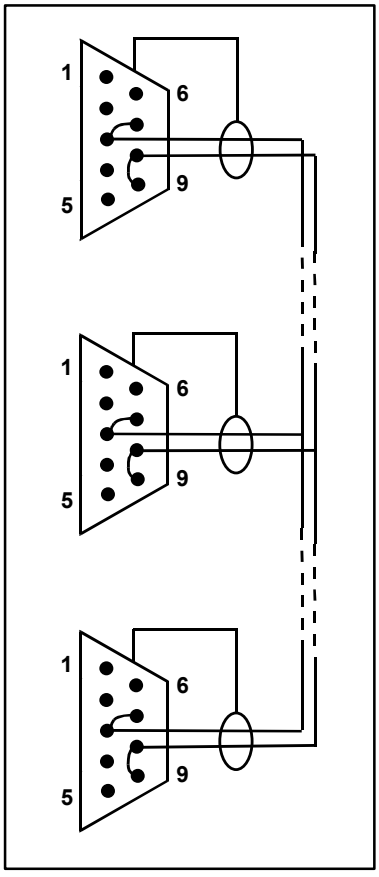


Fig. 2-7 Example of a bus cable with plug connections

## 2.5 Dimensional Drawings

### 2.5.1 CALOMAT 6E Rack-mounted Analyzer

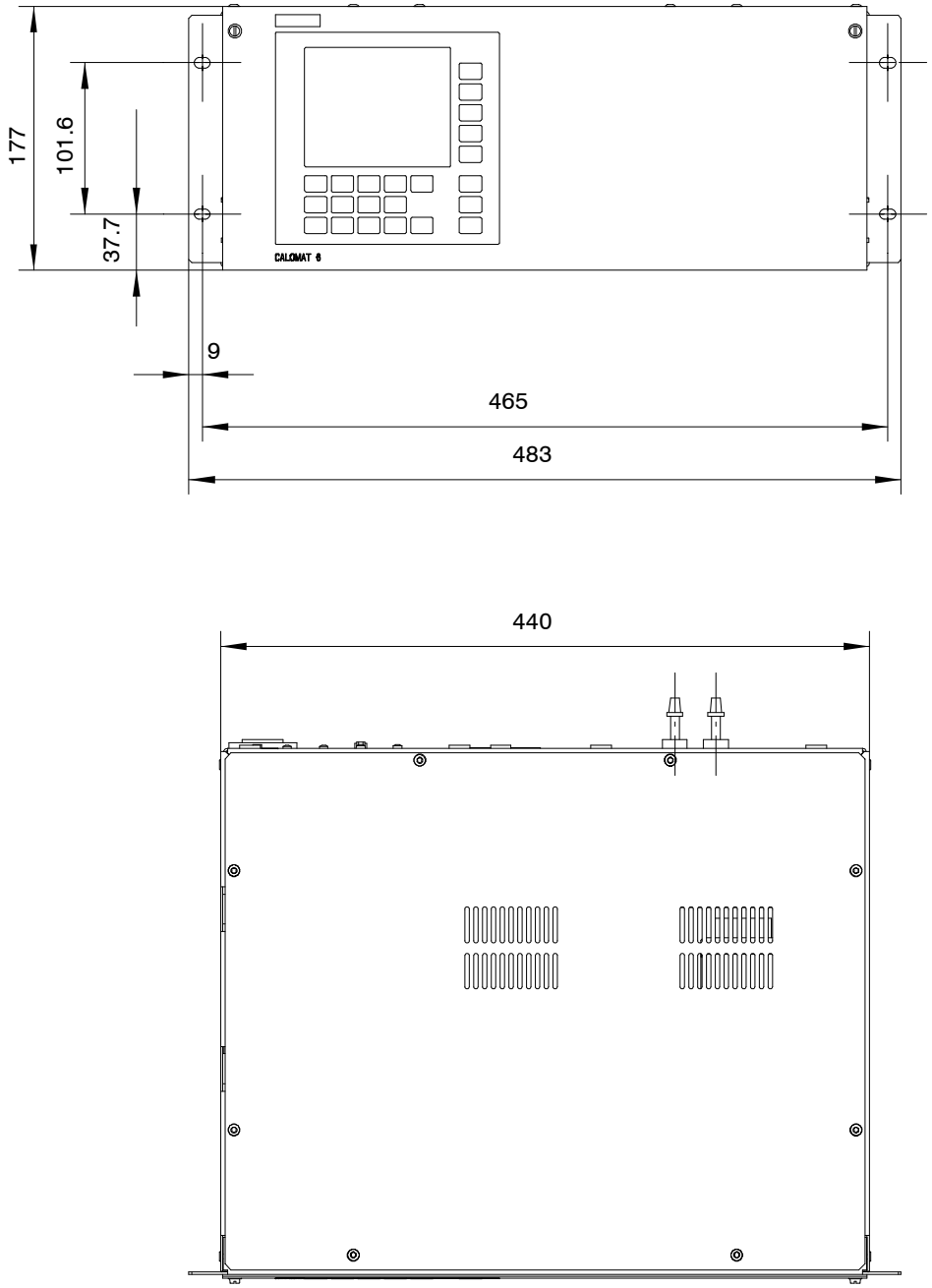


Fig. 2-8 Installation dimensions (front and plan views)

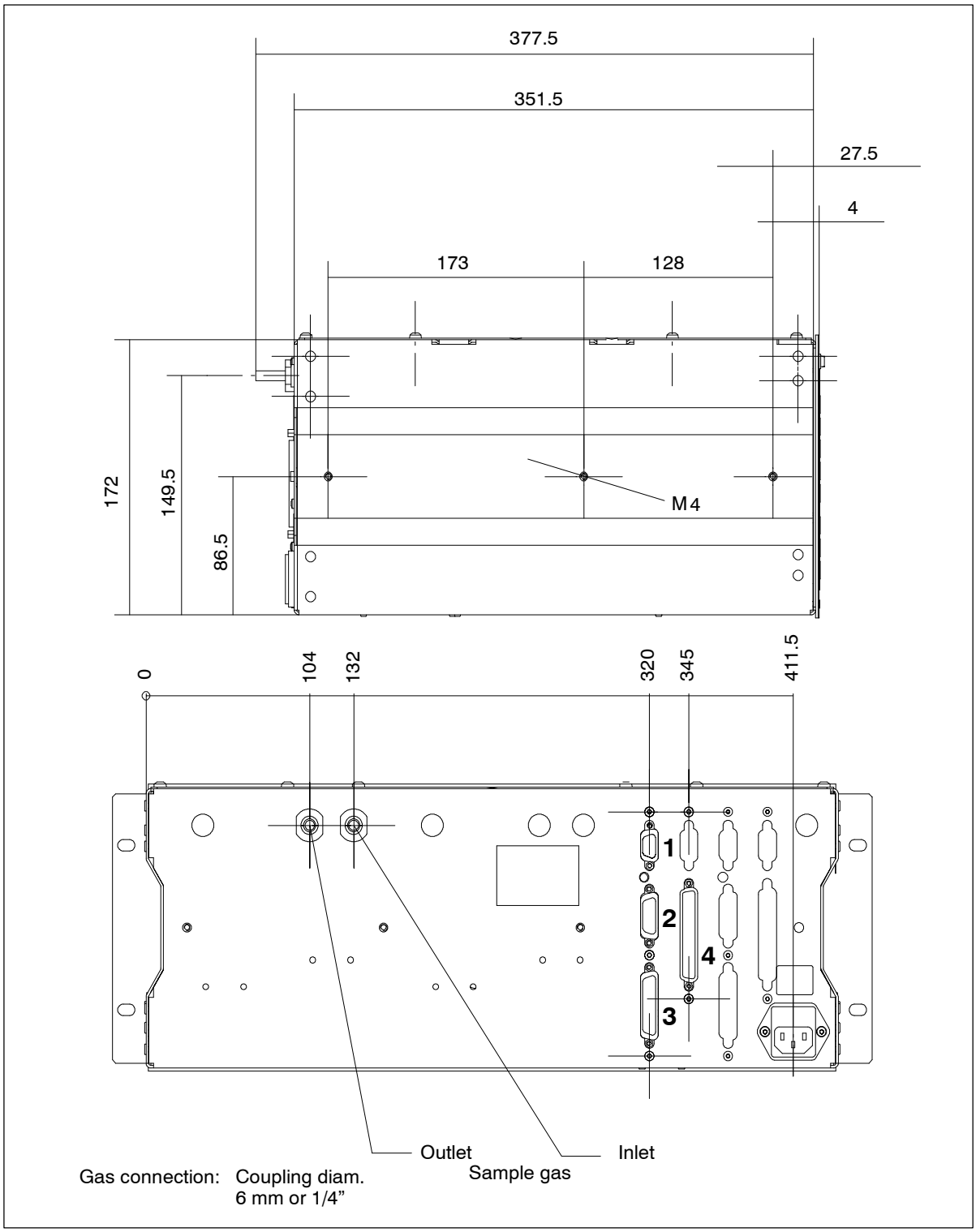


Fig. 2-9 Installation dimensions (side and rear views)

### 2.5.2 CALOMAT 6F Wall Mount Analyzer

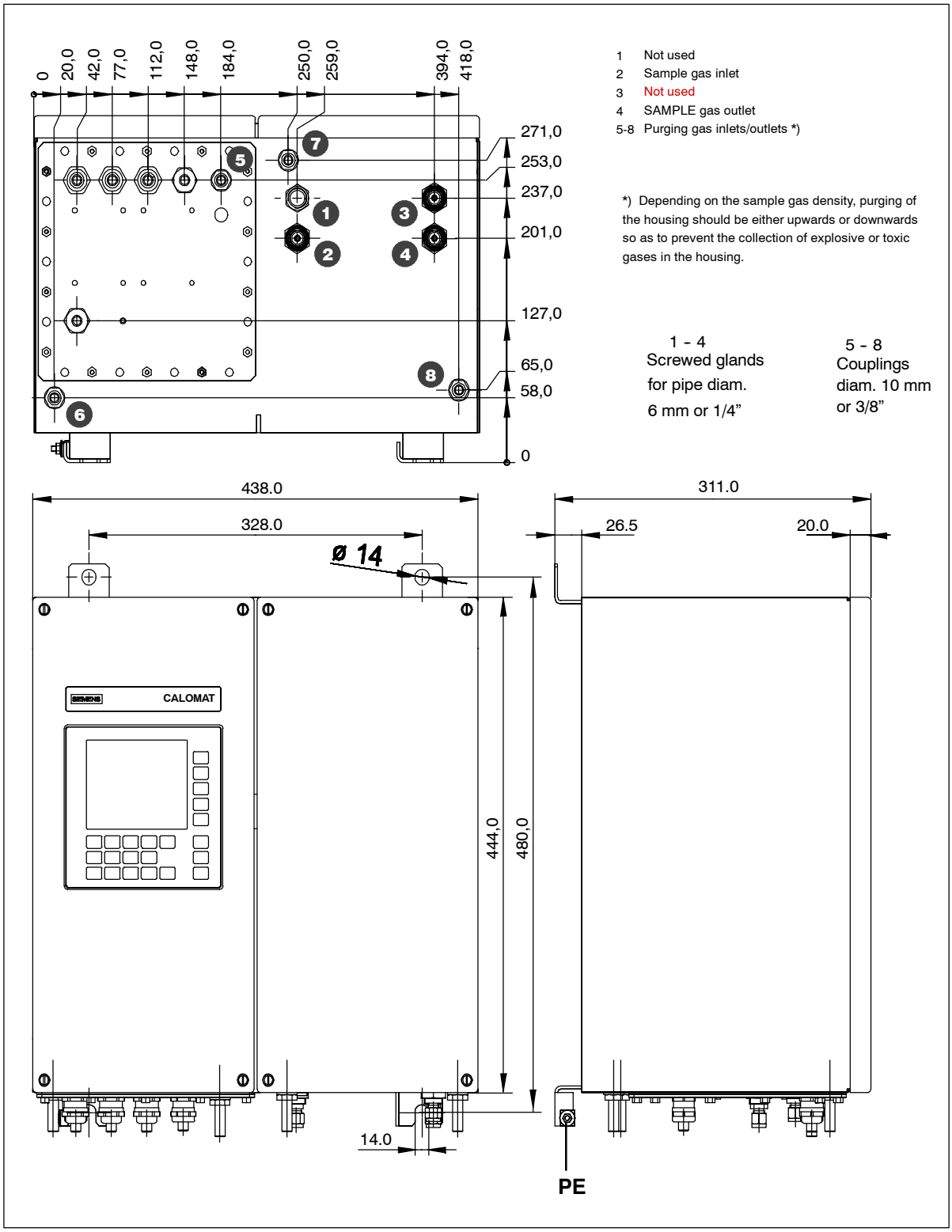


Fig. 2-10 Installation dimensions (rear view, front view and side view, **CALOMAT 6F**)

# Technical Description

# 3


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3.5 Influence of Interfering Gases . . . . . 3-5
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## 3.1 Application

The **CALOMAT 6** gas analyzer is primarily used for quantitative determination of $H_2$ or He in binary or quasi-binary gas mixtures.

Concentrations of other gases can also be measured if their thermal conductivities differ significantly from the residual gases.

The measuring principle is based on the different thermal conductivity of gases. The **CALOMAT 6** operates with a micro-mechanically manufactured silicon sensor which is particularly characterized by a short $T_{90}$ time.

### Application examples

- Pure gas monitoring (0 ...1 % $H_2$ in Ar)
- Protective gas monitoring (0...1 % $H_2$ in $N_2$)
- Hydroargon gas monitoring (0 ...25 % $H_2$ in Ar)
- Forming gas monitoring (0 ...25 % $H_2$ in $N_2$)
- Gas production:
  0 ...2 % He in $N_2$
  0 ... 10 % Ar in $O_2$
- Chemical applications, e.g.:
  0 ... 2 % $H_2$ in $NH_3$,
  50 ...70 % $H_2$ in $N_2$
- Wood gasification (0 ... 30 % $H_2$ in $CO/CO_2/CH_4$)
- Blast furnace gas (0 ... 5 % $H_2$ in $CO/CO_2/CH_4/N_2$)
- Bessemer converter gas (0 ... 20 % $H_2$ in $CO/CO_2$)

### Main features

- Four freely-parameterizable measuring ranges, also with suppressed zero; all ranges linear
- Very small spans possible (down to 1% $H_2$, with suppressed zero: 95 to 100 % $H_2$)
- One electrically isolated analog output 0/2/4 to 20 mA
- Autoranging or manual range selection selectable; remote switching also possible
- Storage of measured value possible during calibration
- Time constants selectable within wide limits (static/dynamic noise suppression); i.e. analyzer response time can be matched to specific requirements
- Simple handling using menu-based operations (interactive mode) based on NAMUR recommendations
- Short response time
- Low long-term drift
- Two operating levels with separate authorization codes to prevent unintentional or unauthorized interventions
- External pressure sensor can be connected to correct variations in pressure of process gas
- Automatic range calibration parameterizable
- PROFIBUS-DP/-PA
- Customer-specific versions possible, e.g.:
  - Customer acceptance
  - Tag labels
  - Drift recording

### Design of housing/analyzer cell

- 19" unit with 4 HU, for installation in hinged bays
- 19" unit with 4 HU, for installation in cabinets, with or without telescopic rails
- Front panel can be swung down for servicing (notebook connection, RS 485)
- Internal gas paths: stainless steel (1.4571) piping
- Gas connections: pipe diameter 6 mm or $^1/_4$"
- Stainless steel (1.4571) analyzer cell;
  sensor with following wetted parts materials:
  Si, $SiO_xN_y$, gold, epoxy resin

## 3.2 Design

### Display and control panel

- Large LCD panel for simultaneous display of:
  - Measured value (digital and analog displays)
  - Status line
  - Measuring ranges
- Contrast of LCD panel adjustable using menu
- Permanent LED backlighting
- Five-digit measured-value display (decimal point counts as digit)
- Washable membrane keyboard/front panel
- Menu-based operation for configuration, test functions, calibration
- User help in plain text
- Graphic display of concentration trend; programmable time intervals
- Operating software in two languages: German/English, English/Spanish, French/English, Spanish/English, Italian/English

### Inputs and outputs

- Two freely-configurable analog inputs, e.g. for correction of cross-interferences, external pressure sensor
- Six freely-configurable binary inputs, e.g. for range switching
- Six freely-configurable relay outputs, e.g. for failure, maintenance request, limit alarm, external solenoid valves
- Expandable by eight additional binary inputs and eight additional relay outputs for automatic calibration with up to four calibration gases

### Communication

- RS 485 interface (Standard)
- RS 232 converter (option)
- Linking into networks via PROFIBUS-PA/-DP interface
- SIPROM GA software as servicing and maintenance tool

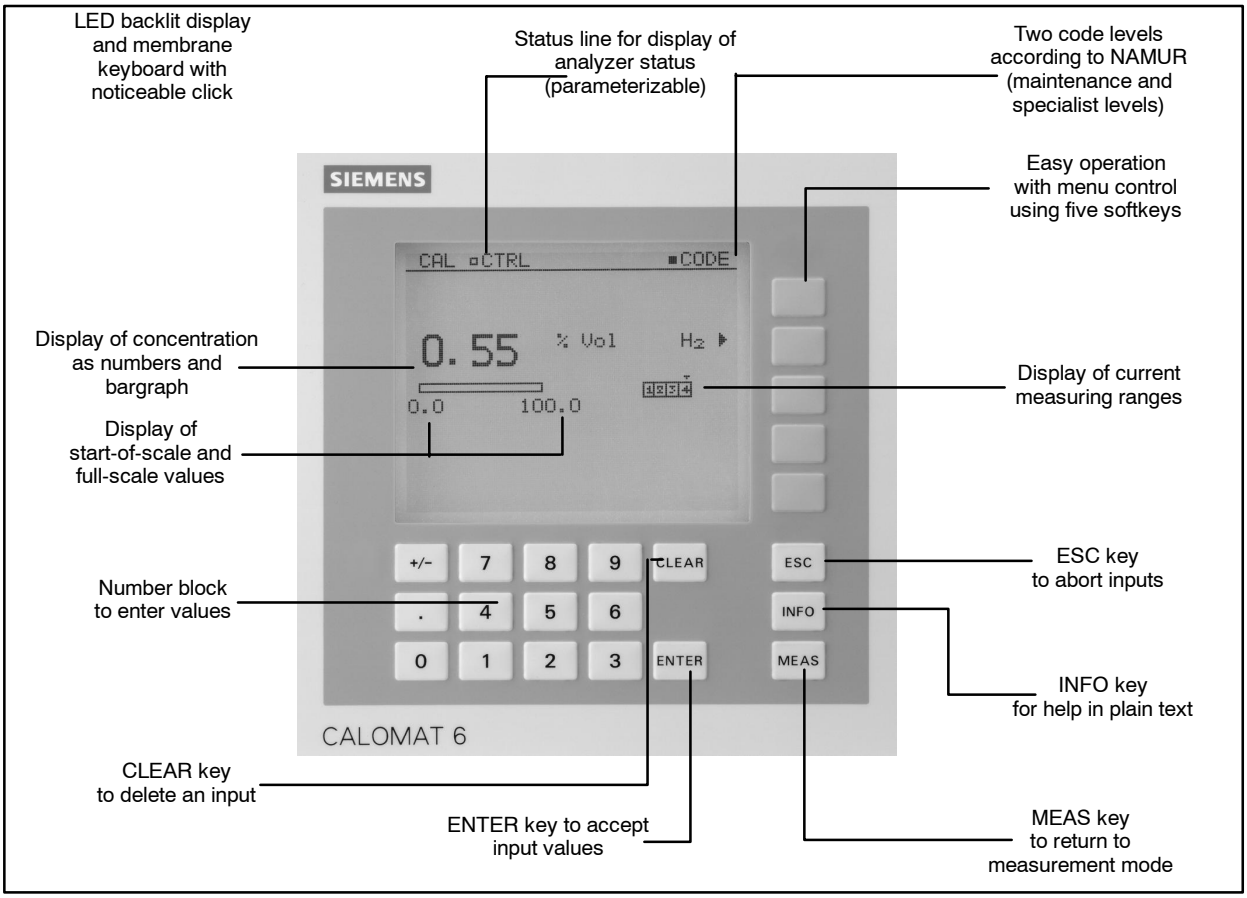


*Fig. 3-1 CALOMAT 6, membrane keyboard and graphic display*

## 3.3 Mode of Operation

The measuring principle is based on the different thermal conductivity of gases.

The CALOMAT 6 operates with a micro-mechanically manufactured Si chip whose measuring diaphragm contains thin-film resistors.

The resistors are regulated at a constant temperature. A current is required to achieve this, and its magnitude assumes a particular value depending on the thermal conductivity of the sample gas. This raw value is subject to further electronic processing and is used to calculate the gas concentration.

To suppress ambient temperature influences, the sensor is located in a thermostatically-controlled stainless steel housing.

To prevent flow influences, the sensor is only subject to an indirect flow.

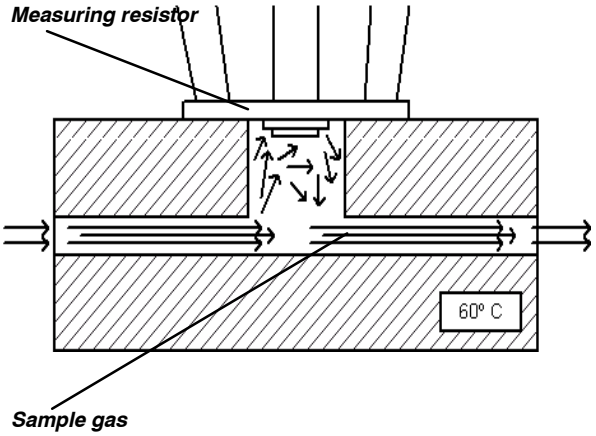


*Fig. 3-2 CALOMAT 6, mode of operation*

## 3.4 Spans

The smallest and largest spans which are possible depend on the measured component (type of gas) as well as the respective application.

The smallest possible spans listed below refer to $N_2$ as the residual gas. With other gases which have a larger/smaller thermal conductivity than $N_2$, the smallest possible span is also larger/smaller.

| | **Smallest possible measuring span** |
|---|---|
| $H_2$ | 0 ... 1 % (95 ... 100 %) |
| He | 0 ... 2 % |
| Ar | 0 ... 10 % |
| $CH_4$ | 0 ... 15 % |
| $CO_2$ | 0 ... 20 % |
| $H_2$ in blast furnace gas | 0 ... 15 % |
| $H_2$ in Bessemer converter gas | 0 ... 20 % |
| $H_2$ with wood gasification | 0 ... 30 % |

## 3.5 Influence of Interfering Gases

Knowledge of the sample gas composition is necessary to determine the influence of residual gases with several interfering components.

The following table lists the zero offsets expressed in % $H_2$ resulting from 5 % residual gas (interfering gas) in each case.

| Gas | Zero offset |
|---|---|
| Ar | -1.28 % |
| $CH_4$ | +1.59 % |
| $C_2H_6$ (non-linear response) | -0.06 % |
| $C_3H_8$ | -0.80 % |
| CO | -0.11 % |
| $CO_2$ | -1.07 % |
| He | +6.51 % |
| $N_2O$ | +1.08 % |
| $NH_3$ (non-linear response) | +0.71 % |
| $O_2$ | -0.18 % |
| $SF_6$ | -2.47 % |
| $SO_2$ | -1.34 % |
| Air (dry) | +0.25 % |

With residual gas concentrations other than 10 %, the corresponding multiple of the table value can be used to a good approximation. This applies to a concentration range of up to approx. 25% for the residual gas (depends on type of gas). This approximation is limited if the response of interfering gases is non-linear!

The thermal conductivity of many gas mixtures has a non-linear response. Ambiguous results can even occur in certain concentration ranges, e.g. with $NH_3/N_2$ mixtures.

In addition to the zero offset, note that the gradient of the characteristic can also be influenced by the interfering gas. However, this effect is negligible for most gases.

Considering these points as well as the fact that the analyzers for interfering gases contribute further inaccuracies, a larger error occurs than with binary gas mixtures despite correction of the interfering gas.

The resulting error - depending on the application - can be up to 5% of the smallest measuring range of the respective application.

## 3.6 Communication

**Communication facilities**

The gas analyzers of series 6, ULTRAMAT 6, ULTRAMAT/OXYMAT 6, OXYMAT 6, OXYMAT 61 and CALOMAT 6, as well as the ULTRAMAT 23, offer the following communication facilities:

- Serial RS 485 interface present as standard with internal communications bus (ELAN) which permits communication between the analyzers and - with multi-channel analyzers - from one channel to the other via the serial interface even without a PC for e.g. information on the process gas pressure and compensation of the influences of interfering gases.
- **SIPROM GA**, a software tool especially for servicing and maintenance tasks. All functions of the analyzers, whether an individual device or where several are networked together, can be remote controlled and monitored using SIPROM GA.
- **PROFIBUS-DP/-PA** is the leading fieldbus on the market. All Siemens gas analyzers are suitable for PROFIBUS when equipped with an optional plug-in card (retrofitting also possible) and satisfy the binding "Device profile for analyzers" defined by the PNO (PROFIBUS International). Central access to the analyzers in the system is possible using the SIMATIC PDM operator input software.

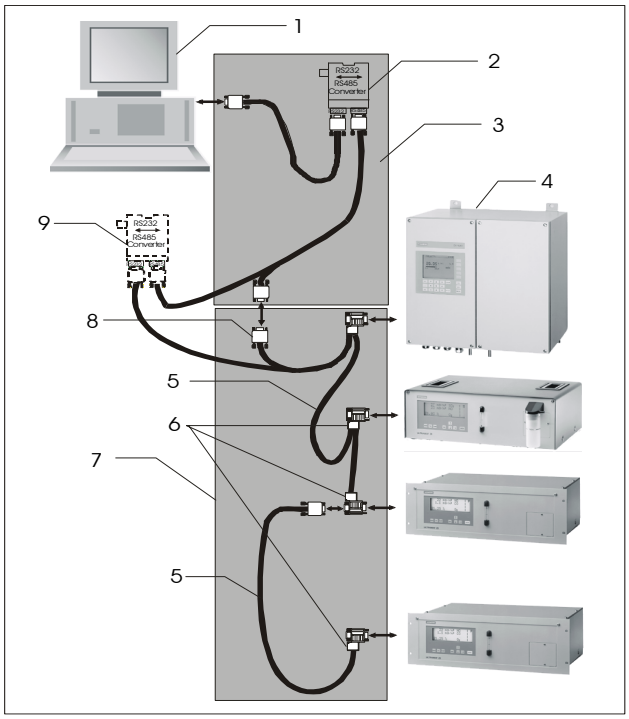


Fig. 3-3 Typical design of an RS 485 network

| Item | Designation |
|---|---|
| 1 | Computer |
| 2 | Converter RS 485 <-> RS 232 with cable |
| 3 | RS 485 bus connector with jumper |
| 4 | Analyzers |
| 5 | RS 485 cable |
| 6 | RS 485 bus connector |
| 7 | RS 485 network |
| 8 | 9-pin DSUB plug |
| 9 | Option: RS 485 repeater |

**Interface parameters**

| | |
|---|---|
| Level | RS 485 |
| Baud rate | 9600 |
| Data bits | 8 |
| Stop bit | 1 |
| Start bit | 1 |
| Parity | None |
| No echo mode | |

| **Ordering information** | Order No. |
|---|---|
| Interface description (German) | **C79000-B5200-C176** |
| RS 485 - RS 232 converter | **C79451-Z1589-U1** |
| SIMATIC cable/bus cable | **6XV1 830-0EH10** |
| SIMATIC bus connector | **6ES7 972-0BB11-0XA0** |
| 9-pin DSUB plug | **6ES7 972-0BB11-0XA0** |
| Repeater (see also catalog CA 01 or IK PI) | **6ES7 972-0AA01-0XA0** |

**SIPROM GA**

**Application**: communications software for remote maintenance and servicing of Siemens process gas analyzers; max. 12 analyzers with up to 4 components each.

**Functions**: display and saving of all analyzer data, remote operation of all analyzer functions, parameter and configuration settings; comprehensive diagnostics information, remote calibration; online help; cyclic saving of measured values and status on hard disk and exporting to commercially available application programs, downloading of new software.

**Hardware requirements**: PC/laptop; min. 486DX-66 with 8 MB RAM, hard disk with min. 10 MB vacant capacity; vacant COM port: RS 232 or RS 485, max. distance 500 m. Larger distances using repeater.

**Software requirements**: Windows 95/98 or NT (4.0 or later).

| **Item** | **Order No.** |
|---|---|
| SIPROM GA software<br>German/English selectable<br>during installation, comprising 3 diskettes (3.5"),<br>with installation instructions, software product certificate and registration form | S79610-B4014-A1 |

**Firmware retrofitting sets for older analyzers**:

| | |
|---|---|
| **ULTRAMAT 23**<br>(prior to SW version 2.06)<br>All languages | **C79451-A3494-S501** |

**ULTRAMAT 6** (prior to SW version 4.1)

| | |
|---|---|
| German | **C79451-A3478-S501** |
| English | **C79451-A3478-S502** |
| French | **C79451-A3478-S503** |
| Spanish | **C79451-A3478-S504** |
| Italian | **C79451-A3478-S505** |

**OXYMAT 6** (prior to SW version 4.1)

| | |
|---|---|
| German | **C79451-A3480-S501** |
| English | **C79451-A3480-S502** |
| French | **C79451-A3480-S503** |
| Spanish | **C79451-A3480-S504** |
| Italian | **C79451-A3480-S505** |

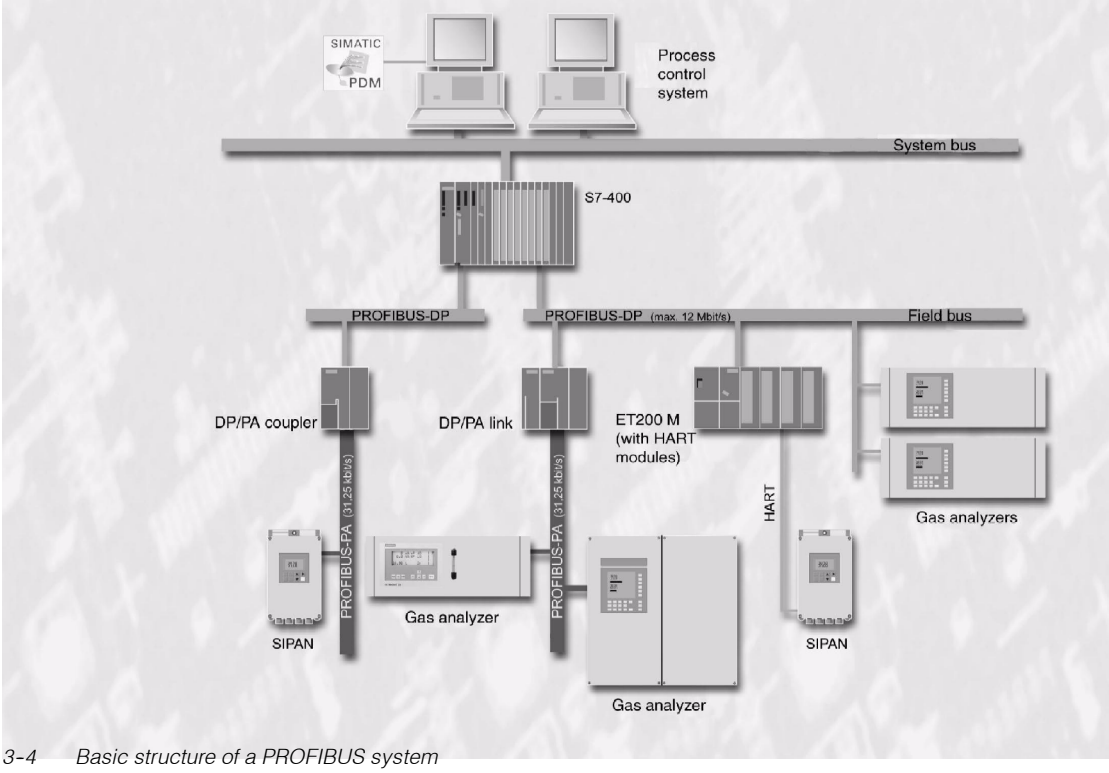


*Fig. 3-4 Basic structure of a PROFIBUS system*

The term "Fieldbus" describes a digital communications system with which distributed field devices in a plant are networked together via one single cable, and connected at the same time to programmable controllers or to a process control system. PROFIBUS is the leading fieldbus on the market. The **PROFIBUS-DP** version is widely used for production automation because of its high transmission rate for relatively small data quantities per device, whereas **PROFIBUS-PA** particularly takes into account the features required for process engineering, e.g. large data quantities and application in potentially explosive atmospheres.

User benefits can be found in the extremely high potentials for cost savings in all areas of the plant, covering configuring and commissioning, operation and maintenance, and up to later plant extensions.

Operation of the gas analyzers from a control system or separate PC is possible using the SIMATIC PDM (Process Device Manager) operator input tool which is software executing under Windows 95/98/NT and which can also be incorporated into the SIMATIC PCS 7 process control system. This permits clear display of both the incorporation of devices into the system and the complex parameter structure of the analyzers, permitting operation to be carried out simply by clicking.

PROFIBUS International (PNO) is an independent international institution, and represents the interests of many vendors and users. In addition to services such as consultation, training and device certification, its prime task is the further development, standardization and promotion of the PROFIBUS technology. The definition of a binding functionality for a device class in a profile is a prerequisite for the uniform response of devices from different vendors, the so-called interoperability. The profile for analyzers was defined as binding at the end of 1999, thus guaranteeing the interaction of all PROFIBUS-based devices in a plant.

This profile defines the functionality of the analyzers in a block model: e.g. the physical block describes the measuring procedure, analyzer and vendor names, serial number and operating state (operation, maintenance). Various functional blocks contain the execution of specific functions such as the processing of measured values or alarms. The transducer blocks describe the functionality of the actual measuring procedure and its control, e.g. preprocessing of a measured value, correction of cross-interferences, characteristics, measuring ranges as well as switching and control procedures. Protocols define the data transmission between the stations on the bus. A differentiation is made between cyclic and acyclic services. Cyclic services are used to transmit time-critical data such as measured values and statuses. The acyclic services permit the scanning or modification of device parameters during operation.

All gas analyzers of Series 6, ULTRAMAT 6, ULTRAMAT/OXYMAT 6, OXYMAT 6/61 and CALOMAT 6, as well as the ULTRAMAT 23 are suitable for PROFIBUS when fitted with the optional plug-in card (retrofitting also possible, see Ordering information).

## 3.7 Technical Data

### 3.7.1 CALOMAT 6E Rack-mounted Analyzer [1]

| General Technical Data CALOMAT 6 | |
|---|---|
| Measuring ranges | 4, switching internally and externally; autoranging is also possible |
| Largest possible span | 100 % v/v $H_2$ (see Section 3.4 for smallest possible span) |
| Measuring ranges with suppressed zero | Any zero is possible within 0 to 100 % v/v; smallest possible span: 5 % $H_2$ |
| Conformity | CE marking to EN 61326/A1. EN 61010-1 |

| Design, housing | |
|---|---|
| Degree of protection | IP 20 to EN 60529 |
| Mounting position | Front panel of device vertical |
| Dimensions (device) | See Fig. 2-9 |
| Weight (device) | Approx. 10 kg |

| Electric features | |
|---|---|
| Electromagnetic compatibility (EMC) [6] | Conforms to standard requirements of NAMUR NE21 (08/98) |
| Electrical safety | According to EN 61010-1, overvoltage test category II |
| Power supply (see rating plate) | AC 100 V -10% to 120 V+10% 47 to 63 Hz or AC 200 V -10% to 240 V+10% 47 to 63 Hz |
| Power consumption (device) | Approx. 20 VA |
| Fuse ratings | 100 ... 120 V 01 T/ 250<br>200 ... 240 V 0.63 T/ 250 |

| Gas path | |
|---|---|
| Gas connections | Stainless steel 1.4571, pipe diameter 1/4" or 6 mm |
| Analyzer cell body | Stainless steel 1.4571 |
| Internal gas path | Stainless steel 1.4571 |
| Gaskets (O-rings) | FFKM (Chemraz) |
| Sensor | Si, $SiO_xN_y$, Au, epoxy resin, glass |
| Leaks | Loss < 1 µl/s |

| Gas inlet conditions | |
|---|---|
| Sample gas pressure | 800...1100 hPa (absolute) |
| Sample gas flow | 30...90 l/h (0.5...1.5 l/min) |
| Sample gas temp. | 0 to 50°C |
| Temperature of analyzer cell | Approx. 60°C |
| Sample gas humidity | < 90% RH [2] |

| Time response [4] | |
|---|---|
| Warm-up time | < 30 min [3] |
| Response time | < 5 s |
| Electr. damping | 0 to 100 s, adjustable |
| Dead time (at 1 l/min) | Approx. 0.5 s |
| Output signal variation [6] | <±0.75% of smallest possible measuring range according to rating plate with electronic damping of 1 s (σ = 0.25%) |
| Drift | < 1% / week of smallest possible span according to rating plate |
| Repeatability | < 1% of respective span |
| Linearity error | <±1% of respective span |

| Influencing variables [4] | |
|---|---|
| Ambient temperature | < 1% / 10 K, referred to smallest possible span according to rating plate |
| Interfering gases | See Section 3.5 for zero deviation (influence of interfering gas) |
| Sample gas flow | < 0.2% of smallest possible span according to rating plate with a change in flow of 0.1 l/min within the permissible flow range |
| Sample gas pressure | < 1% with a change in pressure of 100 hPa |
| Power supply | < 0.1% of output signal span at rated voltage ±10% |

| Electric inputs and outputs | |
|---|---|
| Analog output | 0 / 2 / 4 to 20 mA, floating max. load 750 Ω |
| Relay outputs | 6, with changeover contacts, freely-parameterizable, e.g. for range identification; loading capacity: AC/DC 24 V / 1 A, floating |
| Analog inputs | 2, designed for 0 / 2 / 4 to 20 mA for external pressure sensor and correction of cross-interference |
| Binary inputs | 6, designed for 24 V, floating, freely-parameterizable, e.g. for range selection |
| Serial interface | RS 485 |
| Options | Autocal functions with 8 additional binary inputs and 8 additional relay outputs; also with PROFIBUS-PA or PROFIBUS-DP |

| Climatic conditions | |
|---|---|
| Permissible ambient temperature | -30 to +70 °C during storage and transport, +5 to +45 °C during operation |
| Permissible humidity [5] | < 90% RH [2] as annual average during storage and transport |

[1] Based on DIN EN 61207/IEC 120, i.e.: the Technical data listed above refer to the binary gas mixture H2 in N2! The error may be greater with other gas mixtures. This particularly applies to gas mixtures with several components.
[2] RH: relative humidity
[3] Maximum accuracy achieved after 2 hours
[4] Referred to sample gas pressure of 1000 hPa absolute, 0.5 l/min sample gas flow and 25°C ambient temperature
[5] Dew point must not be fallen below!
[6] All signal cables must be shielded.

## 3.7.2 CALOMAT 6F Wall Mount Analyzer [1)]

| General Technical Data CALOMAT 6 | |
|---|---|
| Measuring ranges | 4, switching internally and externally; autoranging is also possible |
| Largest possible span | 100 % v/v $H_2$ (see Section 3.4 for smallest possible span) |
| Measuring ranges with suppressed zero | Any zero is possible within 0 to 100 % v/v; smallest possible span: 5 % $H_2$ |
| Conformity | CE marking to EN 61326/A1. EN 61010-1 |

| Design, housing | |
|---|---|
| Degree of protection | IP 20 to EN 60529 |
| Mounting position | Front panel of device vertical |
| Dimensions (device) | See Fig. 2-10 |
| Weight (device) | Approx. 25 kg |

| Electric features | |
|---|---|
| Electromagnetic compatibility (EMC) [6)] | Conforms to standard requirements of NAMUR NE21 (08/98) |
| Electrical safety | According to EN 61010-1, overvoltage test category II |
| Power supply (see rating plate) | AC 100 V -10% to 120 V+10% 47 to 63 Hz or AC 200 V -10% to 240 V+10% 47 to 63 Hz |
| Power consumption (device) | Approx. 20 VA |
| Fuse ratings | 100 ... 120 V 01 T/ 250<br>200 ... 240 V 0.63 T/ 250 |

| Gas path | |
|---|---|
| Gas connections | Stainless steel 1.4571, pipe diameter 1/4" or 6 mm |
| Analyzer cell body | Stainless steel 1.4571 |
| Internal gas path | Stainless steel 1.4571 |
| Gaskets (O-rings) | FFKM (e.g. Chemraz) |
| Sensor | Si, $SiO_xN_y$, Au, epoxy resin, glass |
| Leaks | Loss < 1 µl/s |

| Gas inlet conditions | |
|---|---|
| Sample gas pressure | 800...1100 hPa (absolute) |
| Sample gas flow | 30...90 l/h (0.5...1.5 l/min) |
| Sample gas temp. | 0 to 50°C |
| Temperature of analyzer cell | Approx. 60°C |
| Sample gas humidity | < 90% RH [2)] |
| Purging gas pressure | 165 hPa; 250 hPa short-term |

| Time response [4)] | |
|---|---|
| Warm-up time | < 30 min [3)] |
| Response time $T_{90}$ | < 5 s |
| Electr. damping | 0 to 100 s, adjustable |
| Dead time (at 1 l/min) | Approx. 0.5 s |
| Output signal variation [6)] | <±0.75% of smallest possible measuring range according to rating plate with electronic damping of 1 s (σ = 0.25%) |
| Drift | < 1% / week of smallest possible span according to rating plate |
| Repeatability | < 1% of respective span |
| Linearity error | <±1% of respective span |

| Influencing variables [4)] | |
|---|---|
| Ambient temperature | < 1% / 10 K, referred to smallest possible span according to rating plate |
| Interfering gases | See Section 3.5 for zero deviation (influence of interfering gas) |
| Sample gas flow | < 0.2% of smallest possible span according to rating plate with a change in flow of 0.1 l/min within the permissible flow range |
| Sample gas pressure | < 1% with a change in pressure of 100 hPa |
| Power supply | < 0.1% of output signal span at rated voltage ±10% |

| Electric inputs and outputs | |
|---|---|
| Analog output | 0 / 2 / 4 to 20 mA, floating max. load 750 Ω |
| Relay outputs | 6, with changeover contacts, freely-parameterizable, e.g. for range identification; loading capacity: AC/DC 24 V / 1 A, floating |
| Analog inputs | 2, designed for 0 / 2 / 4 to 20 mA for external pressure sensor and correction of cross-interference |
| Binary inputs | 6, designed for 24 V, floating, freely-parameterizable, e.g. for range selection |
| Serial interface | RS 485 |
| Options | Autocal functions with 8 additional binary inputs and 8 additional relay outputs; also with PROFIBUS-PA or PROFIBUS-DP |

| Climatic conditions | |
|---|---|
| Permissible ambient temperature | -30 to +70 °C during storage and transport, +5 to +45 °C during operation |
| Permissible humidity [5)] | < 90% RH [2)] as annual average during storage and transport |

1) Based on DIN EN 61207/IEC 120, i.e.: the Technical data listed above refer to the binary gas mixture H2 in N2! The error may be greater with other gas mixtures. This particularly applies to gas mixtures with several components.
2) RH: relative humidity
3) Maximum accuracy achieved after 2 hours
4) Referred to sample gas pressure of 1000 hPa absolute, 0.5 l/min sample gas flow and 25°C ambient temperature
5) Dew point must not be fallen below!
6) All signal cables must be shielded. In environments with strong electromagnetic interferences, deviations up to 4 % of the smallest measuring range may occur.

# Start-up

# 4


4.1 Safety Information . . . . . 4–2
4.2 Preparation for Start-up . . . . . 4–4
4.3 Start-up and Operation . . . . . 4–6
4.3.1 Measuring Ranges and Calibration . . . . . 4–6
4.3.2 Calibration Examples . . . . . 4–7

## 4.1 Safety Information

**Warning**

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

**Electrical safety**
Certain parts in this analyzer carry dangerous voltages. The housing must be closed and grounded before switching on the analyzer. Death, personal injury and/or damage to property may result if this is not observed. Please also refer to Section 2.4.

**Materials of the gas path**
No aggressive gases must be passed into the analyzer, in particular those to which the wetted parts materials are **not** resistant.

**Purging of housing**
As a result of leakages in the sample gas path, a release of flammable components may occur which can be considered as limited in line with the Technical data. With the **CALOMAT 6E** rack-mounted analyzer, purging of the housing can be omitted if it can be guaranteed that natural ventilation takes place in the environment of the housing (see also report BB–NEG/01 Gr03X from the TÜV Süddeutschland (Southern German Technical Inspectorate). This consideration only applies to a limited extent when using toxic sample gases. The maximum threshold limit value (TLV) must be considered as the basis for judgement in such cases.

With the **CALOMAT 6F** wall mount analyzer, purging of the housing must always be provided in such cases, and the flow should be approx. 1 l/min. Purging may only be omitted if toxic gases or gas mixtures below the lower explosion limit (LEL) are passed into the analyzer. The gas displaced by purging must be connected using suitable equipment, and routed for environmentally friendly disposal via an exhaust line.

**Flammable sample gases**
Flammable gases or gas mixtures up to temperature class **T3** may only be passed into the analyzer if they are only not explosive or only seldom and briefly explosive (see also report BB–NEG/01 Gr03X from the TÜV Süddeutschland (Southern German Technical Inspectorate)).
With occasionally explosive sample gases, the sample gas inlet and outlet must be provided with flame lock-outs. Frequently or permanently explosive gas mixtures must not be used!

**Warning**

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

**Ex protection**
The **CALOMAT 6E** may only be used in potentially explosive atmospheres if particular protective measures are observed. These must be clarified with the responsible Ex authorities. Conformity and type examination certificates according to EG 94/9 (ATEX 100) are available for the **CALOMAT 6F**, confirming its use as equipment for potentially explosive atmospheres of zone 2 or 1 (device category II3G, II2/3G or II2G). It is absolutely essential to observe the “Special conditions” of the certificates.

**Liability**
Following commissioning, the total responsibility is finally in the hands of the owner.

## 4.2 Preparation for Start-up

**Analyzer position**

The **CALOMAT 6** must only be operated in a horizontal position! With the **CALOMAT 6E** rack-mounted analyzer, the housing cover is the top limiting level, with the **CALOMAT 6F** wall mount analyzer, the base with the housing bushings is the bottom limiting level.

**Gas conditioning**

All components for gas conditioning (gas sampling devices, gas coolers, condensation vessels, filters and any controllers, recorders or indicators (if connected) should be made ready for operation (refer to associated Instruction Manuals).

**Checking for leaks**

A leak test must be carried out following all maintenance operations which concern the analyzer cell or gas path. Proceed as follows:

- Connect a relative pressure monitor (0...200 hPa, resolution 0.1 hPa) to the sample gas outlet
- Establish an excess pressure of approx. 100 hPa via the sample gas inlet, and subsequently block off the inlet
- Wait approx. 1 minute until the enclosed air has reached the ambient conditions. Then note the pressure
- Wait for a further 5 minutes, and then read the pressure again.

The gas path is sufficiently leak-proof if the pressure drop is less than 1 hPa within 5 minutes.

**Note:** The gas path including the analyzer cell must have a constant temperature during the measurement.

**Operation**

Before connecting and switching on the analyzer, make yourself acquainted with its operation (Chapter 5 of this Instruction Manual).

**Interfaces**

Prior to start-up, connect and parameterize the interfaces (see Section 2.4.2).

**Noise suppression**

Variations in the output signal resulting from a noisy input signal can be reduced using *function 50*. This function additionally permits parameterization of a low-pass filter with a time constant of up to 100 s.

**Influence of temperature**

Compensation of the influence of temperature depends on the application, and is only required in exceptional cases. This particularly applies to non-standard applications with measuring ranges with a high zero suppression. The required compensation parameters are saved in the software in this case.

Make sure during operation that the permissible ambient temperature of 5 to 45 °C is retained (see Section 3.7 “Technical Data”).

**Influence of pressure**

The thermal conductivity is a variable which is almost pressure-independent within a wide range. Nevertheless it is possible to compensate the pressure if required by connecting an external pressure transmitter (see analog input 2 in Fig. 2-3, plug 2).

Influence of interfering gas

Correct determination of the concentration of components without additional effort is only possible in binary or quasi-binary gas mixtures.

**Correction of cross-interference**

If residual gases are present which could falsify the result, a correction of the cross-interferences must be carried out. If residual gases of variable concentration are present in the sample gas matrix, these must be determined using external analyzers, and passed on to the **CALOMAT 6** for the correction. A maximum of four digital inputs are available for this via the serial ELAN interface, or alternatively two analog inputs. Only SIEMENS analyzers of series 6 or ULTRAMAT 23 can communicate via the ELAN. Cross-interference correction parameters which are already factory-set are always for correction via the ELAN. If correction of cross-interferences is carried out in analog mode, a corresponding conversion must be carried out taking into account the analog input channel (*Function 83* in Section 5).

## 4.3 Start-up and Operation

**Switching on the power supply**

The measured-value display appears in the LCD shortly after switching on. The status display appears above this (in the top line) (see Section 5.1 for more details).

The analyzer cell is in the warming-up phase for the first 10 minutes. The message **CTRL** (function check) is displayed during this time. The analyzer achieves full accuracy after approx. two hours.

**Please observe the information in Section 2.4 “Electric connection”!**

### 4.3.1 Measuring Ranges and Calibration

**Measuring range/spans**

Define the desired spans (full-scale value – start-of-scale value) using *function 41*. The 0(2/4) and 20 mA of the analog output are assigned to the start-of-scale and full-scale values.

If the same values are entered for the start-of-scale and full-scale values of a measuring range, this range is considered as being non-existent.

In the case of several measuring ranges it is recommendable to assign the smallest span to range 1 etc. The following assignment then applies: span1 < span2 < span3 < span4.

The linearized characteristic is saved in the memory for the largest full-scale value (see rating plate). This full-scale value must not be exceeded if the largest measuring range is changed (*function 41*).

Do not select a range smaller than the smallest measuring range (see rating plate) since in this case the temperature error and noise of the measured value increase relative to the span. The drift and repeatability are also worse.

**Zero setpoint**

The zero setpoint is entered using *function 22* and applies to all measuring ranges.

**Suppressed zero**

In the case of analyzers with a suppressed zero, observe the start-of-scale value in % v/v according to the rating plate. This value applies to all measuring ranges.

Analyzers with a non-suppressed zero can be subsequently reparameterized (*functions 22 and 41*). However, it should be noted that influences such as noise and temperature error increase with an increasing distance from the zero.

**Setpoint for sensitivity adjustment**

These setpoints should be as far as possible away from the zero (at least 60 % of the respective full-scale value). The corresponding calibration gases should be available, and the setpoint is entered using *function 22.*

**Single/total calibration**

Select a total or single calibration using *function 23*.

A **single calibration** means that each range is calibrated with its own calibration gas. This is recommendable if the switching ratio between the spans is greater than 1:10.

With a **total calibration**, only the master range is calibrated (selected using *function 22*), the other ranges are determined according to the switching ratio.

**Calibrating the zero, sensitivity**

Connect zero gas or calibration gas at 30...90 l/h (0.5...1.5 l/min) to the analyzer.
Calibrate the zero using *function 20* and the sensitivity using *function 22*.

**Note**

If correction of a cross-interference is active during a calibration procedure, the influence of an interfering gas is not taken into account. Therefore a calibration gas without interfering component must always be used when calibrating the **CALOMAT 6.**

### 4.3.2 Calibration Examples

a) e.g. $H_2$ monitoring in gases
Hydrogen is to be measured in nitrogen.
Measuring range: 0 to 1% $H_2$
Calibration gas: 0.943 % $H_2$

| Procedure | Function No. | Input | Remarks |
|---|---|---|---|
| Selection of start-of-scale and full-scale values of range | 41 | 0 - 1 | 0 ⇒ 0(2/4) mA<br>1 ⇒ 20 mA |
| Input of setpoints for zero and sensitivity | 22 | 0 | Setpoint for zero |
| | | 0.943 | Setpoint for sensitivity |
| Calibration of zero | 20 | | Flow of nitrogen |
| Calibration of sensitivity | 21 | | Flow of calibration gas |

b) Measuring range 95 to 100% $H_2$ (suppressed zero);
Zero gas: 95.3 % $H_2$
Calibration gas: 100 % $H_2$

| Procedure | Function No. | Input | Remarks |
|---|---|---|---|
| Selection of start-of-scale and full-scale values of range | 41 | 95 - 100 | 15 ⇒ 0(2/4) mA<br>21 ⇒ 20 mA |
| Input of setpoints for zero and sensitivity | 22 | 95.3 | Setpoint for zero |
| | | 100 | Setpoint for sensitivity |
| Calibration of zero | 20 | | Flow of zero gas (95.3 %) |
| Calibration of sensitivity | 21 | | Flow of calibration gas (100 %) |

Please refer to Chapter 5 (Operation) for a detailed description of the operation and input possibilities.

# Operation 5


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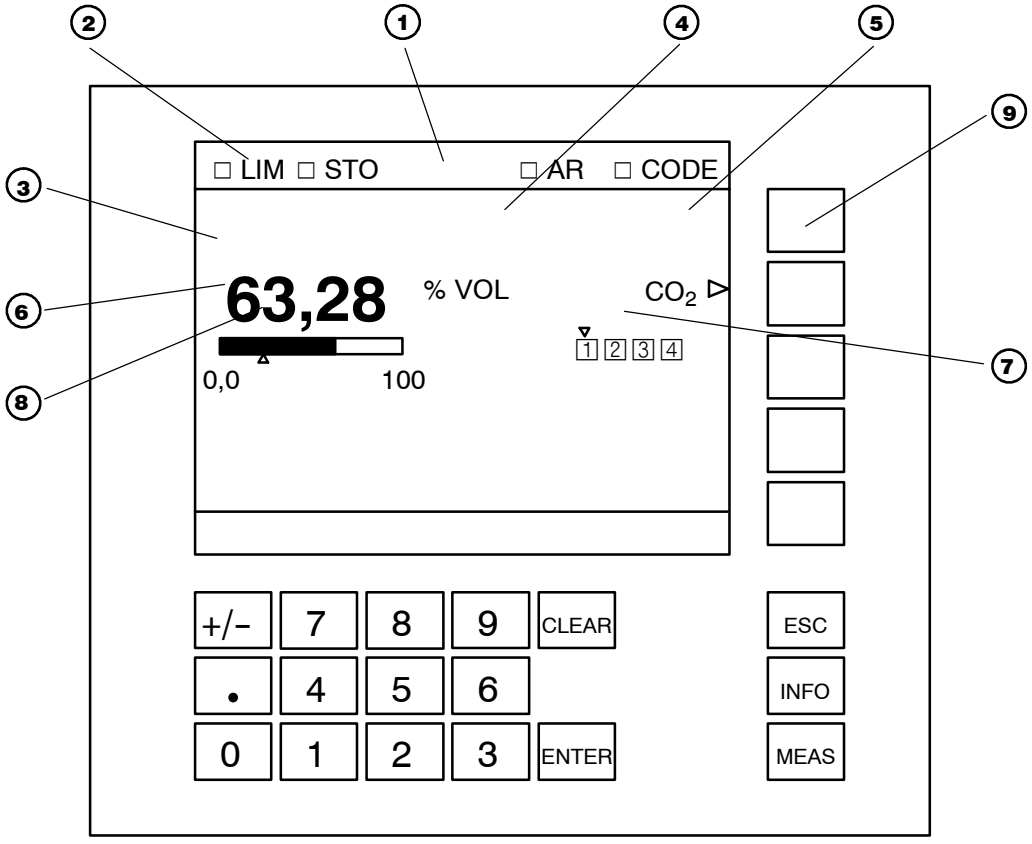
5.2 Summary of Input Functions . . . . . 5-7
5.2.1 Analyzer Status . . . . . 5-8
5.2.2 Calibration . . . . . 5-9
5.2.3 Measuring Ranges . . . . . 5-16
5.2.4 Parameters . . . . . 5-18
5.2.5 Configuration . . . . . 5-24

## 5.1 General




1. Status line (parameterizable using *function 53*)
2. Status display
   (e.g. ☐ LIM means: limit (alarm) signalling is active;
   ■ LIM means: limit (alarm) has been triggered)
3. Measured value
4. Display of dimension
5. Display of measured component
6. Analog measured-value display
   (display of measured value with start-of-scale and full-scale values of current range)
7. Display of activated measuring ranges with identification of current range
8. Limit mark on bargraph
9. Function keys with varying meaning (softkeys)

Fig. 5-1 Display and control panel

**Switches/keys and their meanings**

| Key | Meaning |
|---|---|
| **CLEAR** | Deletes a commenced number input |
| **ENTER** | Every digit input (except fast selection of a function) must be confirmed using **ENTER** |
| **ESC** | Return by one step in the input structure.<br>Modifications are imported |
| **INFO** | Help information |
| **MEAS** | Return from any position in the input structure to display mode (possibly with request whether to import the entered data).<br><br>**Pressing the MEAS key again results in locking of analyzer**;<br><br>i.e. changing to input mode again is only possible following input of the code. |
| Softkey | Varying meaning; possible in this case:<br>• Selection of item in menu tree<br>• Selection function |

**Editing of inputs**

The values in the menus shown in Chapter 5 should be understood as examples.

- An active input field is represented with colons (:10:) as limiters. The cursor is positioned as a flashing line underneath the number to be entered (e.g. :2̲3.45:).
- The input is terminated by pressing the **ENTER** key, and the value stored. If several input fields are present in a menu, the cursor is automatically positioned to the next input field.

**Caution**
Each input value must be confirmed with **ENTER** before you leave the menu. Also the last of several values in a 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 (e.g. start calibration, ...)

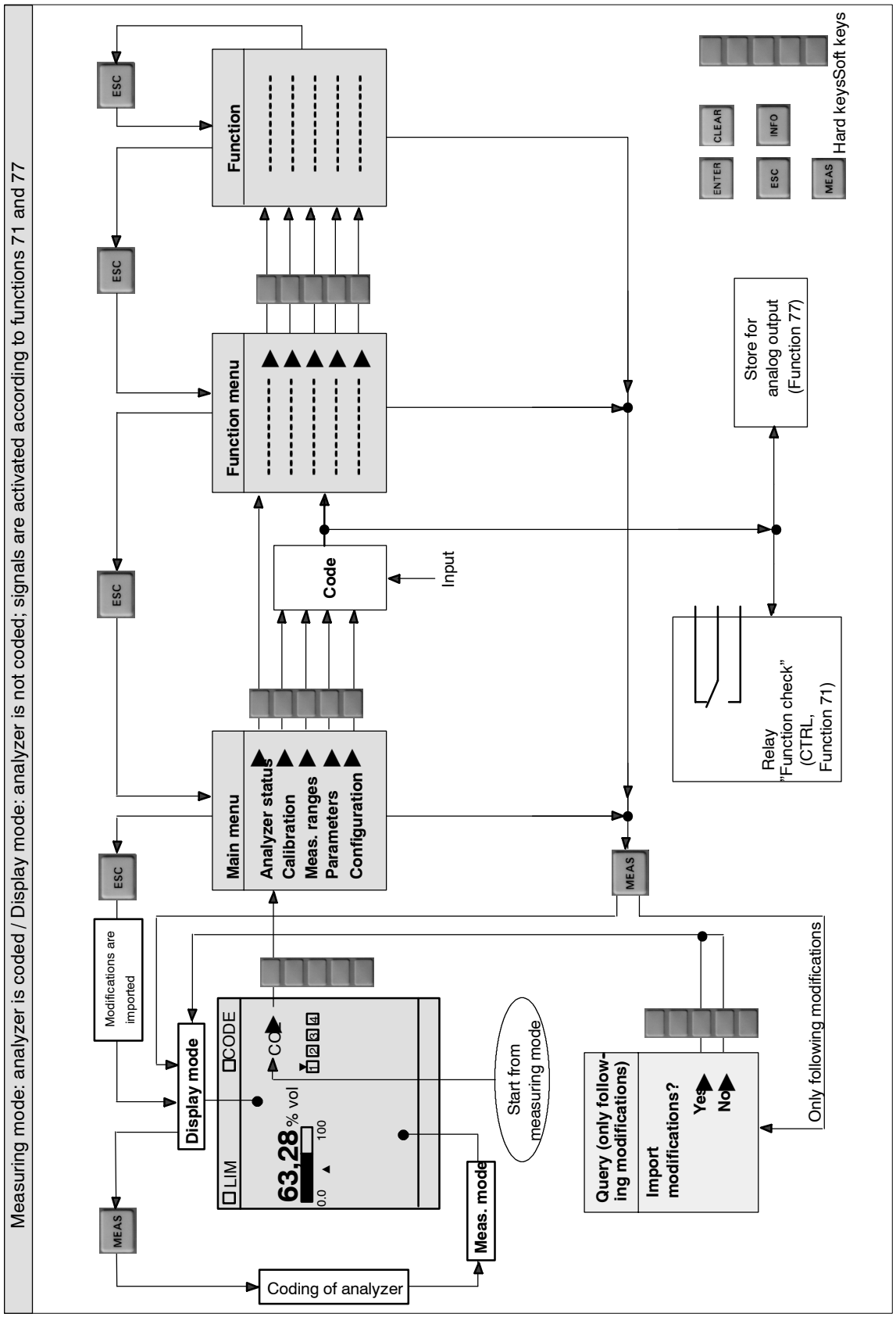
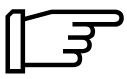



Fig. 5–2 Input sequence

**Note**

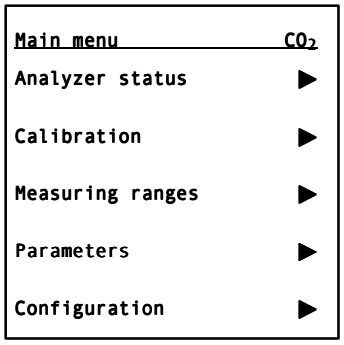


The display of the screen menu is shown for a $CO_2$ application as an example.

## Input sequence

### Entry into main menu

The analyzer is in **measuring mode**. The measured component is shown on the right of the display, together with an arrow pointing to the right (▶). A softkey is assigned to this component. The main menu is called by pressing this softkey.




The main menu consists of the following items (followed by the associated code level):

| | |
|---|---|
| Analyzer status | Not coded |
| Calibration | Code of level 1 |
| Measuring ranges | Code of level 1 |
| Parameters | Code of level 1 |
| Configuration | Code of level 2 |

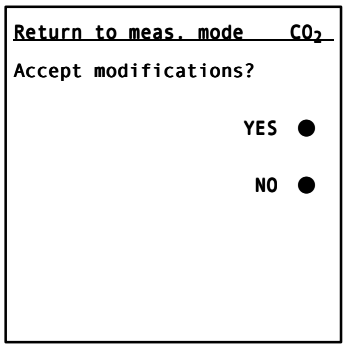
The code for level 1 is factory-set to the value ”111”, that for level 2 to the value ”222”.

### Entering a submenu

Following the selection of a submenu, you will be asked to enter the code of the input level (exception: submenu ”Analyzer status” is not coded and is thus freely-accessible). Decoding of level 2 also decodes level 1. External signalling via a relay contact is possible when decoding if a corresponding relay has been configured with **CTRL** under *function 71*. The warming-up and calibration phases of the analyzer are then also signalled via this relay contact. The measured-value memory becomes active together with the decoding if it has been switched on under *function 77*. The coding can be recognized by the symbol ■ CODE in the display (**display mode**), and decoding by the symbol □ CODE.

**Return to measuring mode**

**MEAS** key: Returns immediately to display mode from any position in the menu structure. A commenced input is aborted.




The adjacent question is displayed before the return is carried out.

Pressing either the YES or NO softkey returns to **display mode**. The modifications are finally imported into the working area of the parameter memory if you press YES, or rejected with NO.

Pressing the **ESC** key returns to the previous function display.

**ESC** key: Leads back step-by-step to display mode. Modifications are then imported without questioning.

**Coding of analyzer**

After returning to **display mode** using **ESC** or **MEAS**, the analyzer can be coded again (□ CODE) by pressing the **MEAS** key again, thus entering **measuring mode**. All statuses produced by the decoding (see above) are cancelled by this.

**Fast selection of functions**

A ”Power user” input has been introduced to permit 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 **measuring mode** and comprises the following input steps:

- Enter number of desired function in measuring display using the digit keys.
- Press the softkey next to the desired component.
- You will then be requested to enter the code if the desired function is protected by a code.

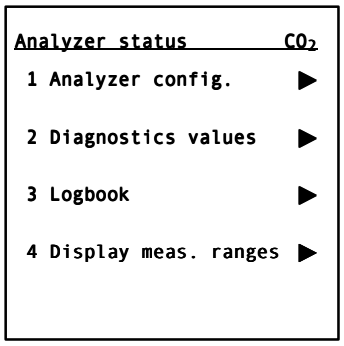
## 5.2 Summary of Input Functions

The following list summarizes the analyzer functions.

| Main menu item (section) | Function number | Function designation |
|---|---|---|
| 5.2.1 Analyzer status | 1 | Analyzer configuration |
| | 2 | Diagnostics values |
| | 3 | Logbook |
| | 4 | Display measuring ranges |
| 5.2.2 Calibration (code 1) | 20 | Zero calibration |
| | 21 | Span calibration |
| | 22 | Setpoints for zero/span |
| | 23 | Total/single range calibration |
| | 24 | Autocal |
| 5.2.3 Measuring ranges (code 1) | 40 | Select ranges |
| | 41 | Define ranges |
| 5.2.4 Parameters (code 1) | 50 | Electric time constants |
| | 51 | Limits |
| | 52 | On/off configurations |
| | 53 | Status messages |
| | 54 | Graphic signal display |
| | 55 | Select display digits/Suppress negative values |
| | 56 | LCD contrast |
| | 58 | Date/time |
| | 59 | Sample point selection |
| | 60 | Setup logbook |
| 5.2.5 Configuration (code 2) | 70 | Analog output |
| | 71 | Relay outputs |
| | 72 | Binary inputs |
| | 73 | ELAN configuration |
| | 74 | Reset |
| | 75 | Save data, load data |
| | 76 | Suppress noise signals |
| | 77 | Store analog output |
| | 78 | Calibration tolerances |
| | 79 | Codes for input levels |
| | 80 | Analyzer test |
| | 81 | Select language |
| | 82 | Pressure correction |
| | 83 | Interference correction |
| | 85 | Switch valves |
| | 86 | Linear temperature compensation |
| | 87 | Error On/Off |
| | 90 | PROFIBUS configuration |

Table 5-1 Summary of input functions

### 5.2.1 Analyzer Status




The adjacent display appears following selection of the diagnostics functions in the main menu by pressing the first softkey (”Analyzer status”).

The diagnostics functions are freely-accessible. You will not be asked to enter a code.

The analyzer provides the following diagnostics functions:

**1 Analyzer configuration**

Important manufacturing data of the analyzer are visible when you select this function:

- Firmware No.
  Order No. of software stored in the EPROM
- Order No.
  Information on ordering data of analyzer
- Serial No.
  Information on date of manufacture and consecutive number of analyzer
- Hardware version
  Information on hardware design of analyzer
- Software version and date
  Information on scope of analyzer functions

**2 Diagnostics values**

The most important internal values are listed under *function 2*. They may be of interest for assessing faults or adjustment operations.

**3 Logbook**

All faults which led to a maintenance request (**W**) or fault message (**S**) are listed in the logbook (see also Section 6.6).

Limit alarms (**LIM**) and function check (**CTRL**) are also recorded. However, these do not trigger a maintenance request or fault message.

The logbook contains a maximum of eight 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 eight pages are full.

The logbook entries can be deleted or blocked (*function 60*), or also switched off individually (*function 87*).

**4 Display measuring ranges**

The measuring ranges defined using *function 41* are listed using *function 4*. However, they cannot be modified in this menu.

**Note**

If a fault occurs whose error message is switched off by *function 87*, there is no reaction at the interface which may be configured. This applies to the ELAN interface as well as to the analog and relay outputs.

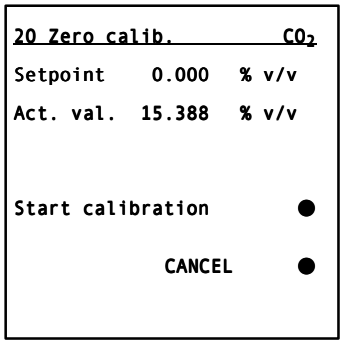
### 5.2.2 Calibration

Either a manual or automatic calibration is possible. The latter (autocal: *function 24*) is only possible with an option board which contains 8 additional binary inputs and 8 additional relay outputs.

The setpoints for the zero and sensitivity adjustments must be set under *function 22*.

The corresponding gases must be applied manually for *functions 20* and *21*.

#### 20 Zero calibration



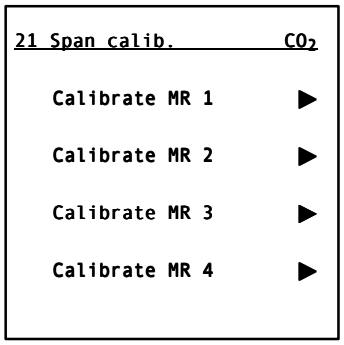

The zero is calibrated simultaneously for all measuring ranges, even if the sensitivity is calibrated individually for the ranges.

The calibration procedure should only be triggered when the measured value (actual value) has stabilized following application of the zero gas.

If the measured value is unsteady, increase the time constant (*function 50*) prior to the calibration.

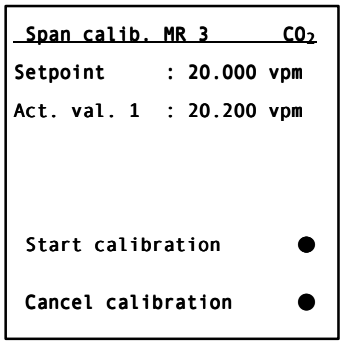
#### 21 Span calibration

A single or total calibration is carried out depending on the setting of *function 23* (component-specific).




**Single calibration:**
The display lists the ranges which were previously defined using *function 41*. The adjacent display is therefore an example of the single calibration of four ranges.

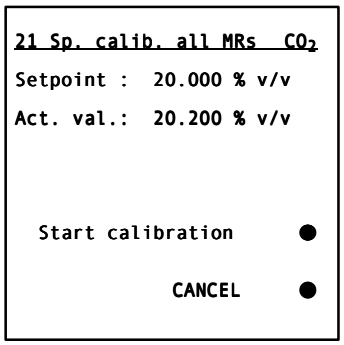
If you now wish to calibrate e.g. range 3, press the corresponding softkey.




The display lists the setpoint and the current value of range 3.

Once the actual value has stabilized, the calibration procedure can be triggered by pressing 4th softkey. The actual value is then set to coincide with the setpoint.

If an incorrect calibration has been carried out by mistake (e.g. with an incorrect calibration gas), the original value can be loaded again by pressing the softkey ”Cancel calibration”.




**Total calibration:**

With a total calibration, all measuring ranges are calibrated together. The ”master” range is defined using *function 22*. It is advisable to select the largest range for this.

The display lists the setpoint and the current value of the ”master” range.

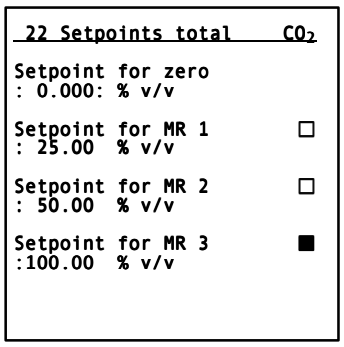
Once the actual value has stabilized, the calibration procedure can be triggered by pressing 4th softkey. The actual value is then set to coincide with the setpoint.

If an incorrect calibration has been carried out by mistake (e.g. with an incorrect calibration gas), the original value can be loaded again by pressing the softkey ”Cancel calibration”.

**Note!**

With a switching ratio for the spans of greater than 1:10, each measuring range should be calibrated separately in order to achieve a higher accuracy.

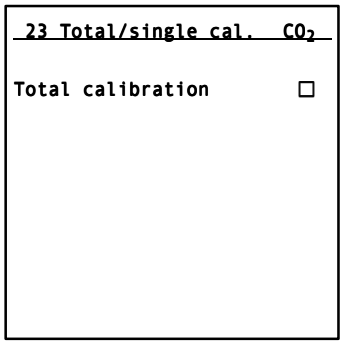
### 22 Setpoints total




The adjacent example shows the setpoint input for a total calibration. The third measuring range has been selected as the master range.

It is not possible to select a master range for a single calibration.

### 23 Total/single range calibration

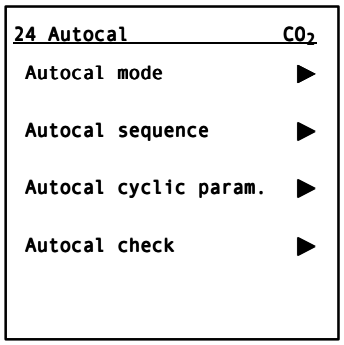



These functions are used to select a total or single calibration of the measuring ranges.

A total calibration means that a ”master range” is calibrated and that all other ranges are calculated by means of a ratio.

If this function is not activated, each range is calibrated individually.

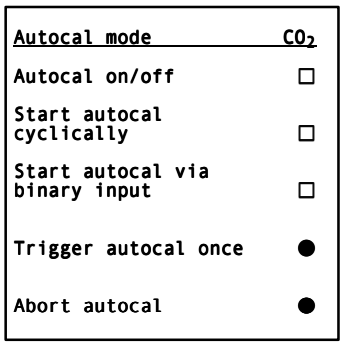
### 24 Autocal




The automatic calibration (Autocal) can only be carried out if the analyzer contains the supplementary electronics (option).

If this is not the case, a corresponding warning is output on the display when you select an autocal parameter.

### Autocal mode




You can use this subfunction to parameterize the various operating modes of the autocal function.

In mode “Start autocal cyclically”, an autocal is started after a specific time (see “Autocal cyclic parameter” for details).

**Autocal on/off**

In the status ”Autocal off” (representation □), the switches ”Start autocal cyclically” and ”Start autocal via binary input” can no longer be activated. ”Trigger autocal once” is also switched off. The cycle time continues, but an automatic calibration is not triggered.

**Start autocal cyclically**

Autocal can be activated in a regular, repetitive cycle if the ”Time from autocal to autocal” has been previously set.

**Start autocal via binary input**

Autocal can be activated via a binary input if you have configured this using *function 72*.

The modes ”Start cyclically” and ”Start via binary input” can be activated simultaneously in order e.g. to check a weekly calibration and to control this check via a binary input.

**Trigger autocal once**

In addition, an autocal sequence can be started in the status “Autocal on” at any time using the softkey ”Trigger autocal once” providing the analyzer is ready for measurement (i.e. calibration or warming-up phase not currently running). A sequence triggered in this manner has no influence whatsoever on the time cycle of an autocal, i.e. the cycle time continues irrespective of this.

When triggered, the point disappears until the process has been finished.

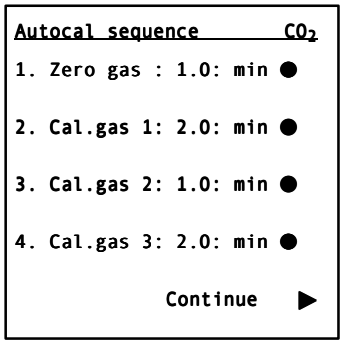
**Abort autocal**

An automatic calibration procedure can be interrupted at any time when being carried out using the key ”Abort autocal”. All calibration data which have been determined so far are rejected, and the calibration data (zero and sensitivity) prior to starting the autocal are used further.

The abort has no influence on the time cycle. All valid adjustment procedures are retained.

**Autocal sequence**

This subfunction can be used to combine several calibration phases into one autocal sequence.




The sequence of the automatic calibration can be freely defined. It is possible to ”compose” a sequence from up to 12 different phases.

In addition to the connection of one zero gas and up to four calibration gases per component, it is also possible to program purging with sample gas, an intermediate sample gas mode, and a signalling contact. This signalling contact is available if it has been previously assigned to a relay output using *function 71*.

**Intermediate sample gas mode**

An intermediate sample gas mode may be necessary if the system is only permitted to leave measuring mode for a specific period. If the total time then required for purging is greater than the permissible loss time, a return must be made to measuring mode between the calibrations (intermediate sample gas mode).

**Signalling contact**

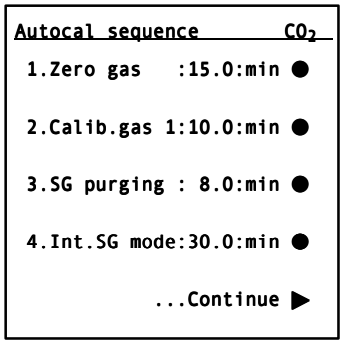
The signalling contact can be used e.g. to trigger the automatic calibration of a second analyzer or to signal the start or end of the autocal function.

**Relay outputs**

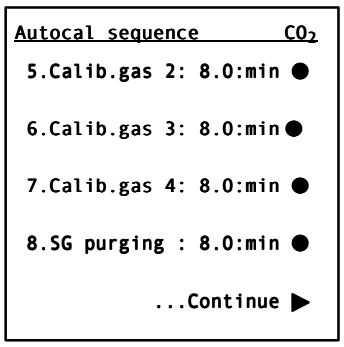
If relay outputs have been assigned for sample gas, zero gas, calibration gases and/or measure/calibrate (*function 71*), these are switched to trigger the corresponding solenoid valves. The same also applies to the signalling contact ”Autocal”; this is closed for approx. one second when the command is executed.

**Example**

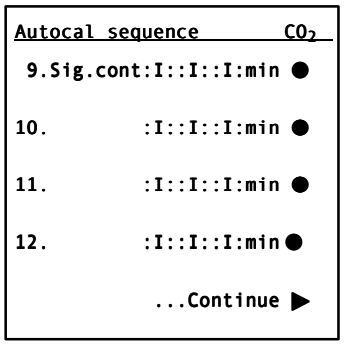
The following sequence is to programmed:




1. Zero gas calibration following 15 minutes purging with zero gas
2. Calibration with gas 1 following purging for 10 minutes
3. Purging with sample gas for 8 minutes
4. Intermediate sample gas mode for 30 minutes
5. Calibration with gas 2 following purging for 8 minutes
6. Calibration with gas 3 following purging for 8 minutes
7. Calibration with gas 4 following purging for 10 minutes
8. Purging with sample gas for 8 minutes
9. Brief signalling contact in order to start ”Autocal” on a further analyzer or channel



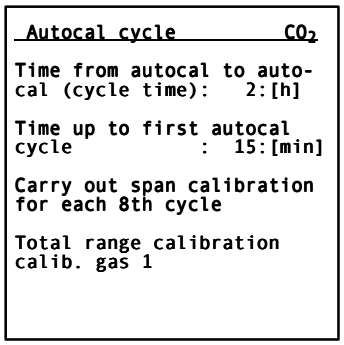

The defined autocal sequence is shown in the adjacent displays.




**List of all commands during an Autocal sequence:**

- Zero gas 1
- Zero gas 2
- Calibration gas 1
- Calibration gas 2
- Calibration gas 3
- Calibration gas 4
- Purge sample gas
- Intermediate sample gas mode
- Signalling contact

### Autocal cyclic parameter




This subfunction can be used to parameterize various time constants for activating a cyclic, repetitive autocal.

- Time from autocal to autocal (cycle time).
  Any setting between 0 and 1000 (hours) is accepted by the analyzer.
- Time up to first autocal cycle (starting at time of setting).
  If “0” is entered here and if autocal is switched on (see ”Autocal on/off”), the analyzer commences immediately with the autocal sequence.

If autocal is switched off, the analyzer only starts an autocal sequence if autocal is switched on within one minute of entering the “0”. If this is not the case, the complete time between two autocal sequences elapses starting with input of the “0”.

**The internal clock continues even when autocal is switched off! It starts at ”01.01.1995 00:00” when the analyzer is switched on, and must be set to the current time using *function 58*.**

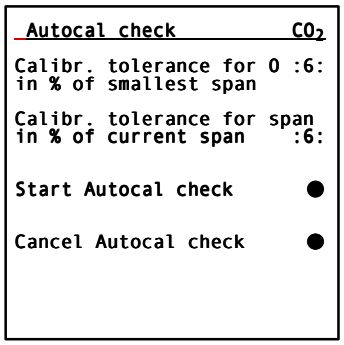
- Number of cycles until the span calibration is carried out.

  The zero is calibrated with each autocal. If it is unnecessary to also calibrate the sensitivity each time the zero is calibrated – e.g. in order to save calibration gas – a value >1 must be entered in the line ”Carry out calibration with calibration gas every : : cycle”.

The information in the last lines indicates that the entered parameters refer to a total calibration with calibration gas for measuring range 3. This range has been previously selected using *function 22*.

**Note**

Access to *functions 20* and *21* is blocked as long as autocal is active (Autocal ■). A corresponding message is output in the display if this function is then selected.

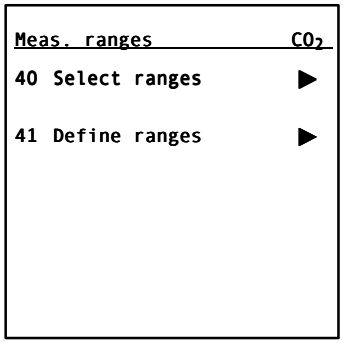



The “Autocal check” is used to check the calibration. The sequence parameterized in the menu “Autocal sequence” is executed as for “Autocal”. However, in contrast to “Autocal”, no new calibrations are triggered, only the deviations with respect to selectable calibration tolerances are checked.

Autocal check sequence:

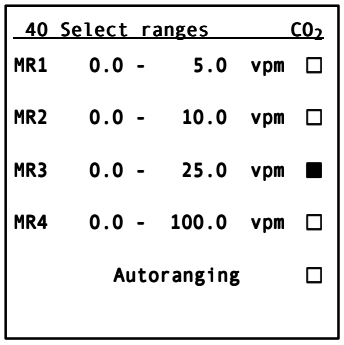
1. Enter the desired calibration tolerances in the menu “Autocal check”. If necessary, select the relay output and the binary input for “Autocal check”.
2. Start the “Autocal check” using the button in the menu “Autocal check” or via the binary input.
3. The analyzer then carries out a sequence as parameterized in the menu “Autocal sequence”.
4. If a calibration limit is violated, the maintenance request W10 is set and, if parameterized, also the relay “AcalChk Dif.”.
5. Both of these are reset following a fault-free Autocal.

### 5.2.3 Measuring Ranges




The adjacent display appears following selection of the range functions in the main menu by pressing the third softkey ("Measuring ranges").

#### 40 Select ranges

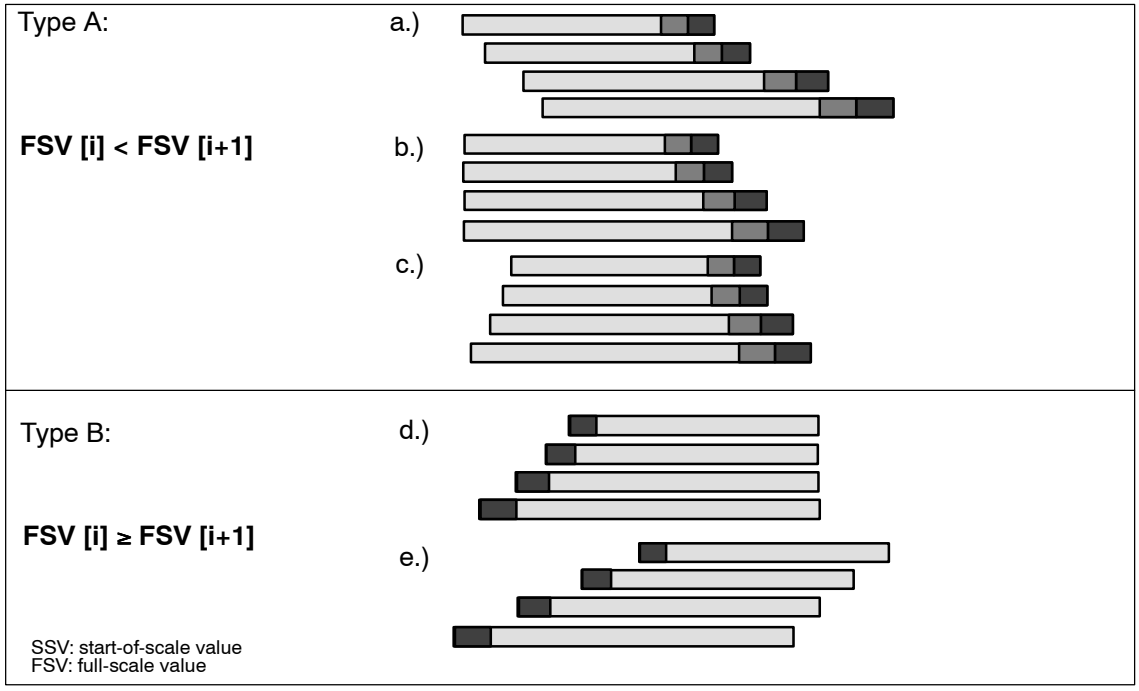



It is possible to select one measuring range or to switch to autoranging. All selection possibilities are subject to mutual interlocking.

**Autoranging** is only possible under the following conditions:

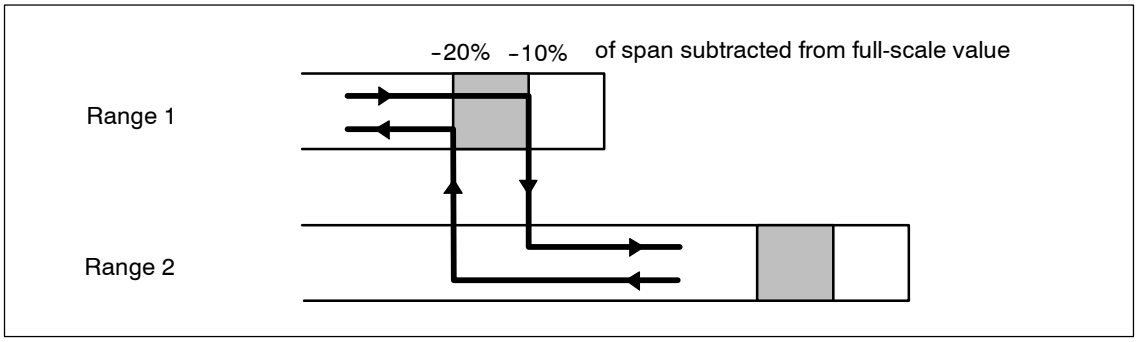
- At least two ranges must be available. A range is considered as present if the start-of-scale value is not equal to the full-scale value.
- The spans must become greater.
- The ranges must be adjacent to one another or overlap.

This results in the following permissible constellations:

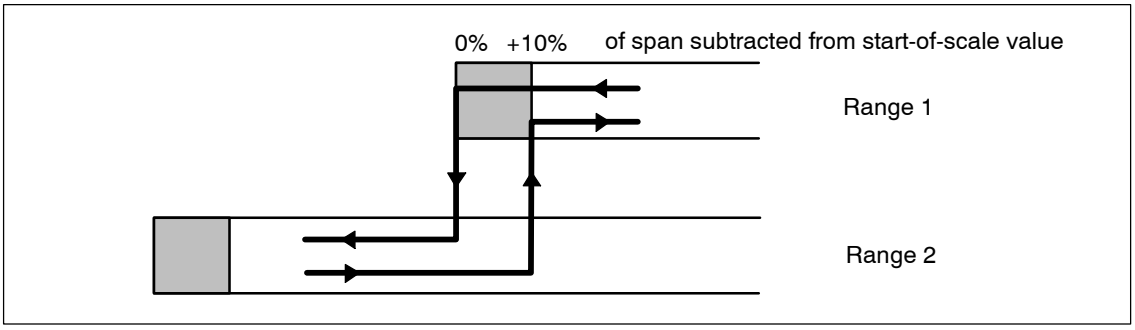


A differentiation is made between two types of range:

Type A: The full-scale value must be smaller than the subsequent full-scale value.
The following applies to autoranging:




Type B: The full-scale value must be greater then or equal to the subsequent full-scale value. Since the spans must become larger at the same time, the start-of-scale values of the subsequent ranges are always smaller.
The following applies to autoranging:




### 41 Define ranges

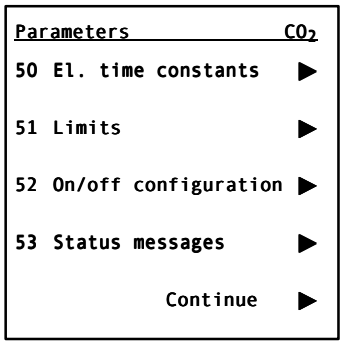
```
 41 Define ranges          CO2
No.  Start value  End value
1  : 0.000 :   : 10.0: % v/v
2  : 0.000 :   : 50.0: % v/v
3  : 0.000 :   : 80.0: % v/v
4  : 0.000 :   :100.0: % v/v

Ranges not plausible!
```

Up to four measuring ranges can be defined whose start-of-scale values are assigned to the bottom value (0/2/4 mA) and whose full-scale values are assigned to the top value (20 mA) of the analog output.

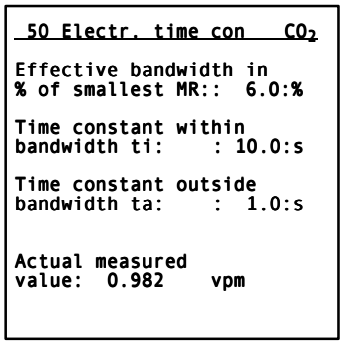
If the message “Ranges not plausible” is displayed, this means that autoranging is not possible.

### 5.2.4 Parameters




The adjacent display with selection of the parameter functions *50* to *53* appears following selection of the parameter functions in the main menu by pressing the fourth softkey (”Parameters”). You can branch to the parameter functions *54* to *61* by pressing the fifth softkey (...Continue).

### 50 Electric time constants



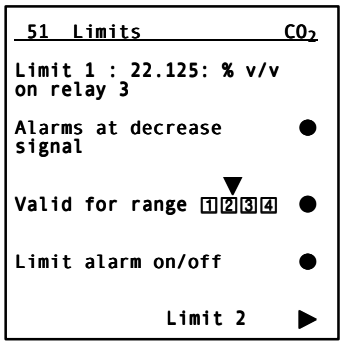

This function can be used to set various time constants to reduce the noise superimposed on the measured value. The reduction in noise approximately corresponds to that of a low-pass filter with a corresponding time constant.

The time constant $t_i$ is effective within a parameterizable interval defined in % of the smallest measuring range. On the one hand, this dampens small changes in measured value (e.g. noise), but becomes immediately ineffective when the signal passes through the effective interval. In this case, the signal is dampened by the external time constant $t_a$.

You can set values up to 100 % for the effective interval, and values up to 100 s for the time constants $t_i$ and $t_a$. Appropriate combination of these three parameters permits the implementation of a low display delay (90 % time) despite high noise suppression.

The effect of the set damping parameters can be observed in the bottom line in which the ”real” measured value is displayed (in % of full-scale value).

### 51 Limits




The analyzer can monitor up to 4 limits which you can assign to the measuring ranges as desired.

Any relay can be assigned to each limit (see *function 71*). If this has not been configured, ”–” appears in the limit display.

Only positive limit values up to 100 % can be parameterized.

It is additionally possible to select whether an alarm is to be output when the entered limit is exceeded or fallen below.

The assignment of the limit to the measuring ranges is achieved by repeatedly pressing the third softkey. Pointers above the bordered range numbers move in the process and show the ranges in which the limit monitoring is to be active (all ranges in the adjacent example).

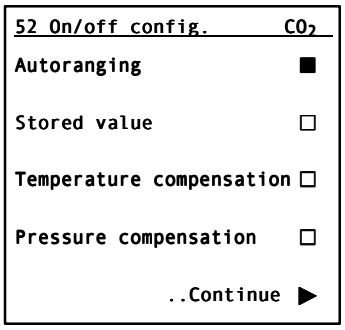
Limit monitoring can be switched off individually for each limit (see also *function 52*).

Resetting of limit alarm:

The triggering of a limit relay is registered in the logbook (*function 3*). The limit relay is automatically reset as soon as the cause for its setting is no longer present.

The program jumps to the next limit display when you press the fifth softkey ("...Continue").

### 52 On/off configurations




This function permits simple switching on and off of the functions listed in the adjacent display.

This simplified input means that it is not necessary to pass through the various menu levels for these functions.

It is possible to switch up to four functions on and off in each of the displays which can be called. Switched-on configurations are identified by ■ , switched-off ones by □. The next display can be selected in each case using the fifth softkey ("...Continue").

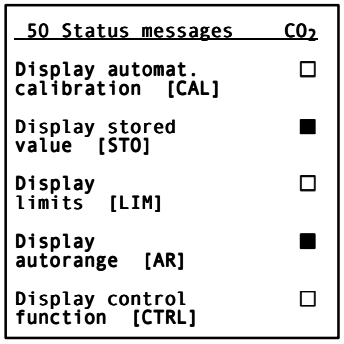
The following configurations can be switched on and off using *function 52*:

| Designation | No. |
|---|---|
| Total calibration | 23 |
| Autocal | 24 |
| Autoranging | 40 |
| Limit monitoring 1 | 51 |
| Limit monitoring 2 | 51 |
| Limit monitoring 3 | 51 |
| Limit monitoring 4 | 51 |
| Blocking of logbook | 60 |
| Suppression of negative measured values | 70 |
| Store analog output | 77 |
| Signalling of tolerance violation | 78 |
| Temperature compensation of zero | 86 |
| Temperature compensation of sensitivity | 86 |
| Fault / maintenance request / CTRL to NAMUR | 72 |

Table 5-2 Functions accessible using *function 52*

Apart from the functions listed in Table 5-2, further service functions can be addressed using *function 52*. These are reserved for servicing personnel and are only visible following input of the service code (code stage 3).

### 53 Status messages




This function can be used to display - in the status line - up to four different statuses which can be assumed by the analyzer.

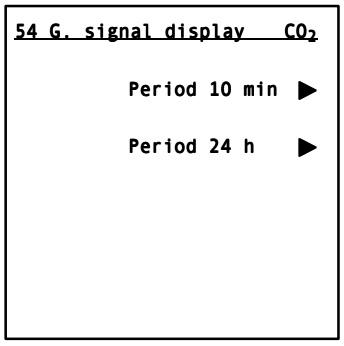
| **Status** | **Output in display depending on *functions 52* and *53*** | | | | |
|---|---|---|---|---|---|
| | *Fct. 53* ☐ | *Fct. 52* ☐<br>*Fct. 53* ■ | *Fct. 52* ■<br>*Fct. 53* ■ | | |
| Calibration: CAL | None | CAL | ☐ CAL | ■ CAL | Calibration running |
| Stored value : STO | None | STO | ☐ STO | ■ STO | Analog output connected to memory<br>(see also *function 77*) |
| Limit: LIM | None | LIM | ☐ LIM | ■ LIM | Upward or downward violation of limit<br>(see also *function 51*) |
| Autoranging: AR | None | AR | ☐ AR | ■ AR | During automatic switching over of ranges |
| Function check: CTRL | None | CTRL | ☐ CTRL | ■ CTRL | Analyzer is decoded<br>Warming-up phase<br>Calibration running |

Table 5-3 Status messages

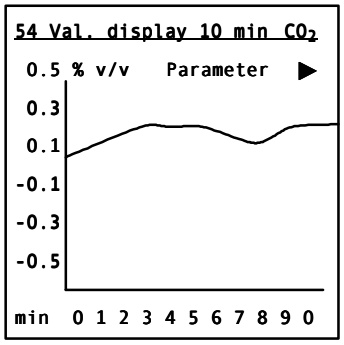
The type of status ”Code” is always present in the status line.

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 output alternately with the status messages.

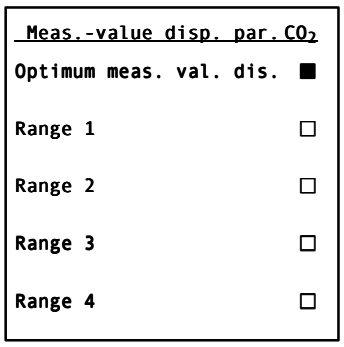
## 54 Graphic signal display




Using this function you can follow the trend of the measured values for the last 10 minutes or 24 hours in the display.

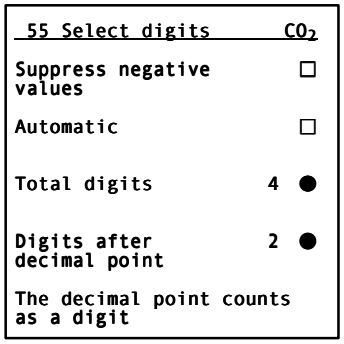



When you select a time axis (period), the measured value is displayed as a trend. The most recent value is at the far right on this axis.




A specific range can be assigned under ”Parameter” to the measured-value axis. Also possible is a facility for an ”Optimum measured-value display”. This means that the software automatically carries out scaling of the measured-value axis when this parameter is activated. The scale is matched to the scatter of the measured values.

## 55 Select display digits

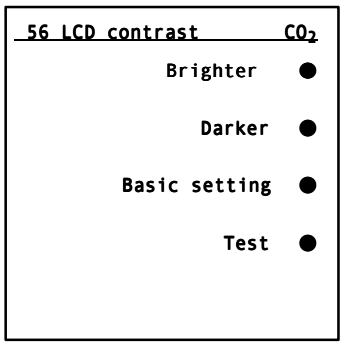



This function permits you to suppress the output of negative values.

It is also possible to select the total number of digits and the number of decimal places.

Note that a maximum of four digits can be displayed which can be distributed before and after the decimal point.

### 56 LCD contrast



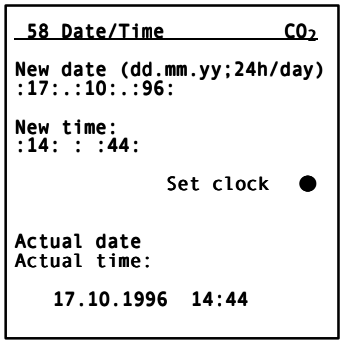

You can adjust the display contrast using this function.

If the contrast is maladjusted you can reestablish the factory setting by pressing the third softkey (”Basic setting”).

It is additionally possible to carry out an LCD test by pressing the fourth softkey (”Test”). Various test displays are then output in succession.

If the LCD contrast is extremely maladjusted, and if the analyzer is in measuring mode, you can reestablish the basic setting by pressing the following key sequence:
8 8 8 8 **ENTER**.

### 58 Date/time




The analyzer has a system clock which is not protected against power failure (not a real-time clock). The clock commences at 1.1.1995 when the analyzer is started.
This function permits you to exactly set the date and time.

This is particularly important to be able to assign a specific point in time to faults stored in the logbook. This can be advantageous when troubleshooting.

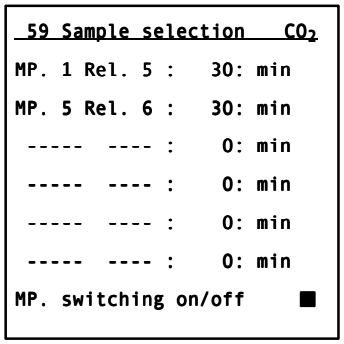
An editing field appears when you call this function in which you can enter the day, month and year as the ”New date”. Hours (24-hour system) and minutes are entered as ”New time”.

The set data are imported when you press the third softkey (”Set clock”). The data then appear as an active display at the bottom of the display.

**Caution**

The date and time are deleted in the event of a power failure and must then be reset.

### 59 Sample point selection




You can use this function to assign up to six measuring points to the analyzer and to switch these over automatically.

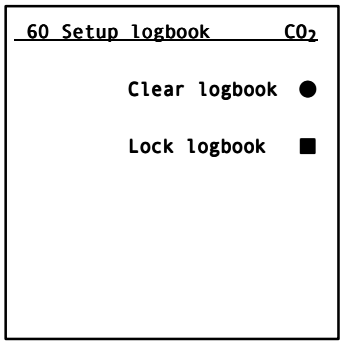
A prerequisite is that the measuring point relays, which then trigger the corresponding solenoid valves, have first been parameterized using *function 71* (”Relay outputs”).

A time duration is also assigned to each measuring point relay and must be entered into the appropriate editing field using *function 59*. Values between 0 and 60000 minutes are possible.

You can switch the measuring point switching on and off by pressing the fifth softkey.

It is additionally possible to assign a signal relay to each measuring-point relay. This permits signalling of the measuring point separate from the measuring point relay. These signal relays must also have already being configured using *function 71*.

### 60 Setup logbook




You can use this function to delete logbook entries (see also *function 3*) or to lock them.

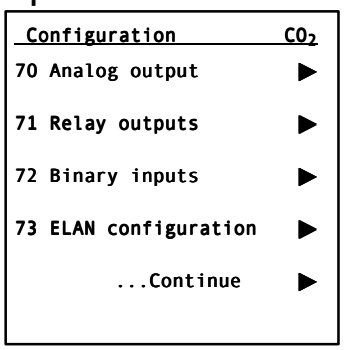
You can also delete logbook entries using the key sequence 5 5 5 5 ENTER.

Status messages, maintenance requests or faults cannot be suppressed by this function; the appear even if the logbook is locked.

### 5.2.5 Configuration

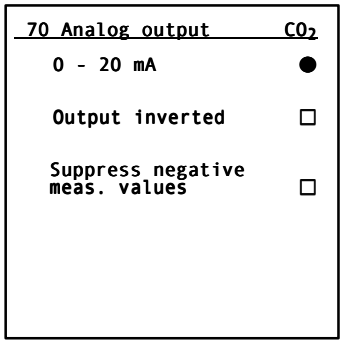
All functions of this block are only accessible via the code for level 2.

**Input menu**




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

**70 Analog output**



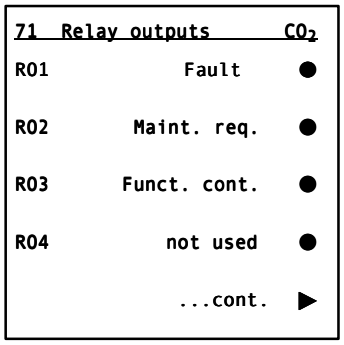

With this function you can define the start-of-scale value of the measuring range (0, 2,4 mA or 4 mA according to NAMUR).

Select the desired value by pressing the softkey assigned to it; the other two values are reset at the same time.

In addition, the analog output can be displayed in reversed form; e.g.
0...20 % $CO_2$ ≡ 0...20 mA → 0...20% $CO_2$ ≡ 20...0 mA.

Negative measured values: if negative measured values have an unfavorable effect on further processing, activate this function to set the negative measured values to 0 (or 2/4) mA at the analog output. The correct measured value is still output in the display.

**71 Relay outputs**




Six freely-configurable relays are available in the basic version. Their switchable output contacts (max. 24 V AC/DC / 1 A) can be used for signalling, controlling valves etc. If six relays are insufficient, it is possible to retrofit eight further relays with additional electronics (option). Each relay can be assigned one of the functions listed in Table 5.4, but each function may only be assigned once. This means, for example, that the fault signal cannot be applied to two relays.

Refer to the terminal assignment diagram in Section 2.5 "Electric connection" for the assignments of the individual relays when de-energized. On delivery, the relays are preset as shown.

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) softkey ("...Continue").

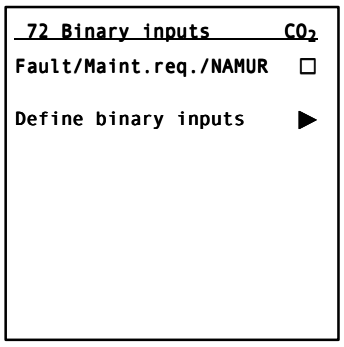
**Caution**

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, the danger exists that a previous (undesired) configuration is called when selecting ”Load user data” (*function 75*).

| Function | Relay is de-energized with | Relay is energized | Remarks |
|---|---|---|---|
| Vacant | | | Relay permanently de-energized |
| Fault | Fault | | Also output in display (in measuring mode) (see Section 6.6) |
| Maintenance request | Maintenance request | | |
| Calibration | | Calibration running | For information |
| Range 1 (...4) | | Range 1 (....4) on | For range identification |
| Limit 1 (... 4) | Limit 1 (...4) has been triggered | | Limit signalling |
| Function check (CTRL) | Function check on | Decoding, warming-up phase, autocal running | Signalling with:<br>● Analyzer is decoded<br>● Warming-up phase (30 min)<br>● Calibration running (Autocal) |
| Sample gas | | Supply of sample gas | Triggering of valves with autocal |
| Zero gas | | Supply of zero gas | |
| Calibration gas 1 (...4) | | Supply of calibration gas | |
| Meas. point 1 (...6) | | Meas. point 1 (...6) selected | For gas sampling via solenoid valves at different measuring points |
| Signal from meas. point 1 (...6) | | Meas. point 1 (...6) selected | For measuring point identification (parallel to measuring point) |
| Signalling contact | | When signalling, the relay is briefly energized | e.g. with autocal: control of a 2nd analyzer |
| Flow of gas | | Sample gas flow too low | For information |
| Autocal check | | Autocal difference too large (*function 24*) | |

Table 5-4 Relay assignments

### 72 Binary inputs



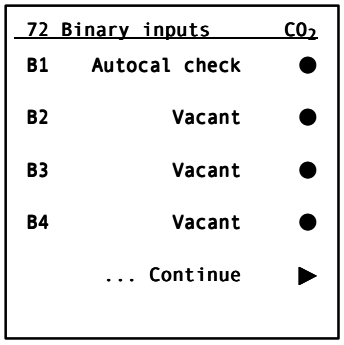

Six floating binary inputs [”0” = 0 V (0...4.5 V); ”1” = 24 V (13...33 V)] which you can configure freely are available in the basic version. If these six inputs are insufficient, you must fit additional electronics with a further eight binary inputs (option).

The mode for the binary inputs is defined here. With “NAMUR” (■) mode, the binary inputs respond as identified by “N” in Table 5-5.

If “NAMUR” mode is not activated (□), the binary inputs respond compatible to the older software release versions V4.3.0 (identified by “X” in Table 5-5).

You can assign one of the **control functions** listed below to each input, but each function must only be assigned once.

Refer to Section 2.4 ”Electric connection” for the assignments of the individual inputs.




No binary channels are already assigned on delivery.
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) softkey (”...Continue”).

**Caution**

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, the danger exists that a previous (undesired) configuration is called when selecting ”Load user data” (*function 75*).

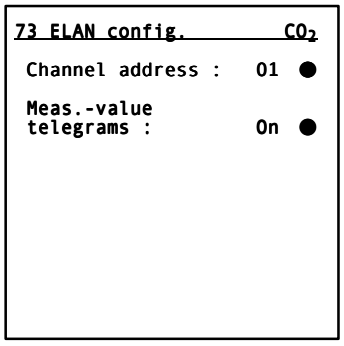
### Control functions/ NAMUR

| Function | Required control voltage | | | Remarks / effects |
|---|---|---|---|---|
| | 0 V | 24 V | 24 V pulse (1 s) | |
| Vacant | | | | No effect when triggered |
| External fault 1, 2, ..., 7 | N | X | | e.g. Signal from gas conditioning: condensation overflow, gas cooler faulty etc. (see also Section 6.6) |
| External maintenance request 1, 2, ..., 7 | N | X | | |
| Deletion of logbook entries | | | N, X | Following deletion, the analyzer is set to the initial state. If the cause of a fault or maintenance request has not been eliminated, the corresponding message appears in the logbook again. |
| Function check (CTRL) 1 ... 4 | N | X | | Relay must be configured to function check using *function 71* if e.g. the function is to be checked with a second analyzer. |
| Start Autocal | | | N, X | Autocal must be parameterized (*functions 23*, *24* and *25*) |
| Measuring range 1 ( ... 4) on | | N, X | | For remote range switching (switch off autoranging (*function 52*)) |
| Zero gas on | | N, X | | Relay must be configured with *function 71* to zero gas, calibration gas or sample gas, and the corresponding valves must be connected. Only applies to total calibration since only one calibration gas can be considered (*function 22*). |
| Calibration gas on | | | | |
| Sample gas on | | | | |
| Start zero calibration | | | N, X | |
| Sensitivity calibration | | | | |
| Autorange | | N, X | | Automatic switching over of measuring ranges |
| Autocal check | | N, X | | Start Autocal check (*function 24)* |
| Measuring protection | | N, X | | You can define a binary input “Measuring protection” with the following effects: If the analyzer is in the status “Measure” (not carrying out function check), it remains in this status, i.e.: - The analyzer can no longer be decoded - The analyzer can no longer be set to “Remote”. The message “Measuring protection switched on” is output in the status line of the measurement display |

Table 5-5 Control functions

The meaning of “N” and “X” in the columns “Required control voltage” is described in *function 72* “Binary inputs”.

### 73 ELAN configuration



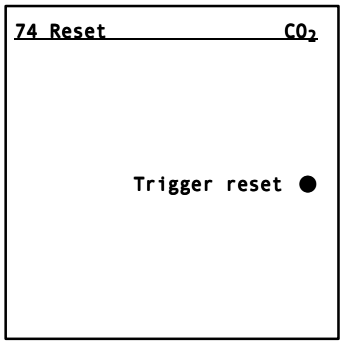

The parameters for an ELAN network can be set in this dialog.

- Channel address
  The channel address for this analyzer can be set here. Addresses between 1 and 12 can be set. Each address must only be used **once** in an ELAN network. Addresses of analyzers used to correct the pressure or the influence of interfering gases must not be entered at this point.
- Measured-value telegrams (on/off)
  The automatic, cyclic transmission of measured values every 500 ms can be switched on/off here.

**Tip!**

For further details on ELAN, refer to the ELAN interface description (C79000-B5274-C176, German/English).

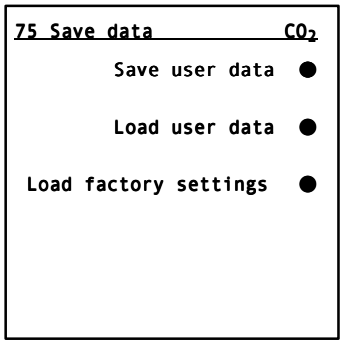
### 74 Reset




This function is used to carry out a cold restart of the analyzer, e.g. in the event of a fault in program execution.

You must wait for the warming-up time following triggering of this function. The analyzer is only fully ready for use following this time.

### 75 Save data, load data

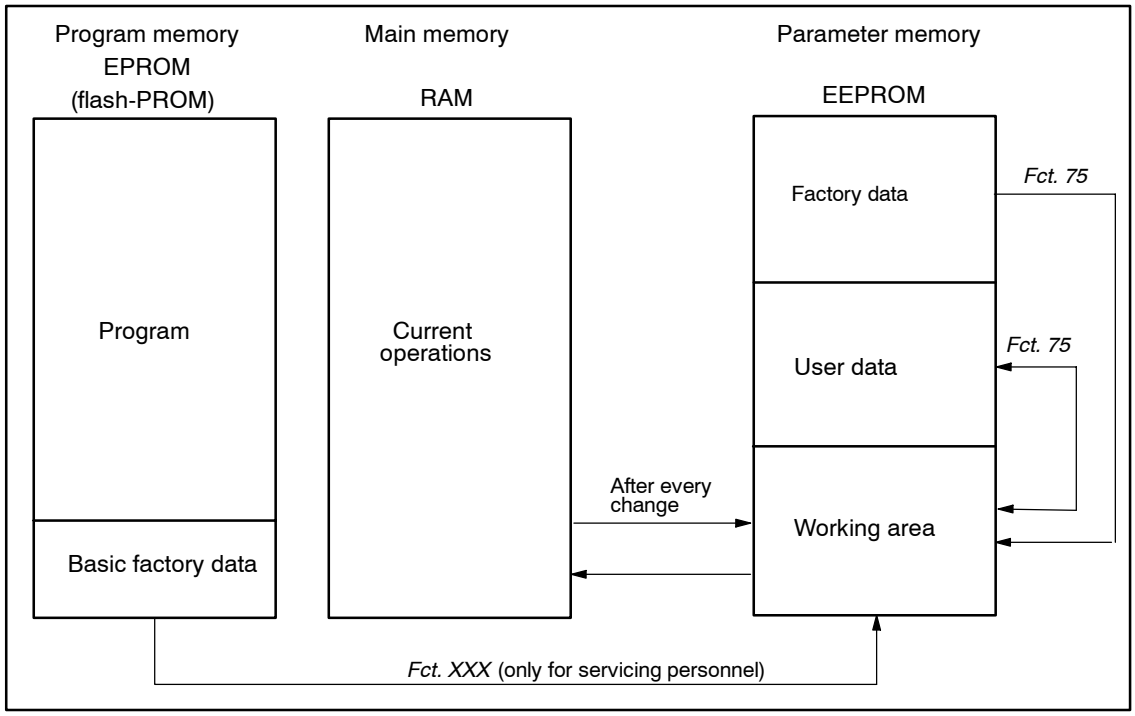



You can use this function to save user-specific data in the user data memory.

This should always be carried out e.g. following successful starting-up of a 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 e.g. new parameter settings are to be tried.

The following Fig. provides a summary of the interactions between the various memory components.




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

### 76 Suppress noise signals

This function is used to eliminate undesirable spikes which exceed an adjustable threshold of the smallest measuring range.

```
 76 Suppress fault      CO2

Suppress noise signals
with a duration of up to
              :  1.0 :  s

Threshold in % of
smallest range        1.0 %
```

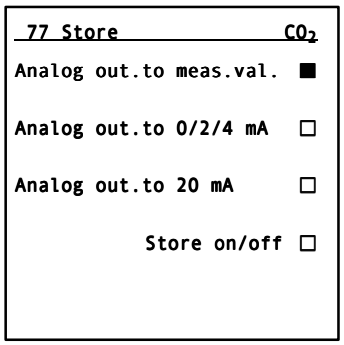
Spikes are caused by electromagnetic interferences or occasional mechanical shocks. These interferences can be suppressed by entering an "action time" of 0 to 5 s. This time means that spikes with a shorter duration are suppressed and no longer influence the measured values..

The input can be made in steps of 0.1 s.

If a change in concentration occurs directly after a fault, there may be a delay in its display.

The settings of *function 50* ("Electric time constants") must be taken into account when activating this function.

### 77 Store analog output



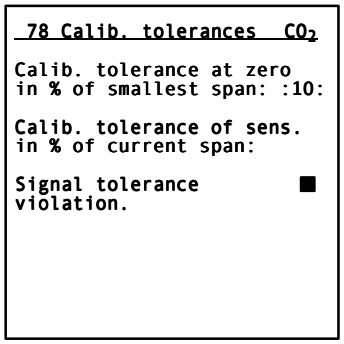

You can use this function to define the response of the analog output or the digital interface (ELAN) with certain analyzer statuses:

In the event of a fault (**S**), **CTRL** (decoding; calibration; warming-up phase), either

- the last measured value
- or 0 (2/4) mA
- or 21 mA

is output at the analog output.

### 78 Calibration tolerances




Using this function it is possible to signal changes in the zero or sensitivity compared to the last calibration as a ”Maintenance request” if a relay output was configured to ”Maintenance request” using *function 71*.

The analyzer must also be set to ”**Total calibration**” (using *function 22*) for this function to be effective.

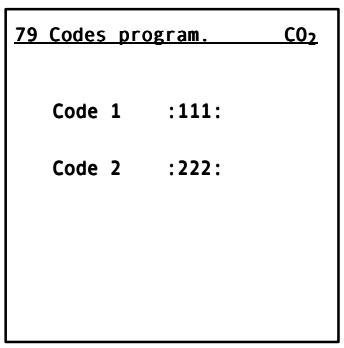
The calibration tolerance, adjustable from 0 to 99 %, refers at the zero to the smallest measuring range and at the sensitivity to the measuring range in which the total calibration is carried out.

This can be clarified by an example:

| | |
|---|---|
| Measuring range 1: | 0 ... 50 % $CO_2$ |
| Measuring range 2: | 0 ... 100 % $CO_2$ |
| Smallest span: | 50% $CO_2$ |
| Range in which calibration is carried out: | Range 2 |
| Defined calibration tolerance: | e.g. 6% |
| Response threshold for zero: | 50% $CO_2$ • 0.06 = 3% $CO_2$ |
| Response threshold for sensitivity: | 100% $CO_2$ • 0.06 = 6% $CO_2$ |

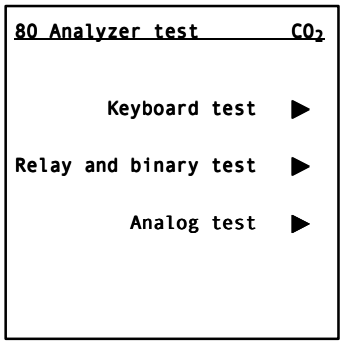
If the zero (sensitivity) differs from the last calibration by more than the parameterized value, the correspondingly configured relay signals a maintenance request.

### 79 Codes for input levels




You can use this function to replace the factory-set codes (”111” for level 1, ”222” for level 2) by your own. The value ”000” for a code means that disabling is not present and that complete access is possible to the corresponding input level.

## 80 Analyzer test




The analyzer test comprises

Keyboard test
Relay and binary test
Analog test

- **Keyboard test**
  The keyboard test can be used to check various keys on the input panel.
  The five softkeys at the right margin can make the associated point disappear or appear.
  If 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 is output in plain text when you press the **INFO** key; the **MEAS** and **ESC** keys retain their return functions.

- **Relay and binary test**

**Caution**

First remove data plugs X3/X5.

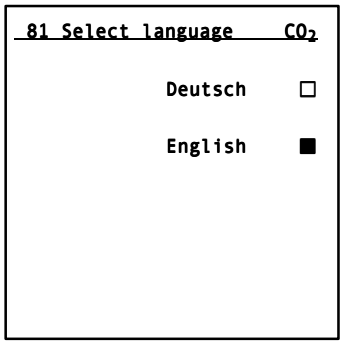
The first display shows 6 of the relay and binary channels. With an option board, a further 8 channels are present on a second page.
Individual relays can be activated using the relay test. This is carried out using the input field. A ”1” makes the relay pull up, a ”0” makes it return to the de-energized state.
Digits other than 0 and 1 are not accepted by the input field.
After leaving *function 80*, the relays reassume the status which they had 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 parameterize the analog output with a constant current of 0 – 24000 μA for test purposes.

  The analog input permanently shows the input currents in μA.

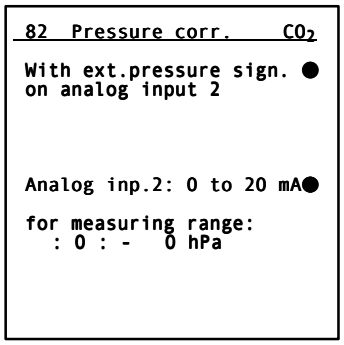
### 81 Select language




You can use this function to switch the analyzer to a second dialog language.

The analyzer is delivered in the ordered language. If English is set as the first language, Spanish is set as the second language. Otherwise, English is usually present as the second language.

### 82 Pressure correction




You can use this function to select

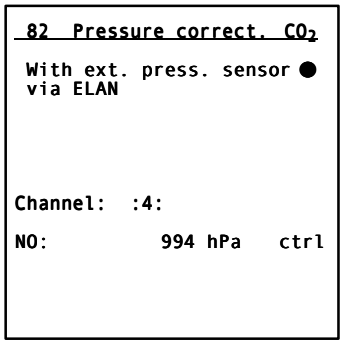
- Pressure correction using an external pressure sensor via analog input 2 (example as shown on left)
- Pressure correction using an external pressure sensor via ELAN (RS 485)

It is also possible to switch off the pressure correction using *function 52* (”On/off configurations”).

The external pressure sensor must be equipped with a diaphragm suitable for the application. Its analog input signal range must be 0(2/4) to 20 mA or 0(1/2) to 10 V.

You can enter the characteristic data of the external pressure sensor using *function 82*. The pressure measuring range is entered in hPa (1 hPa = 1 mbar).

### 82 Pressure correction with external pressure sensor via ELAN




A pressure correction can also be carried out via the ELAN if e.g. a further gas analyzer is already provided with an external pressure sensor and is connected to the analyzer via a serial interface.

The following line shows the component, the pressure, and the status of the analyzer connected via ELAN.

**Note!**

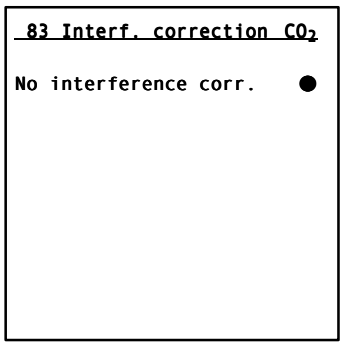
The measured value ”Pressure” is an internal value which can be applied via the ELAN to a further analyzer. It is also possible to use other pressure measuring instruments or analyzers with pressure measuring function if they possess the ELAN functions.

The parameter “Measured-value telegrams” of *function 73* must be set to “On” for the device which delivers the pressure data.

## 83 Interference correction

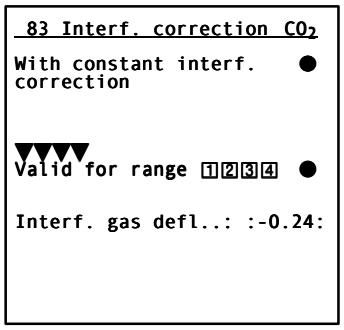
The correction of cross-interference is cancelled for the duration of a calibration (zero or sensitivity). The correction is reactivated when the calibration has been terminated and a return made to measuring mode.

When correcting the cross-interference, it is necessary to differentiate whether the residual gas has a constant or variable composition.




The type of residual gas influence is first defined by pressing the first softkey. The following possibilities exist:

- No interference correction
- Correction of cross-interference for constant influence of residual gas
- Correction of cross-interference for variable influence of residual gas via analog input
- Correction of cross-interference for variable influence of residual gas via ELAN

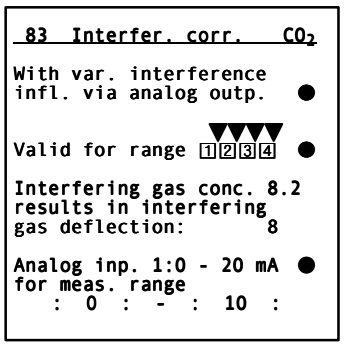



Correction of cross-interference with **constant influence of interfering gas**:

The analyzer must be informed of the value of the zero offset – referred to below as the sample gas equivalent.

It is also possible to define that the correction of cross-interference is only to apply to certain measuring ranges.

**Example:**
If the sample gas of a $CO_2$ analyzer (0–10%) contains a cross-interference whose concentration is approximately constant and which results in a display deviation of –0.24% $CO_2$, you should enter –0.24 as the interfering gas deflection.




The conditions are different with a **variable residual gas composition**.

A variable influence of interfering gas is active here. This can be measured using a separate analyzer and then applied as an analog or digital signal (via ELAN) to the analyzer for calculation of the cross-interference.

Furthermore, the parameter “Measured-value telegrams” *(function 73)* must be set to “On” for the device/channel which delivers the correction data.

An example can clarify this:

The sample gas of an $H_2$ analyzer (0...1 %) contains a concentration of $CH_4$ varying from approx. 0 to 7% $CH_4$. This is measured by a $CH_4$ analyzer where 0 ... 10% $CH_4$ = 4 ... 20 mA. A calibration gas with 8.2% $CH_4$ is available for this analyzer.

Procedure:

1. Enter data:

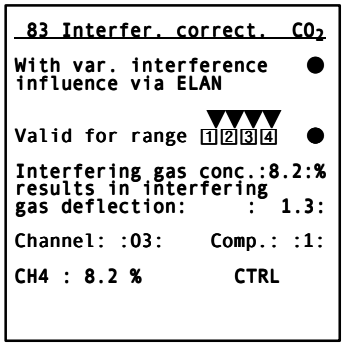
   - Measuring ranges for which the correction of cross-interference is to be applicable (e.g. 1, 2, 3, 4)
   - Analog input 1: 4...20 mA for 0...10% ($CH_4$)

2 Set analyzer to display mode

3 Connect calibration gas with 8.2 % $CH_4$ to the $H_2$ analyzer and record deflection. (In the example, 8.2 % $CH_4$ result in a deflection on the $CO_2$ analyzer corresponding to +1.3 % $H_2$).

4 Enter the value +8.2 as the interfering gas concentration.

5 Enter the value 1.3 as the interfering gas deflection.




If the correction of cross-interference is to be carried out via the RS485 serial interface (ELAN), the same inputs must be made as for **correction of the cross-interference via analog input**.

The following is additionally required:

Channel number and component number of the cross-interference gas analyzer. The type of gas, the measuring range and possibly the analyzer status which are assigned to the channel and the component are then displayed (see also *function 82* "Pressure compensation").

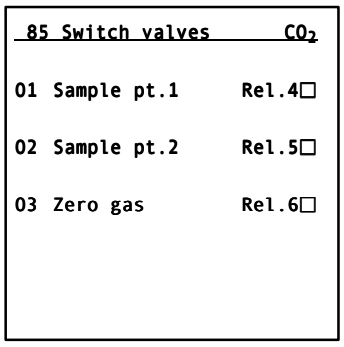
Furthermore, the parameter "Measured-value telegrams" (*function 73*) must be set to "On" for the device/channel which delivers the correction data.

**Note**

In addition to the influence of interfering gases on the zero of the measuring range, changes in the gradient of the characteristic for the measured components occur with certain applications. This change in gradient can also be corrected using the cross-interference function. The gradient correction is parameterized using *function 117* (factory function) by the manufacturer.

Parameters which are factory-set for the correction of cross-interferences (e.g. for the application "Measurement of blast furnace gas") are always set for correction via the ELAN. Refer to the enclosed parameter sheets for details. If correction of cross-interferences is to be carried out using a different ELAN channel or an analog input, *function 83* must be reparameterized.

### 85 Switch valves

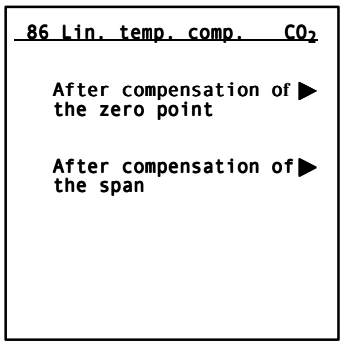



It is possible to manually switch up to six valves using this function. This is achieved using the relays assigned to the individual valves. The relays are located on the motherboard and option board.

A prerequisite is that the corresponding relays have first being configured using *function 71* ("Relay assignment"). The function "Switch valves" only applies to the relay configurations "Zero gas", "Calibration gas 1...4" and "Sample gas".

Only one valve of a maximum of six can be switched at a time since the corresponding relays are mutually interlocked under this function.

### 86 Linear temperature compensation




With certain applications, the analyzer is temperature-compensated both for the zero and the sensitivity. If an additional temperature error occurs during operation, e.g. as a result of slight contamination of the cell, it can be compensated using this function.

**Temperature compensation for zero:**

Starting with an average display temperature $T_M$ it is possible to define two different correction variables for ranges with a higher or lower temperature.

**Example:**

If an increase in the display temperature from $T_M$ to $T_M$' results in a change in zero by e.g. +0.3% referred to the difference between the full-scale and start-of-scale values (according to rating plate) (see *function 2*, Fig. 2), the value

$$\Delta = -\frac{(+\ 0.3)}{|T_M - T_M'|} \times 10 \quad [\%/10°C]$$

must be entered under "Δ" for a temperature increase.

A factor can be determined in the same manner for a decrease in temperature.

If only one correction value is determined, it is meaningful to enter the same value for the second correction value but with the opposite sign.

**Temperature compensation for measured value:**

The procedure is the same as for the zero, except that the percentage change applies to the measured value itself.

**Example**:
If the measured values changes from 70 % to 69 % when the temperature increases by 4°C, the percentage change is

$$\frac{(70 - 69)}{70} \times 100 = 1.42 \quad [\%/4°C]$$

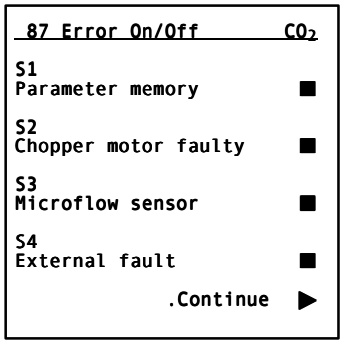
and

$\Delta = 3.55$ [%/10°C].

**Note**

If the zero changes negatively on changes in temperature, $\Delta$ has a positive sign. The same applies to a measured value which becomes smaller.

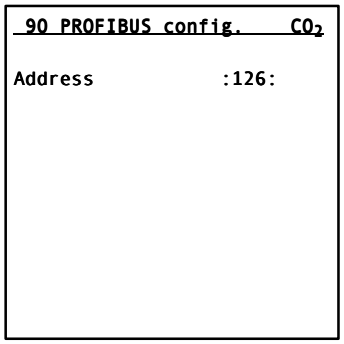
### 87 Error On/Off




Signalling of maintenance requests and faults (see Table 6-1 and LEERER MERKER) can be switched off individually using this function so that neither an entry in the logbook, nor a status signal nor external signalling takes place.

Error messages which do not apply are identified by the absence of text following the error number.

### 90 PROFIBUS configuration




This function can only be called if the analyzer contains additional PROFIBUS electronics.

You can use this function to set the PROFIBUS station address. The address range is from 0 to 126.

# Maintenance

# 6


6.1 Maintenance Concept . . . . . 6–2
6.1.1 Design, Removal and Dismantling of Analyzer Module . . . . . 6–2
6.1.2 Replacement of Analyzer Cell and Piping . . . . . 6–4
6.2 Replacement of Motherboard and Option Board . . . . . 6–5
6.3 Replacement of Fuses . . . . . 6–6
6.4 Cleaning the Analyzer . . . . . 6–7
6.5 Maintenance Request and Fault Messages . . . . . 6–8
6.5.1 Maintenance Request . . . . . 6–9
6.5.2 Faults . . . . . 6–10
6.5.3 Further Errors . . . . . 6–11


**Note**
The analyzer must be regularly maintained to guarantee electrical safety and correct functioning.

The maintenance interval can be defined by the owner. The influence of the sample gases on the wetted parts must be taken into account. If standards or regulations have been defined for these gases/components, these must also be taken into account.

The top cover of the **CALOMAT 6E** can be removed, and the front panel can be swung to the front, to permit maintenance work. With the **CALOMAT 6F**, open the front doors.

The analyzer must be closed again if the maintenance work is interrupted for more than two hours.

## 6.1 Maintenance Concept

All assemblies present in the housing can be replaced in the event of a fault. These assemblies are not repaired. The following assemblies can be replaced:

- Analyzer cell
- Complete piping
- Gas inlets
- Power supply transformer
- Fuses
- Complete motherboard
- Option board
- Complete front panel of housing (C 6E)
- Front panel of housing without display (C6E).

Removal of these assemblies – with the exception of the analyzer cell – is self-explanatory.

**Note**
With the wall mount analyzers, tighten the screws after closing the doors until the doors rest on the housing frame.

**Warning**

Disconnect the power supply and gas supply prior to opening the analyzer.

To prevent short-circuit on the electronics, adjustments must only be carried out using appropriate tools.

Faulty installation or adjustments may result in the discharge of gas, possibly resulting in damage to the analyzer (e.g. explosion hazard) or to the health of personnel (e.g. symptoms of poisoning).

### 6.1.1 Design, Removal and Dismantling of Analyzer Module

**Design**

The analyzer module consists of the actual analyzer cell, a mounting plate with metal cover, and the inlet and outlet piping for the sample gas.

The analyzer cell itself consists of a stainless steel block containing a thermal conductivity sensor.

The top and bottom of the stainless steel block each contain a circuit board. The bottom PCB is for thermostatic control of the analyzer cell, the top PCB is used to control the thermal conductivity sensor and its signal processing.

**Removal**

The analyzer module must be removed before it can be dismantled. To do this, remove the cable from its plug, as well as the gas inlet and outlet piping from the bushings on the rear panel of the housing.

In the **CALOMAT 6E**, loosen the base screws, and in the **CALOMAT 6F**, loosen the mounting nuts on the mounting plate; the module can then be removed from the housing.

**Dismantling**

First remove the gas piping from the analyzer cell. To do this, first remove the metal cover. Then loosen the pressure nuts of the gas inlet and outlet piping which then become visible using a 10-mm spanner, and remove the piping.

Further removal of the analyzer cell is described in Section 6.1.2 “Replacement of Analyzer Cell”.

Assemble in the reverse order.

### 6.1.2 Replacement of Analyzer Cell and Piping

Replace following removal and dismantling of the analyzer cell (see Section 6.1.1). Do this in the following steps:

- Loosen the mounting screws on the brackets, and remove the analyzer cell.
  There are two spacers on each side of the analyzer cell; these are components of each cell and need not be replaced.
- Insert the new cell in the reverse order.
  Ensure that the O-rings are still located in the flanges of the inlet and outlet piping!

The scope of delivery of the piping to be replaced includes the flange nuts as well as a set of clamping ring glands for a pipe diameter of 6 mm, but no O-rings!

- Remove the O-rings from the old piping, and insert entered the flanges of the new piping (use new O-rings if the old ones are defective).
- Fitting of the piping is self-explanatory. It is only necessary to observe the correct procedure when assembling the clamping ring glands.

**Note**

Following each maintenance measure affecting the analyzer cell and the gas path, carry out a leak test as described in Section 4.2.

## 6.2 Replacement of Motherboard and Option Board

It is easy to replace or retrofit the motherboard and option board. Proceed as follows:

**CALOMAT 6E**

- Disconnect data plug from rear panel
- Loosen the three screws (M3) between the DSUB plugs
- Unscrew the housing cover, and remove the locking bracket above the motherboard
- Disconnect the ribbon cable connectors from the motherboard
- Carefully remove the motherboard.

**CALOMAT 6F**

- Open the left housing door
- Disconnect the ribbon cable plugs of the interface cables from the terminals A and B
- Remove the sheet–metal covers
- Remove all cables leading to the motherboard
- Remove the metal cassette in which the motherboard is present out of the analyzer
- Discontent the interface cables (ribbon cables) from the motherboard
- To remove the motherboard, remove the three screws (M 3) between the plugs and a locking screw (M 4) at the opposite end of the motherboard.

**Removal of option board**

Proceed in the same manner as for the motherboard. In contrast to the latter, the option board is only secured using two screws to the rear panel of the housing (**CALOMAT 6E**) or to the metal cassette (**CALOMAT 6F**)**.**

**Installation**

Install the motherboard and option board in the reverse order.

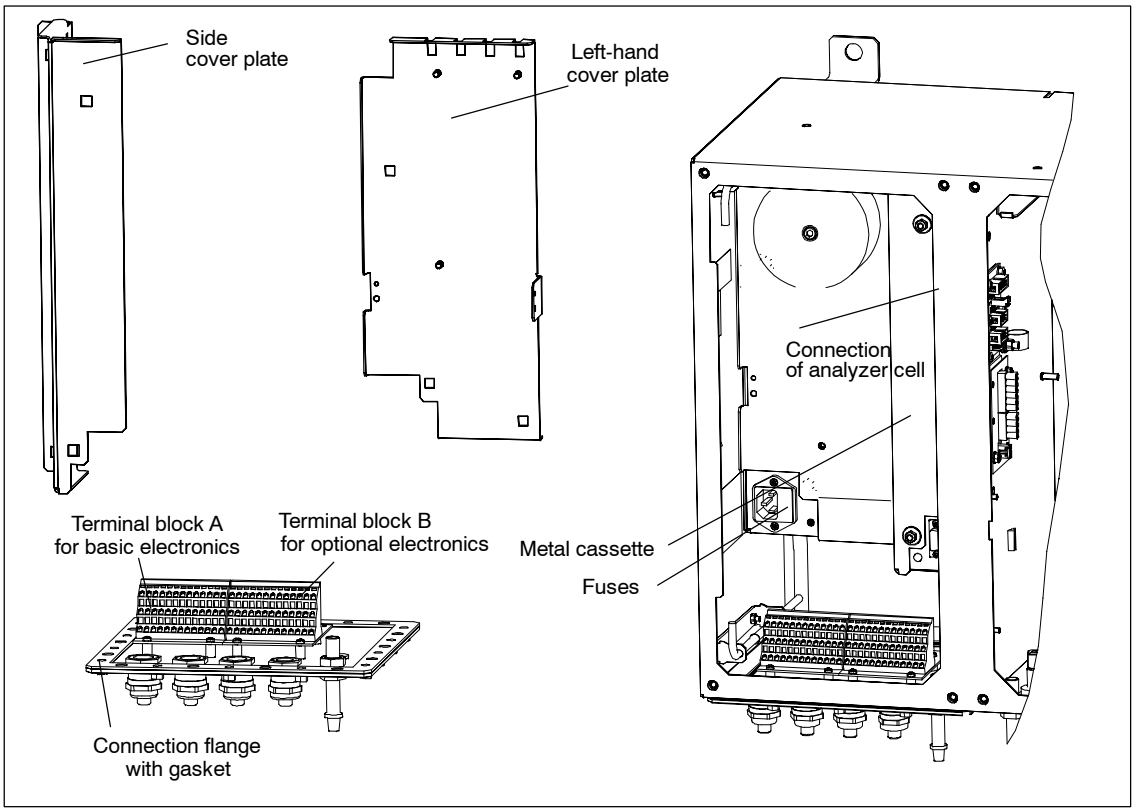



Fig. 6-1 CALOMAT 6F

## 6.3 Replacement of Fuses

**Warning**

Disconnect the analyzer from the power supply before replacing fuses!

In addition, the information described in Section 1.5 concerning operating/maintenance personnel applies.

The analyzer is protected by several fuses with the following ratings depending on the power supply:

200...240V 0.63 T/250
100...120 V 1.0 T/250

To replace, pull out the drawer containing the fuses which is located in the mains filter.

## 6.4 Cleaning the Analyzer

**Surface**

The front panel and control panel can be washed. In hazardous areas, they must only be cleaned using a moist cloth. Otherwise it is recommendable to use water with a commercially available cleansing agent. The surface of the display area in particular must only be cleaned using a slight pressure to prevent damage to the thin foil. Make sure that no water enters the analyzer when cleaning.

**Interior**

If necessary, the inside can be carefully blown out using a compressed air gun after opening up the analyzer.

## 6.5 Maintenance Request and Fault Messages

The **CALOMAT 6** is able to recognize irregularities in the functions. These appear either as a ”Maintenance request” or a ”Fault” in the status line. These are recorded in the **logbook** (*function 3*) at the same time and can also be called from there. A corresponding report is acknowledged by pressing a key next to it. However, this appears again if the cause has not been eliminated.

If a new message occurs, the report stored in the logbook is shifted by one memory location. A total of 32 locations are available, and the oldest of the 32 reports is deleted when a new report occurs. A power failure deletes all reports.

*Function 60* can be used to switch off the logbook or also to delete the messages present in it.

The output of messages can be particularly inconvenient during test runs. They can therefore be switched off using *function 87*. It is not recommendable to use this facility during normal operation.

**Maintenance request**

If references to modifications of device-internal parameters occur, “Maintenance request” is output in the status line of the display. Such modifications need not influence the measuring ability of the analyzer at the time they occur. However, to guarantee reliable measurement in the future, it may be necessary to carry out remedial measures.

If the relay output of the analyzer has been configured accordingly (see also Section 5, *function 71*), it is also possible to output a signal.

**Fault**

Faults in the hardware or modifications to analyzer parameters which make the analyzer unable to carry out measurements result in a fault message. ”Fault” appears in the status line if the analyzer is in measuring mode. The measured value flashes, and it is always necessary to carry out remedial measures in such a case.

It is also possible to output a signal via a relay output just like with a maintenance request (*function 71*). In addition, the analog output can be set to the output current range set using *function 77* (”Store analog output”).

**Further messages**

Further important messages are recorded in the logbook in addition to maintenance requests and faults:

**LIM 1 (... 4)** (upward/downward violation of limits) and
**CTRL** (function check, see Section 5.1).

**Troubleshooting**

Errors are defined as statuses which result in a maintenance request or a fault message. Individual errors, their causes and remedies are described below.

### 6.5.1 Maintenance Request

The following error messages necessitate a maintenance request (output in display) and are signalled externally if a corresponding relay has been configured using *function 71*.

Maintenance requests can be individually deactivated using *function 87*.

| No. | Error message | Possible causes | Remedy | Remarks |
|---|---|---|---|---|
| W1 | Calibration tolerance violated | Contamination of thermal conductivity sensor | Replace the analyzer cell; sample gas must be cleaned prior to entry into analyzer | See also *function 78* for calibration tolerance |
| | | Condensation in gas path | Use appropriate measures to ensure that the wetted parts are **always** above the dew point | |
| | | Calibration gas has been replaced | Repeat calibration | |
| W4 | Set clock | Analyzer has been switched off | New input of date and time | See *function* 58 |
| W6 | Temperature of LCD too high or low | Ambient temperature outside permissible range of 5 ... 45 °C | Ensure that the ambient temperature is in the range of 5 °C ... 45 °C | |
| W9 | External maintenance request | Signal from outside | Check external devices | *Function 72* must be configured accordingly |

Table 6-1 Maintenance requests

### 6.5.2 Faults

The faults listed below lead to a fault message (output in display) and are signalled externally if a corresponding relay has been configured using *function 71*. Immediate remedial measures must always be carried out here by qualified maintenance personnel.

Faults can be individually deactivated using *function 87*.

| No. | Error message | Possible causes | Remedy | Remarks |
|---|---|---|---|---|
| S1 | Parameter memory test unsuccessful | EEPROM contains incorrect or incomplete data in working area | 1. Carry out RESET or switch the analyzer off and on again. If error message S1 appears again:<br>2. Load user data (*function 75*)<br>3. Contact servicing department | Leave analyzer in operation to assist troubleshooting by the servicing staff |
| S4 | External fault message | External signalling | Check external devices | *Function 72* must be configured accordingly |
| S5 | Analyzer cell temperature outside tolerance | Heating controller faulty Temperature sensor of analyzer cell faulty | Replace analyzer cell | The “Temperature of analyzer cell” displayed in “Analyzer status” only has an accuracy of ±5 °C and is therefore only suitable for plausibility monitoring |
| S12 | Mains power supply | Mains voltage outside tolerance | Mains voltage must be within tolerance limits specified on rating plate | |
| S14 | Measured value greater than full-scale value (+5%) | Incorrect calibration; incorrect calibration gas; sample gas concentration too high | Repeat calibration; check calibration gas; check measuring range | |
| S15 | Calibration aborted (cancellation of autocal) | Error message during calibration procedure | Eliminate cause of error message, and repeat calibration | No message on cancellation of manual calibration! |

Table 6-2 Causes of fault messages

### 6.5.3 Further Errors

Within an appropriate period and according to the drift data (see Section 3.7 “Technical data”), calibrate the zero and sensitivity (*functions 20* and *21* respectively) using the corresponding zero and calibration gases. Make sure that the gas conditioning results in pure gases. A larger drift usually indicates that the analyzer cell is contaminated (e.g. by condensation or dirt).

| Fault | Possible cause and elimination |
|---|---|
| Large drift | Check gas conditioning (filter);<br>if the analyzer cell leaks, it must be replaced |
| Measured value is flow-dependent | Check flow; when using a rotameter, note that this is calibrated for air: therefore take the gas density into consideration |
| Green LED at rear flashes at a specific cyclic interval (not regular flashing) | Contact servicing department |
| Sporadic spikes occur | See also *function 76*; contact servicing department if necessary |

Table 6-3 Causes of unstable measured-value display

# Spare Parts List/Returned Deliveries

# 7


7.1 Spare Parts . . . . . 7-2

7.2 Returned Deliveries / Form . . . . . 7-4

## 7.1 Spare Parts

Diese Ersatzteilliste entspricht dem technischen Stand April 2002.

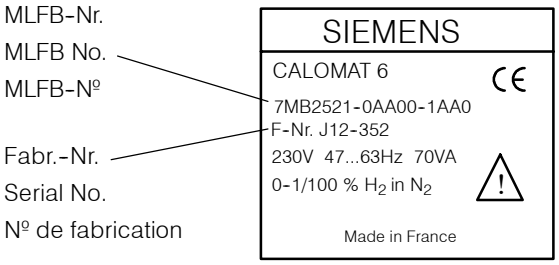
Am Typenschild ist das Baujahr des Gasanalysengerät (verschlüsselt) aufgeführt.

This Parts List corresponds to the technical state of April 2002.

The rating plate shows the year of construction (coded) of the gas analyzer.

Cette list de pièces de rechange correspond au niveau technique d'Avril 2002.

La plaque signalétique de l'analyseur indique l'année de fabrication (codifié) de l'appareil.




Hinweis für die Bestellung

Die Ersatzteilbestellung muß enthalten:

1. Menge
2. Bezeichnung
3. Bestell-Nr.
4. Gerätename, MLFB und Fabr.-Nr. des Gasanalysengerätes, zu dem das Ersatzteil gehört.

Bestellbeispiel:

1 Meßzelle
A5E00095332
für CALOMAT 6
Typ 7MB2521-0AA00-0AA0
Fab.-Nr. J12-352

Wir haben den Inhalt der Druckschrift auf die Übereinstimmung mit der beschriebenen Hard- und Software geprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, sodaß wir für die vollständige Übereinstimmung keine Gewähr übernehmen. Die Angaben in dieser Druckschrift werden jedoch regelmäßig überprüft, und notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar.



Technische Änderungen vorbehalten



Ordering instructions

All orders should specify the following:

1. Quantity
2. Designation
3. Order No.
4. Name of gas analyzer, MLFB No. and Serial No. of the instrument to which spare part belongs.

Example for ordering:

1 Measuring cell
A5E00095332
for CALOMAT 6
type 7MB2521-0AA00-0AA0
Serial No. J12-352

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be excluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections are included in subsequent additions. Suggestions for improvement are welcomed.



Technical data subject to change.



Indications lors de la commande

La commande de pièces de rechange doit comporter:

1. Quantité
2. Désignation
3. Nº de réferénce
4. Nom, type et Nº de fabrication de l'analyseur de gaz pour lequel est destiné la pièce de rechange.

Exemple de commande:

1 Cellule de mesure
A5E00095332
pour CALOMAT 6
type 7MB2521-0AA00-0AA0
Nº de fab. J12-352

Nous avon vérifié la concordance du contenu de ce document avec les charactéristiques du matériel et du logiciel. Toutefois des divergences ne sont pas à exclure ce qui ne nous permet pas de garantir une conformité intégrale. Les informations contenues dans ce document sont régulièrement vérifiées, et les indispensables corrections apportées dans les éditions suivantes. Nous vous remercions pour toutes propositions visant à améliorer la qualité de ce document.



Sous réserve de modifications techniques

| **Bezeichnung**<br>**Designation**<br>**Désignation** | **Bestell-Nr.**<br>**Order No.**<br>**Nr. de référence** | **Bemerkungen**<br>**Remarks**<br>**Remarques** |
|---|---|---|
| Analyzer cell* without housing or piping | A5E00095332 | |
| Piping* (inlet) with screwed glands<br>Piping* (outlet) with screwed glands | A5E00160260<br>A5E00160261 | Only for rack-mounted analyzer<br>Only for rack-mounted analyzer |
| Piping* (inlet) with screwed glands<br>Piping* (outlet) with screwed glands | A5E00124610<br>A5E00124610 | Only for wall mount analyzer<br>Only for wall mount analyzer |
| O-rings (pack of 4) | A5E00124182 | Material: FFKM |
| Gas bushing 6 mm<br>Gas bushing 1/4" | C79451-A3480-B32<br>C79451-A3480-B33 | Only for rack-mounted analyzer<br>Only for rack-mounted analyzer |
| Gas bushing 6 mm<br>Gas bushing 1/4"<br>Gasket for gas bushing | A5E00139114<br>A5E00139116<br>C79165-A3044-C166 | Only for wall mount analyzer<br>Only for wall mount analyzer<br>Only for wall mount analyzer |
| Mains transformer 230 V<br><br>Mains transformer 115 V | W75040-B31-D80<br><br>W75040-B21-D80 | For rack-mounted and wall mount analyzers<br>For rack-mounted and wall mount analyzers |
| Fuse T 0.63 A<br>Fuse T 1.0 A | W79054-L1010-T630<br>W79054-L1011-T100 | For 200 - 240 V power supply<br>For 100 - 120 V power supply |
| Mains filter | W75041-E5602-K2 | |
| Motherboard **without** firmware | C79451-A3474-B601 | |
| Motherboard **with** German firmware<br>Motherboard **with** English firmware<br>Motherboard **with** French firmware<br>Motherboard **with** Spanish firmware<br>Motherboard **with** Italian firmware | A5E00124006<br>A5E00124008<br>A5E00124009<br>A5E00124010<br>A5E00124011 | When ordering firmware or motherboards with firmware, always specify the serial No. of the analyzer! |
| German firmware<br>English firmware<br>French firmware<br>Spanish firmware<br>Italian firmware | A5E00092676<br>A5E00092677<br>A5E00092678<br>A5E00092679<br>A5E00092680 | |
| Relay option board<br>PROFIBUS PA option board<br>PROFIBUS DP option board<br>Relay option board<br>PROFIBUS PA option board<br>PROFIBUS PA EEx i option board<br><br>PROFIBUS DP option board | C79451-A3480-D511<br>A5E00057307<br>A5E00057312<br>A5E00064223<br>A5E00057315<br>A5E00057XXX<br><br>A5E00057318 | Retrofitting set for rack-mounted analyzer<br>Retrofitting set for rack-mounted analyzer<br>Retrofitting set for rack-mounted analyzer<br>Retrofitting set for wall mount analyzer<br>Retrofitting set for wall mount analyzer<br>Retrofitting set for wall mount analyzer EEx p<br>Retrofitting set for wall mount analyzer |
| PROFIBUS firmware update | A5E00057164 | For PROFIBUS PA and PROFIBUS DP |
| LCD/keyboard adapter board<br><br>LCD | C79451-A3474-B605<br><br>W75025-B5001-B1 | For rack-mounted and wall mount analyzers<br>For rack-mounted and wall mount analyzers |
| Housing front panel, complete<br>Housing front panel, **without** LCD | C79165-A3042-B18<br>C79165-A3042-B508 | Only for rack-mounted housing<br>Only for rack-mounted housing |

***** When ordering piping or measuring cell, it is recommendable to also order O-rings.

## 7.2 Returned Deliveries / Form

The gas analyzer or spare parts should be returned in the original packing material. If the original packing material is no longer available, wrap the analyzer in plastic foil and pack in a sufficiently large box lined with padding material (wood shavings or similar). When using wood shavings, the stuffing should be at least 15 cm thick on all sides.

When shipping overseas, the analyzer must be additionally sealed air-tight in polyethylene foil at least 0.2 mm thick with addition of a drying agent (e.g. silica gel). In addition, the transport container should be lined with a layer of union paper.

Please photocopy the form printed overleaf, fill in, and enclose with the returned device.
In case of guarantee claim, please enclose your guarantee card.

### Addresses for Returned Deliveries

**Spare parts service**

- Please send your orders for spare parts to the following address:
  SIEMENS SPA
  CSC
  Tel.: (00333)88906677
  Fax: (00333)88906688
  1, chemin de la Sandlach
  F–67506 Haguenau
- DP order form receiver: 0011E

**Repairs**

To enable fast detection and elimination of faults, please return the analyzers to the following address until further notice:

SIEMENS SPA
CSC
Tel.: (00333)88906677
Fax: (00333)88906688
1, chemin de la Sandlach
F–67506 Haguenau

- DP order form receiver: 0011E

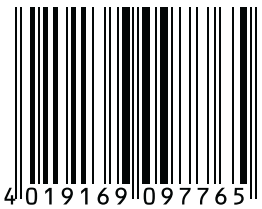
# Returned deliveries form

**( ) Repair ( ) Guarantee**

| | |
|---|---|
| **Name of customer** | |
| Address | |
| Person responsible | |
| Delivery address | |
| Telephone<br>Fax<br>E-Mail | |
| Address for returned delivery<br>(if different from above) | |
| Customer (original)<br>Order No. | |
| Siemens (original)<br>order confirmation No. | |
| Device name | |
| MLFB No. | |
| Serial No. | |
| Designation of returned part | |
| **Description of fault** | |
| **Process data at position of use** | |
| Operating temperature | |
| Operating pressure | |
| Composition of sample gas | |
| **Duration of use/ date of first use** | |

| | | | |
|---|---|---|---|
| **Repair report** | | | |
| RH-Nr.: | Arrival date: | Ready: | Technician: |

Do not fill in this block; for internal use only

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**Siemens AG**
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