PowerMon

USER MANUAL

KOLORIMETER
SILIKOMETER
IONOMETER
NATRIOMETER
TITROMETER

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BRAN+LUEBBE
An SPX Process Equipment Operation

Read the instructions in this manual carefully before installing or starting the system. Bran+Luebbe GmbH can accept no liability for damages due to non-observance of this manual. Furthermore guarantee will invalidate.

Using non-Bran+Luebbe spare parts will also invalidate the guarantee.

Information in this manual is subject to change without notice and does not represent a commitment on the part of Bran+Luebbe GmbH.

Where manuals are translated into several languages, the German language text is considered as the original.

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1 INTRODUCTION

The Bran+Luebbe PowerMon analyzers belong to a new generation of fully automatic online analyzers. They continuously measure trace concentrations in liquid samples by using wet-chemistry methods. The manual describes the following analyzers:

- PowerMon Kolorimeter
- PowerMon Silikometer

The manual includes information about installation, operation and maintenance of the PowerMon. We assume that operators have a basic technical knowledge.

The operation of the analyzer and the system program is described in a separate manual „PowerMon – Operating Manual“.

Read this manual carefully before installing or commissioning the system. Keep the manual near the system.

The manual is divided into the following chapters:

If you have any problems or questions please contact our service hot-line:

HOTLINE PHONE/FAX: PLEASE CONTACT YOUR LOCAL DISTRIBUTOR

With systems where start-up or reagent supply has been contracted, vouchers for these services are supplied to the initial customer (e.g. project engineering office or first supplier).

1.1 Conventions used in this manual

The following markings are used:

- Capital letters are used to mark operating modes and functions, e.g. CALIBRATE.
- Bold letters are used to indicate the **keys** on the Touch Screen.

Following safety warnings are used:

Danger:
Used if disregarding of a safety precaution may result in serious injury or death.

Warning:
Used when there is a danger of minor injury or serious damage to the system if you do not follow the precautions.

Caution:
Used when there is a danger of minor damage to the system if you do not follow the precautions.

Arrows indicate supplementary information or to call attention to recommendations that simplifies daily operation and ensures proper function.

1.2

1.3 Bran+Luebbe Training courses

Bran+Luebbe offers regularly practice-oriented training courses for all PowerMon analyzing devices.

Contents of that two or three-day-long training courses are:

- Introduction to the analytical procedures
- Handling chemicals
- Operation of the equipment with practical exercises
- Maintenance work
- Error search and solving on the equipment

For more information on that contact us by phone: ++49 (0)40/522 02 505

Or send following form by post to:

Bran+Luebbe GmbH
- Service AOLM -
POB 1360
22803 Norderstedt
Germany

You can also send an email to the following address:
ServiceAnalyzer@ProcessEquipment.spx.com

✂

Bran+Luebbe PowerMon Training Course

Fax an ++49 (0)40/522 02 317

Bran+Luebbe GmbH, Service AOLM, POB 1360, 22803 Norderstedt, Germany

❑ **Yes**, I would like to receive more information about the PowerMon training courses.

We operate

❑ PowerMon Ionometer/Natriometer

❑ PowerMon Kolorimeter/Silikometer

❑ PowerMon Titrometer

Company _____

Name _____

Address _____

_____

_____

Phone _____

Fax _____

Email _____

2 SAFETY PRECAUTIONS

Use this device only for the purpose it is intended for. The owner has to take care that the system is only operated by qualified and well instructed staff. Pay attention to the safety warnings at all times.

2.1 General safety precautions

Danger:
This system contains electrical circuits and components operating under dangerously high voltages. Contact may result in electric shock and severe or fatal injury.

Observe the following general precautions:

- All electrical connections, maintenance and repair work which requires the control section to be opened may only be performed by a qualified electrician.
- Make sure the system is properly grounded before switching on.
- Check the power cable for damage before switching on, and do not switch on if it is damaged or cut.
- Switch the system off before starting maintenance, repair or cleaning work in the control section and enter STOP mode before working on the analyzer in. Make sure there is no dangerous reagent in the tubing of the analyzer section.
- Switch the system off before starting work on heating elements. Contact may result in burning and the heating elements could be damaged.
- The control section contains condensers charged with dangerously high voltages. Wait at least one minute after switching the system off before opening the control section.
- Never spray or wash the system because no water may the interior.
- Protect the system from one-sided heat radiation, direct sunlight and vibration! It must be installed in a dry, dust-free room. Special precautions are required in environments with corrosive gas, vapor or explosion risk.
- Do not place things on the top of the system

2.1.1 Appropriate usage

The PowerMon analyzers are dedicated for the on-line measurement of substances in water. Depending on the application the sample can measure the concentration of specific parameter, which is described in Appendix C. The analyzers may only be used for this purpose. The systems are intended for commercial use and are only permitted for this usage.

The systems may not

- be operated under pressure, i.e. the sample has to be supplied unpressurized.
- be operated with reagents that are not described in the Method Description (refer to Appendix C).
- changed without permission. The manufacturer/supplier can accept no liability for damages due to non-observance.

2.1.2 Safety hazards and behavior in case of emergency

The Bran+Luebbe PowerMon devices comply with legal safety requirements.

The risks based on the devices have been minimized by engineering design. Residual risks (electrical, mechanical, thermal, chemical or biological dangers) due to transport, commissioning, repair and maintenance work or in operating mode cannot be completely excluded.

IMPORTANT!
Observe strictly the warning and safety advices on the devices and those in this User Manual and in the Operating Manual.

In case of emergency you must be able to shut down the device immediately. There is an emergency if human life is in danger and/or another danger exists. The source of danger may be the device itself or another origin.

To switch off the device in case of emergency pull out the power plug. If this is not possible, there has to be an emergency stop switch near the device.

IMPORTANT!
An emergency stop switch is not included in the standard scope of delivery of the PowerMon!

Fix the failure.

In case of fire use only appropriate extinguishing media.

Warn the other staff of any danger, even if it is only supposed.

Keep calm.

After an emergency the device may not commissioned again before the failure is fixed and it has be ensured that the system is not damaged.

2.1.3 Working place

When operating the device or performing repair or maintenance work, the area around the device has to be considered as working place.

Reagents are needed to operate the system. They must be particularly marked in accordance with EU-regulations (Council Directive 67/548/EEC ”Classification, packaging and labeling of dangerous substances”). The operator has to take care that the necessary safety devices exists near to the working place. If the system is installed without housing it must be ensured that the working place below the device is protected from dropping reagents.

IMPORTANT!
Please also pay attention to chapter 4.3 Installing the system and especially section 4.4 Operating area requirements.

2.1.4 Operating staff

Only persons may work on the system that are authorized and instructed by the operator. Trainees may only work on the device under supervision. Within the working area the operator is responsible to one or more other parties.

The operator has to

- make this User Manual and the Operating Manual accessible to the operating staff
- ensure himself that the operating staff has read and understand these manuals

As a competent, qualified and certified operating staff all persons apply who have, based on their education and experience, enough knowledge to fulfill the requirements to operate this device. Furthermore these persons must be familiar with the general approved rules of technology as well as the appropriate industrial safety and accident prevention regulations. This applies also and in particular to the rules for the handling of reagents. Section 2.2 Rules for reagent handling and section 2.3 Labeling of dangerous substances go into the detail of these rules.

Bran+Luebbe practice oriented training courses for all PowerMon analyzers (refer to section 1.2).

2.2 Rules for reagent handling

Danger:
Special precautions are needed when working with chemical reagents, both when renewing the reagents and when dealing with leaks or spills. Some reagents can cause chemical burn and may cause injury or death if swallowed. Refer to the hazard symbols and R- and S-codes on the reagent containers. The corresponding R- and S-codes are also part of the safety data sheets which are available on request.

Section 2.3.1 contains a list of hazard symbols and section 2.3.2 a list of the R-codes (warnings about particular dangers) and the S-codes (safety recommendations).

Additionally pay attention to the following:

- Only qualified staff may work with reagents.
- Avoid any reagent contact with skin or mucous membranes.
- Wear protective clothing if necessary, such as overalls, gloves and safety glasses.
- Never pipette reagents by mouth.
- Do not put reagents into containers which could be confused with those used for drinks.
- Do not eat, drink or smoke next to reagents.
- Remove reagent splashes on and inside the monitor at once with a damp cloth to protect it from damage.
- Keep the reagents securely closed and in a safe place where there is no risk of abuse.

2.3 Labeling of hazardous material

Some of the PowerMon reagents contain hazardous materials. These reagents underlie a body of rules and regulations according to the EU-directive (Council Directive 67/548/EEC).

Hazardous materials are chemical substances or mixtures (preparations) which can be injurious to human health. Those may be solid, liquid or gaseous and can enter the human body by inhalation, swallowing or by contact with the skin.

If the reagents used with your analyzer are classed as hazardous they will be marked as following:

- Hazard symbols. See explanation in section 2.3.1.

- The relevant R- and S-codes (safety and hazard labeling). A complete list is shown in section 2.3.2.

2.3.1 Hazard symbols and descriptions

The following hazard symbols and danger labels can be found on Bran+Luebbe reagent containers:

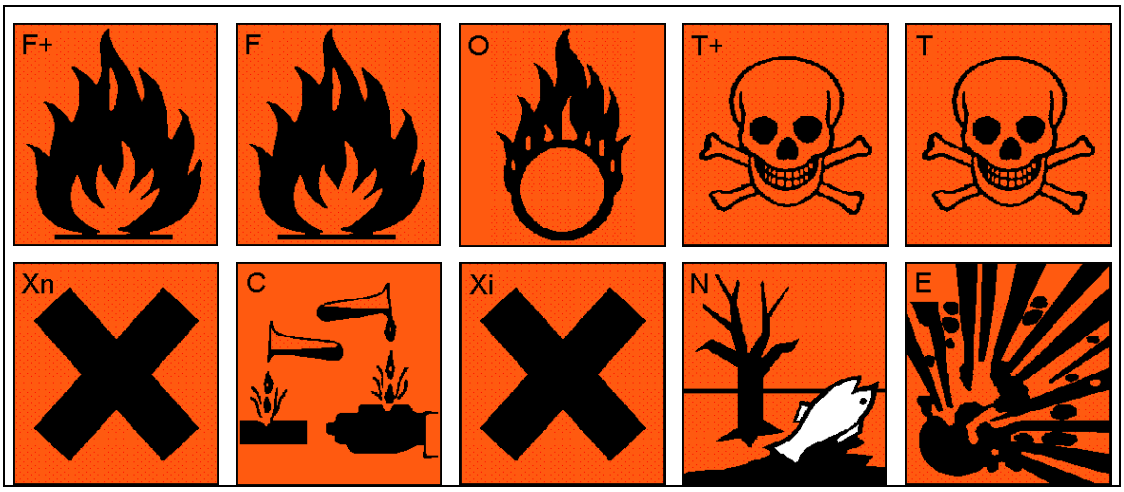


Fig. 2.1: Hazard symbols

The hazard symbols have the following meaning:

Hazard symbol	Meaning
F+	Extremely flammable
F	High flammable
O	Oxidizing
T+	Very toxic
T	Toxic
Xn	Harmful
C	Corrosive
Xi	Irritant
N	Environmentally harmful
E	Explosive

2.3.2 Risk (R) and Safety (S) phrases

Apart from the hazard symbol the risk phrases and the safety phrases give closer information to characteristics of the hazardous material. The phrases applying to a particular Bran+Luebbe reagent are listed on the reagent container and in the safety data sheet for the reagent (see below).

The R-phrases contain indications on special risks; the S-phrases contain safety advices.

R-phrases (indications on special risks)

R 1	Explosive when dry.
R 2	Risk of explosion by shock, friction, fire or other sources of ignition.
R 3	Extreme risk of explosion by shock, friction, fire or other sources of ignition.
R 4	Forms very sensitive explosive metallic compounds.
R 5	Heating may cause an explosion.
R 6	Explosive with or without contact with air.
R 7	May cause fire.
R 8	Contact with combustible material may cause fire.
R 9	Explosive when mixed with combustible material.
R 10	Flammable.
R 11	Highly flammable.
R 12	Extremely flammable.
R 14	Reacts violently with water.
R 14/15	Reacts violently with water, liberating extremely flammable gases.
R 15	Contact with water liberates extremely flammable gas.
R 15/29	Contact with water liberates toxic, extremely flammable gas.
R 16	Explosive when mixed with oxidizing substances.
R 17	Spontaneously flammable in air.
R 18	In use may form flammable/explosive vapor-air mixture.
R 19	May form explosive peroxides.
R 20	Harmful by inhalation.
R 20/21	Harmful by inhalation and in contact with skin.
R 20/21/22	Harmful by inhalation and in contact with skin, and if swallowed.
R 20/22	Harmful by inhalation and if swallowed.
R 21	Harmful in contact with skin.
R 21/22	Harmful in contact with skin, and if swallowed.
R 22	Harmful if swallowed.
R 23	Toxic by inhalation.
R 23/24	Toxic by inhalation and in contact with skin.
R 23/24/25	Toxic by inhalation and in contact with skin, and if swallowed.
R 23/25	Toxic by inhalation and if swallowed.
R 24	Toxic in contact with skin.
R 24/25	Toxic in contact with skin and if swallowed.
R 25	Toxic if swallowed.
R 26	Very toxic by inhalation.
R 26/27	Very toxic by inhalation and in contact with skin.
R 26/27/28	Very toxic by inhalation and in contact with skin, and if swallowed.
R 26/28	Very toxic by inhalation and if swallowed.

R 27	Very toxic in contact with skin.
R 27/28	Very toxic in contact with skin and if swallowed.
R 28	Very toxic if swallowed.
R 29	Contact with water liberates toxic gas.
R 30	Can become highly flammable in use.
R 31	Contact with acids liberates toxic gas.
R 31.1	Contact with bases liberates toxic gas.
R 32	Contact with acids liberates very toxic gas.
R 33	Danger of cumulative effects.
R 34	Causes burns.
R 35	Causes severe burns.
R 36	Irritating to eyes.
R 36/37	Irritating to eyes and respiratory system.
R 36/37/38	Irritating to eyes, respiratory system and skin.
R 36/38	Irritating to eyes and skin.
R 37	Irritating to respiratory system.
R 37/38	Irritating to respiratory system and skin.
R 38	Irritating to skin.
R 39	Danger of very serious irreversible effects.
R 39/23	Toxic: Danger of very serious irreversible effects through inhalation.
R 39/23/24	Toxic: Danger of very serious irreversible effects through inhalation and in contact with skin.
R 39/23/24/25	Toxic: Danger of very serious irreversible effects through inhalation and in contact with skin, and if swallowed.
R 39/23/25	Toxic: Danger of very serious irreversible effects through inhalation and if swallowed
R 39/24	Toxic: Danger of very serious irreversible effects in contact with skin.
R 39/24/25	Toxic: Danger of very serious irreversible effects in contact with skin and if swallowed.
R 39/25	Toxic: Danger of very serious irreversible effects if swallowed.
R 39/26	Very toxic: Danger of very serious irreversible effects through inhalation.
R 39/26/27	Very toxic: Danger of very serious irreversible effects through inhalation and in contact with skin, and if swallowed.
R 39/26/27/28	Very toxic: Danger of very serious irreversible effects through inhalation and in contact with skin.
R 39/26/28	Very toxic: Danger of very serious irreversible effects through inhalation and if swallowed.
R 39/27	Very toxic: Danger of very serious irreversible effects through contact with skin.
R 39/27/28	Very toxic: Danger of very serious irreversible effects through contact with skin and if swallowed.
R 39/28	Very toxic: Danger of very serious irreversible effects if swallowed.
R 40	Possible risks of irreversible effects.
R 41	Risk of serious damage to eyes.
R 42	May cause sensitization by inhalation.
R 42/43	May cause sensitization by inhalation and skin contact.
R 43	May cause sensitization by skin contact.
R 44	Risk of explosion if heated under confinement.
R 45	May cause cancer (according to § 12 "Ordinance on hazardous substances“ - pay attention to the special instructions in section 6).

R 46	May cause heritable genetic damages (according to § 12 "Ordinance on hazardous substances“ - pay attention to the special instructions in section 6).
R 48	Danger of serious damage to health by prolonged exposure.
R 48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R 48/20/21	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R 48/20/21/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin, and if swallowed.
R 48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R 48/21	Harmful: danger of serious damage to health by prolonged exposure in contact with skin.
R 48/21/22	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R 48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R 48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R 48/23/24	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R 48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin, and if swallowed.
R 48/23/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R 48/24	Toxic: danger of serious damage to health by prolonged exposure in contact with skin.
R 48/24/25	Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R 48/25	Toxic: danger of serious damage to health by prolonged exposure if swallowed.
R 49	May cause cancer by inhalation (according to § 12 "Ordinance on hazardous substances“ - pay attention to the special instructions in section 6).
R 50	Very toxic to aquatic organism.
R 50/53	Very toxic to aquatic organism; may cause long-term adverse effects in the aquatic environment.
R 51	Toxic to aquatic organism.
R 51/53	Toxic to aquatic organism, may cause long-term adverse effects in the aquatic environment.
R 52	Harmful to aquatic organism.
R 52/53	Harmful to aquatic organism, may cause long-term adverse effects in the aquatic environment.
R 53	May cause long-term adverse effects in the aquatic environment.
R 54	Toxic to flora.
R 55	Toxic to fauna.
R 56	Toxic to soil organisms.
R 57	Toxic to bees.
R 58	May cause long-term adverse effects in the environment.
R 59	Dangerous for the ozone layer.
R 60	May impair fertility.
R 61	May cause harm to the unborn child.

R 62	Possible risk of impaired fertility.
R 63	Possible risk of harm to the unborn child.
R 64	May cause harm to breastfed babies.
R 65	Harmful: may cause lung damage if swallowed.
R 66	Repeated exposure may cause skin dryness or cracking.
R 67	Vapors may cause drowsiness and dizziness.
R 68	Possible risks of irreversible effects.
R 68/20	Harmful: possible risks of irreversible effects through inhalation.
R 68/20/21	Harmful: possible risks of irreversible effects through inhalation and in contact with skin.
R 68/20/21/22	Harmful: possible risks of irreversible effects through inhalation and in contact with skin, and if swallowed.
R 68/20/22	Harmful: possible risks of irreversible effects through inhalation and if swallowed.
R 68/21	Harmful: possible risks of irreversible effects in contact with skin.
R 68/21/22	Harmful: possible risks of irreversible effects in contact with skin, and if swallowed.
R 68/22	Harmful: possible risks of irreversible effects if swallowed.

S-phrases (safety advices)

S 1	Keep locked up.
S 1/2	Keep locked up and out of the reach of children.
S 2	Keep out of the reach of children.
S 3	Keep in a cool place.
S 3/14.1	Keep in a cool place away from reducing agents, heavy metal compounds, acids and alkalis.
S 3/14.2	Keep in a cool place away from reducing agents, heavy metal compounds, acids and alkalis.
S 3/14.3	Keep in a cool place away from oxidizing and acidic substances as well as heavy metal compounds.
S 3/14.4	Keep in a cool place away from iron.
S 3/14.5	Keep in a cool place away from water and alkalis.
S 3/14.6	Keep in a cool place away from acids.
S 3/14.7	Keep in a cool place away from alkalis.
S 3/14.8	Keep in a cool place away from metals.
S 3/7	Keep in a cool place away from oxidizing and acidic substances.
S 3/9	Keep container tightly closed in a cool place.
S 3/9/14.1	Keep in a cool, well-ventilated place.
S 3/9/14.1/49	Keep in a cool, well-ventilated place away from reducing agents, heavy metal compounds, acids and alkalis.
S 3/9/14.2	Keep only in the original container in a cool, well-ventilated place away from reducing agents, heavy metal compounds, acids and alkalis.
S 3/9/14.2/49	Keep in a cool Keep in a cool place away from water and alkalis place away from oxidizing and acidic substances as well as heavy metal compounds.
S 3/9/14.3	Keep only in the original container in a cool, well-ventilated place away from oxidizing and acidic substances as well as heavy metal compounds.
S 3/9/14.3/49	Keep in a cool, well-ventilated place away from iron.
S 3/9/14.4	Keep only in the original container in a cool, well-ventilated place away from iron.
S 3/9/14.4/49	Keep in a cool, well-ventilated place away from water and alkalis.

S 3/9/14.5	Keep only in the original container in a cool, well-ventilated place away from water and alkalis.
S 3/9/14.5/49	Keep in a cool, well-ventilated place away from acids.
S 3/9/14.6	Keep only in the original container in a cool, well-ventilated place away from acids.
S 3/9/14.6/49	Keep in a cool, well-ventilated place away from alkalis.
S 3/9/14.7	Keep only in the original container in a cool, well-ventilated place away from alkalis.
S 3/9/14.7/49	Keep in a cool, well-ventilated place away from metals.
S 3/9/14.8	Keep only in the original container in a cool, well-ventilated place away from metals.
S 3/9/14.8/49	Keep in a cool, well-ventilated place away from oxidizing and acidic substances.
S 3/9/49	Keep only in the original container in a cool, well-ventilated place away from oxidizing and acidic substances.
S 4	Keep only in the original container in a cool, well-ventilated place.
S 5.1	Keep away from living quarters.
S 5.2	Keep contents under water.
S 5.3	Keep contents under petroleum.
S 6.1	Keep contents under paraffin oil.
S 6.2	Keep contents under argon.
S 6.3	Keep contents under carbon dioxide.
S 7	Keep container tightly closed.
S 7/47	Keep container tightly closed and at a temperature not exceeding … °C (to be specified by the manufacturer).
S 7/8	Keep container tightly closed and dry.
S 7/9	Keep container tightly closed and in a well-ventilated place.
S 8	Keep container dry.
S 9	Keep container in a well-ventilated place.
S 12	Do not keep the container sealed.
S 13	Keep away from food, drink and animal feeding stuffs.
S 14.1	Keep away from reducing agents, heavy metal compounds, acids and alkalis.
S 14.10	Keep away from acids, reducing agents and flammable material.
S 14.11	Keep away from flammable material.
S 14.2	Keep away from oxidizing and acidic substances as well as heavy metal compounds.
S 14.3	Keep away from iron.
S 14.4	Keep away from water and alkalis.
S 14.5	Keep away from acids.
S 14.6	Keep away from alkalis.
S 14.7	Keep away from metals.
S 14.8	Keep away from oxidizing and acidic substances.
S 14.9	Keep away from flammable organic substances.
S 15	Keep away from heat.
S 16	Keep away from sources of ignition – No smoking.
S 17	Keep away from combustible material.
S 18	Handle and open container with care.
S 20	When using do not eat and drink.
S 20/21	When using do not eat, drink or smoke.
S 21	When using do not smoke.

S 22	Do not breathe dust.
S 23.1	Do not breathe gas.
S 23.2	Do not breathe vapor.
S 23.3	Do not breathe spray.
S 23.4	Do not breathe fumes.
S 23.5	Do not breathe vapor/spray.
S 24	Avoid contact with skin.
S 24/25	Avoid contact with skin and eyes.
S 25	Avoid contact with eyes.
S 26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S 27	Take off immediately all contaminated clothing.
S 27/28.1	After contact with skin, remove soiled clothing at once and wash immediately with plenty of water.
S 27/28.2	After contact with skin, remove soiled clothing at once and wash immediately with plenty of soap and water.
S 27/28.3	After contact with skin, remove soiled clothing at once and wash immediately with plenty of soap and water, if possible also with polyethylene glycol 400.
S 27/28.4	After contact with skin, remove soiled clothing at once and wash immediately with plenty of polyethylene glycol 300 and ethanol (2:1) followed by plenty of soap and water.
S 27/28.5	After contact with skin, remove soiled clothing at once and wash immediately with polyethylene glycol 400.
S 27/28.6	After contact with skin, remove soiled clothing at once and wash immediately with polyethylene glycol 400, then rinse with plenty of water.
S 27/28.7	After contact with skin, remove soiled clothing at once and wash immediately with plenty of water and acidic soap.
S 28.1	After contact with skin, wash immediately with plenty of water.
S 28.2	After contact with skin, wash immediately with plenty of soap and water.
S 28.3	After contact with skin, wash immediately with plenty of soap and water, if possible also with polyethylene glycol 400.
S 28.4	After contact with skin, wash immediately with plenty of polyethylene glycol 300 and ethanol (2:1) followed by plenty of soap and water.
S 28.5	After contact with skin, wash immediately with polyethylene glycol 400.
S 28.6	After contact with skin, wash immediately with polyethylene glycol 400, and then rinse with plenty of water.
S 28.7	After contact with skin, wash immediately with plenty of water and acidic soap.
S 29	Do not empty into drains.
S 29/35	Do not empty into drains. This material and its container must be disposed of in a safe way.
S 29/56	Do not empty into drains. Disposal of waste material and container at hazardous or special collection point.
S 30	Never add water to this product.
S 33	Take precautionary measures against static discharges.
S 35	This material and its container must be disposed of in a safe way.
S 35.1	This material and its container must be treated with 2 % sodium hydroxide solution prior to disposal.
S 36	Wear suitable protective clothing.
S 36/37	Wear suitable protective clothing and gloves.
S 36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S 36/39	Wear suitable protective clothing and eye/face protection.

S 37	Wear suitable gloves.
S 37/39	Wear suitable gloves and eye/face protection.
S 38	In case of insufficient ventilation, wear suitable respiratory equipment.
S 39	Wear eye/face protection.
S 40.1	Clean floor and all contaminated objects with plenty of water.
S 41	In case of fire and/or explosion do not breathe fumes.
S 42	During fumigation/spraying wear suitable respiratory equipment (appropriate wording to be specified by the manufacturer).
S 43.1	In case of fire, use water.
S 43.2	In case of fire, use water or powder extinguisher.
S 43.3	In case of fire, use powder extinguisher – never use water.
S 43.4	In case of fire, use carbon dioxide – never use water.
S 43.6	In case of fire, use sand – never use water.
S 43.7	In case of fire, use metal fire powder – never use water.
S 43.8	In case of fire, use sand, carbon dioxide or powder extinguisher – never use water.
S 45	In case of accident or if you feel unwell, seek medical advice immediately (show label where possible)
S 46	If swallowed seek medical advice immediately and show this container or label.
S 47	Keep at a temperature not exceeding … °C (to be specified by the manufacturer).
S 47/49	Keep only in the original container at a temperature not exceeding … °C (to be specified by the manufacturer).
S 48.1	Keep wet with water.
S 49	Keep only in the original container.
S 50.1	Do not mix with acids.
S 50.2	Do not mix with alkalis.
S 50.3	Do not mix with strong acids, strong bases or non-ferrous metals or their salts.
S 51	Use only in well-ventilated areas.
S 52	Not recommended for interior use on large surface areas.
S 53	Avoid exposure – obtain special instructions before use.
S 56	Dispose of this material and its container at hazardous or special waste collection point.
S 57	Use appropriate container to avoid environmental contamination.
S 59	Refer to manufacturer/supplier for information on recovery/recycling.
S 60	This material and its container must be disposed of as hazardous waste.
S 61	Avoid release to the environment. Refer to special instructions/safety data sheets.
S 62	If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.
S 63	In case of accident by inhalation: remove casualty to fresh air and keep at rest.
S 64	If swallowed, rinse mouth with water (only if the person is conscious).

2.4 Disposal of chemicals

Everybody who works with reagents is obligated to dispose of chemicals safely. Acids and bases may be poured into the public waste water system after they have been neutralized. Special disposal is mandatory for poisons, heavy metals and organic solvents. The disposal can be done by an incineration plant or by a recycling company. Further information is given in the Safety Data Sheet (section 2.5).

If you have any problems or questions concerning the disposal please contact the Bran+Luebbe service hot-line.

The operator is responsible for a correct disposal of the analyzer according to the regulations.

2.5 Safety data sheets and usage precautions

A safety data sheet is available for each Bran+Luebbe reagent. If the data sheet was not delivered with a reagent, please contact Bran+Luebbe. Safety data sheets contain information about:

- Chemical characteristics
- Physical and safety-related data
- Transport codes
- General precautions
- Means of protection, storage, usage and disposal
- What to do in case of accident or fire
- Toxicology data
- Environmental data

The Employers are obliged to inform their employees about operating instructions. These instructions should be brief and to the point; they should cover information about dangers at the working place, including:

- Hazard labeling codes
- dangers for human beings and the environment
- Means of protection and behavioral rules
- What to do in an emergency
- First aid
- Correct and safe disposal

3 SYSTEM DESCRIPTION

3.1 Overview

This chapter contains information about

- General PowerMon applications (section 3.2)
- PowerMon Kolorimeter/Silikometer (section 3.3)
- Construction and layout (section 3.4)
- Single-stream and multi-stream operation (section 3.5)
- Sample value outputs (section 3.6)
- Technical specification (section 3.7)

3.2 Applications of PowerMon Analyzers

PowerMon Kolorimeter and Silikometer belong to the On-line Monitor series of Bran+Luebbe analyzers.

These PowerMon analyzers operate fully automatically with wet-chemical methods. They measure on-line trace concentration of different parameters in liquids, e.g. phosphate, nitrate, ammonia, chlorine, metals and silicate. Application areas include power generation, water treatment, chemical industry, chemical surface treatment, waste water.

The monitors are used for several purposes, including:

- **Process Monitoring**

  The change in analytical result is used as early warning of changes in a production process. It must be intervened to obtain the desired values.

  Example:

  Change in concentration of metals or acids in galvanizations- and pickling baths.

- **Process Control**

  Here the analytical result is used in a closed-loop control system to initiate changes in reaction conditions or raw material dosing.

Example:

Change in concentration of phosphate in waste water to control the dosing of precipitating agents.

- **Process Registration**

  The analytical results must be recorded. These results are probative for the correct function of the plant or are the basis for investigation of pollutant emissions.

  Example:

  Content of nutrient parameters in the outlet of sewage plants.

- **System Monitoring**

  Here the change in concentration of an indicator substance is used as an alarm trigger for an error condition.

  Example:

  The concentration of silicate in demineralized water. A rise indicates an exhaustion of the anion exchanger in power plants.

- **System Supervision**

  Here the analysis values have to persist within a given tolerance to ensure that certain components of the system will not be damaged.

  Example:

  Measurement of iron in boiler feed water.

According to the type of application, various measuring methods are necessary. Bran+Luebbe Analyzers are available in different versions covering many different application fields:

Bran+Luebbe PowerMon Kolorimeter

Bran+Luebbe PowerMon Silikometer

All PowerMon Analyzers have the following performance characteristics in common:

- Short response time
- Low sensitivity to interference
- Low drift
- High mechanical reliability
- Operation in harsh environment
- Easy operation
- Low operation and maintenance costs
- Low space requirement
- Long life

3.3 PowerMon Kolorimeter and Silikometer

The Kolorimeter is a system for the automatic photometric measurement of substances dissolved in water. Among others it is used for measuring phosphate in municipal or industrial waste water.

The Silikometer is a Kolorimeter that is specially designed for the analysis of silica.

The system is permanently connected to the process being monitored and receives a constant sample feed. The operation of the system is cyclic.

Sample ant reagent(s) are delivered in predetermined proportions by peristaltic pumps and mixed. The reagent(s) and the sample undergo a chemical reaction that produces a colored compound proportional to the sample concentration

At the end of this reaction time the reaction mixture enters the photometer flow cell. Monochromatic light is passed through it and the absorbance (light absorption) is measured electrically. This reading is used to calculate the concentration.

The mathematical basis of the concentration calculation is described in Appendix C.

3.4 Construction and layout of the PowerMon

Each PowerMon consists of a mounting panel (Analyzer section) which contains all measuring components. The analyzer is wall-mounted in a housing or on a rack.

Danger:
It is possible that by blockage in the flexible tubing system hose couplings come loose. Dangerous liquids can thereby spray.

If the analyzer is mounted in a housing the operator is protected against splashes by the closed door. It should be checked through the window of the housing door whether there is a leakage.

If the analyzer is not mounted in a housing the operator has to wear suitable protective clothing and eye protection when working near the system. Please refer to the safety advices on the mounting plate. The measures depend on the application. Pay attention to the reagents that are used and to the sample consistence.

- **Analyzer section**

  The analyzer section contains the measuring components where the chemical reaction and the measurement take place. Furthermore the analyzer section contains a Touch Screen for the display of measured values and messages, and manual inputs.

  The components of the analyzer are mounted on a pivotable mounting plate.

- **Control section**

  The control section is located at the rear of the pivotable plate. The control section regulates the operation of pumps and valves, calculates results and outputs data to the display or external computer. The control section is protected by an additional cover where the microprocessor, power supply, etc. are located.

The analyzer and the control section will be described in more details in the following.

3.4.1 Analyzer section

The analyzer section contains all components used for the chemical measuring process, including pumps, valves, reagents, waste connections, low-sample detector and a photometer.

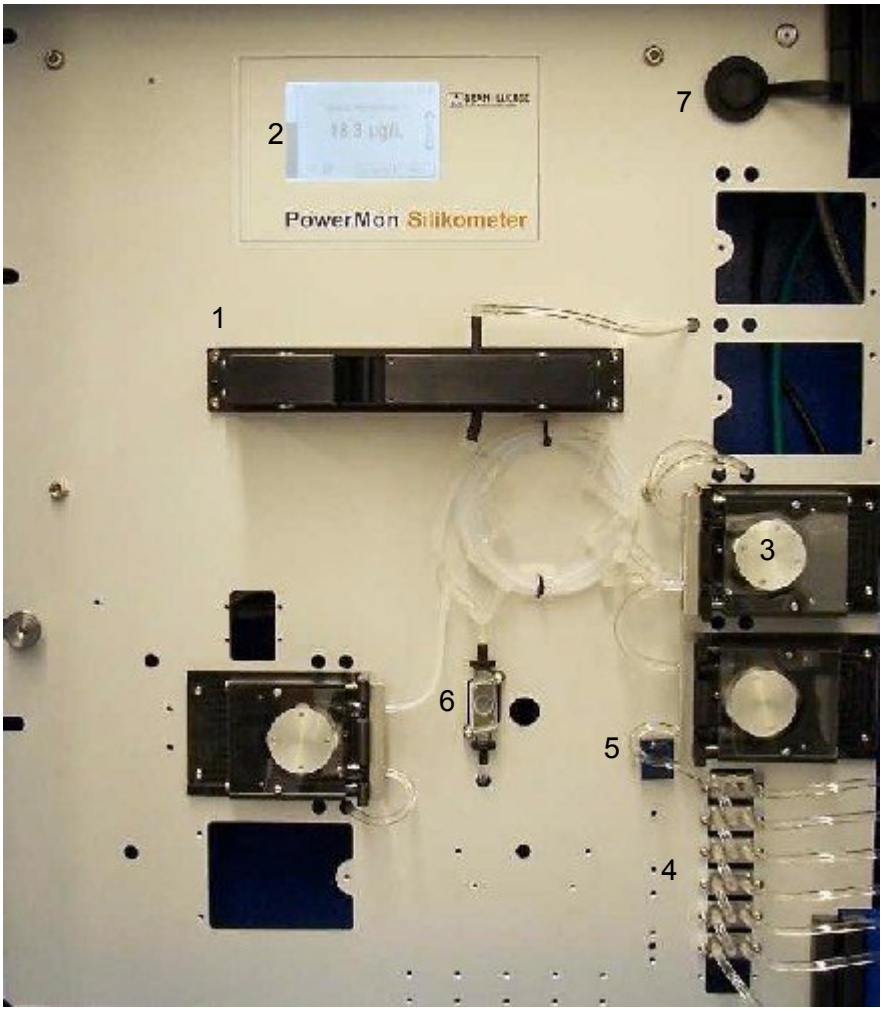
Fig. 3.1 shows a typical example of the analyzer section for a Silikometer. The figure shows a multi-stream system. Depending on the application, the analyzer section can contain further elements, such as reductors, heating elements or mixers. The quantity of pumps and valves depends on the number of measuring points and the application.

A detailed description of your specific system is shown in the Flow Diagram and the Tubing Diagram of the Method Description in Appendix C.

The Flow Diagram contains a schematic plan of all components necessary for the chemical analysis. The table below the Diagram lists the specific components for your system.

The Tubing Diagram shows details of the analyzer construction, including details of materials, dimensions and tubing disposition.

The following figure shows a PowerMon analyzer section.



1. Photometer
2. Touch Screen
3. Tube pumps
4. Sample valves
5. Low-sample detector
6. Drain valve
7. USB Interface

Fig. 3.1: PowerMon

The analyzer section normally consists of following components:

- **Photometer**

  In the photometer the light absorption of the reaction mixture is measured. The concentration of the measured component is calculated from the absorbance.

- **Peristaltic pumps**

  Peristaltic pumps are used to meter the sample, reagents and calibration solutions. The pumps consist of a controlled motor, gearbox, rotor, tube-bed and dosing tube. They are triggered by the sequence program. Different dosage volumes are realized by the usage of a specific dosing tube and the pump speed.

- **Solenoid valves**

  Solenoid valves switch between different sample streams, calibration solutions, etc.. They are controlled by the sequence program in the built-in computer.

- **Low-sample and low-dilution water detector (if applicable)**

  Sensors determine the presence or absence of sample and, if required, dilution water.

  These sensors are optoelectrical elements which detect the presence of liquids within the feeding tubes at a specific time. If an adjustable threshold value is exceeded in a certain time interval, the switch responds. If the sample runs short the system displays a suitable error message.

- **Low-reagent detector (option)**

  Optional up to 5 reagent-lines can be controlled. The sensors work like the low-sample detector.

- **Bottles for reagents and calibration solutions**

  These solutions are kept in bottles. By means of extraction pipes they are connected with the respective pumps and valves. Optional a reagent cabinet can be placed below the PowerMon housing. This cabinet can include up to 6 x 5 L bottles.

3.4.2 Control section

The control section contains all components used for system control, signal production and data handling.

The control section is located at the rear of the pivotable plate and is protected by an additional cover.

Fig. 3.2 shows the control section and its components without cover.

Danger:
This system contains electrical circuits and components operating under dangerously high voltages. Contact may result in electric shock and severe or fatal injury.

The control section may only be opened by a qualified electrician. The system has to be made zero-potential first.

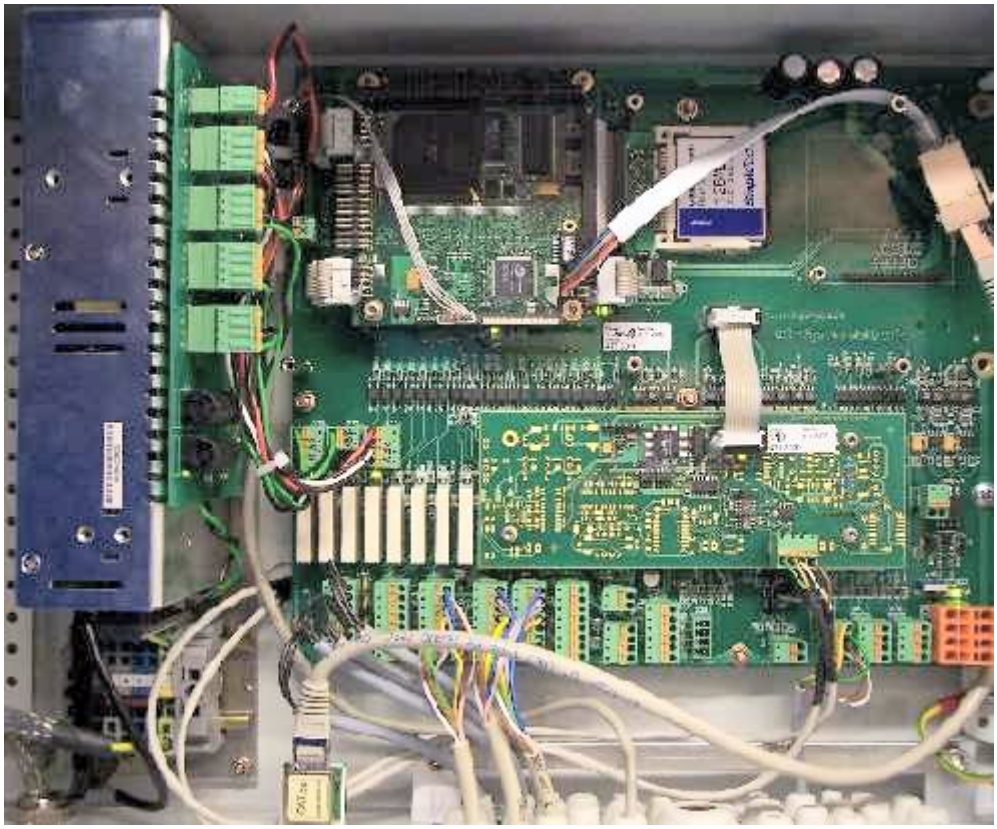


Fig. 3.2: Internal view of the control section (single-stream system) without cover

Details of the electrical connections are shown in the Terminal Diagram and the Wiring Diagram in Appendix C.

The analyzer is controlled and monitored by a microprocessor (based on PC).

The tasks of this integrated microprocessor are:

- Controlling the analysis program
- Signal processing
- Result presentation (Converting data to be displayed in the Touch Screen and for analog output)
- Data communications with external computers
- Automatic function and error monitoring
- Dialogue with the operating staff and an external computer respectively
- Recording
- Data storage
- The analysis cycle is factory-programmed by Bran+Luebbe. User changes are usually not necessary. The Method Description in Appendix C contains the details of the sequence program for your system.
- All important parameters such as limit values, calibration data, calibration frequency, temperature, etc. can be entered, viewed, changed, deleted and dis-

played via the Touch Screen. Depending on the relevance some areas are protected by a password.

3.5 Single-stream and multi-stream operation

PowerMon systems are usually factory-configured for single-stream operation. Kolorimeter and Silikometer can optional be fitted up to 6 sample streams.

The analysis sequence for multi-stream systems can be set as required in the system program. If one sample stream runs dry the system automatically proceeds to the next.

The values from each sample stream are shown either in rotation, with a 2 second interval between each one, or the last available measurement is displayed until the next on is ready.

3.6 Sample value output and display

The calculated concentration of the sample can be indicated in different ways.

- **Display on the Touch Screen**

  When the system is in MEASURE mode the last available sample reading is shown on the Touch Screen (refer to the Operation Manual).

  Multi-stream systems have two display options:

  Rolling display: The values from each sample stream are shown in rotation, with a 2 second interval between each one.

  Single display: The last available measurement is displayed.

  The display mode can be changed via the Touch Screen at any time.

- **Display in the control room**

  Via analog signal outputs the measured values can be displayed in a control room.

Other analog signals are provided for a general alarm and limit values. Details on the connections are given in section 4.3.2 and in the Wiring Diagram in Appendix C.

3.7 Specifications

This section describes general technical data. Possible deviations are listed in Appendix C

No. of sample streams:	1 – 2 (with optional upgrading up to 6)
Cycle time:	Kolorimeter/Silikometer: 6 - 15 min
Signal output:	0/4...20 mA, variable zero point, max. load 500 Ω, galvanically isolated, test voltage 1000 V AC (1 output per sample stream)
Limit alarm signal: Potential-free contacts:	3 potential-free contacts (with optional upgrading up to 11), max. load: 30 V DC 6 A; 60 V DC 0,6 A; 110 V DC 0,2 A; 250 V AC 6 A
General system alarm:	Potential-free contact, max. load: 30 V DC 6 A; 60 V DC 0,6 A; 110 V DC 0,2 A; 250 V AC 6 A
Sample	
Flow rate:	Min. 3 l/h, particle-free
Pressure:	Unpressurized
Temperature: with sample heating (option):	15 – 45 °C (288 - 318 K) 1 – 45 °C (274 – 318 K)
Connection:	Flexible tubing (PVC, PVDC, Viton, etc.) ID 1,5 – 3 mm
Waste outlet:	Unpressurized, flexible PVC ID 10 mm
Surrounding temperature:	15 - 35°C (288 - 308 K); with sample heating even below it
Supply voltage:	85 ... 264 VAC at 47 ... 63 Hz 120 ... 370 VDC
Power supply line:	Two pin grounded plug with 3 m cable (default) or shielded cable (customer concern)
Power requirement:	Max. 150 VA
Protection:	IP 54 (only with housing) IP 65 (optional)
Device class:	Class A (following DIN EN 61326:2004)
Interfaces:	USB : Data-Download and Software-Update LAN : network connection Modem : optional CAN Bus : connection of external sensors
Dimensions: with reagent cabinet	700 x 600 x 320 mm 1100 x 600 x 354 mm
Weight: with housing without housing	approx. 60 kg without reagents (can be more depending on number of sample streams and application)

4 INSTALLATION

4.1 Overview

This chapter contains information on

- The operating conditions under which the system should be used (section 4.2)
- Installing the system (section 4.3)
- Operating area requirements (section 4.4)

4.2 Operating conditions

For trouble-free operation the system should be used only under the following conditions:

- Free from unidirectional heat radiation or direct sunlight.
- Vibration-free mounting.
- Compliance with regulations for the protection class of the device: Additional precautions are necessary in areas where corrosive gas or vapor may occur or where there is risk of explosion.
- Surrounding temperature between 15 and 35 °C (288 - 308 K).
- The system must not be used outdoors, but always in a building or cabin conforming to the above requirements, with temperature control if necessary.
- The sample must be homogenous and particle-free. I fit is not, a filtration system must be used (e.g. for systems in waste water treatment plants). Contact Bran+Luebbe for details.
- Pressure-free sample flow. The differential pressure of the sample may not exceed 100 hPa (0.2 bar). Otherwise pressure reducing valves have to be used. These valves can be ordered from Bran+Luebbe.
- Sample temperature between 15 – 35 °C (288 - 308 K).

4.3 Installing the system

The following sections cover:

- Wall mounting (section 4.3.1)
- Electrical installation (section 4.3.2)
- Tubing connections (section 4.3.3)

4.3.1 Wall mounting

The PowerMon is wall mounted.

Fig. 4.1 shows a dimensional drawing with the necessary holes for wall mounting.

Warning:
The wall and the screws must be suitable for the weight of the housing, the optional reagent cabinet, resp. the mounting rack. According to the specific configuration the weight of the PowerMon can be approx. 60 kg (without reagents).

Possible deviations are listed in Appendix C.

For maintenance make sure that there is enough place in front of the device.

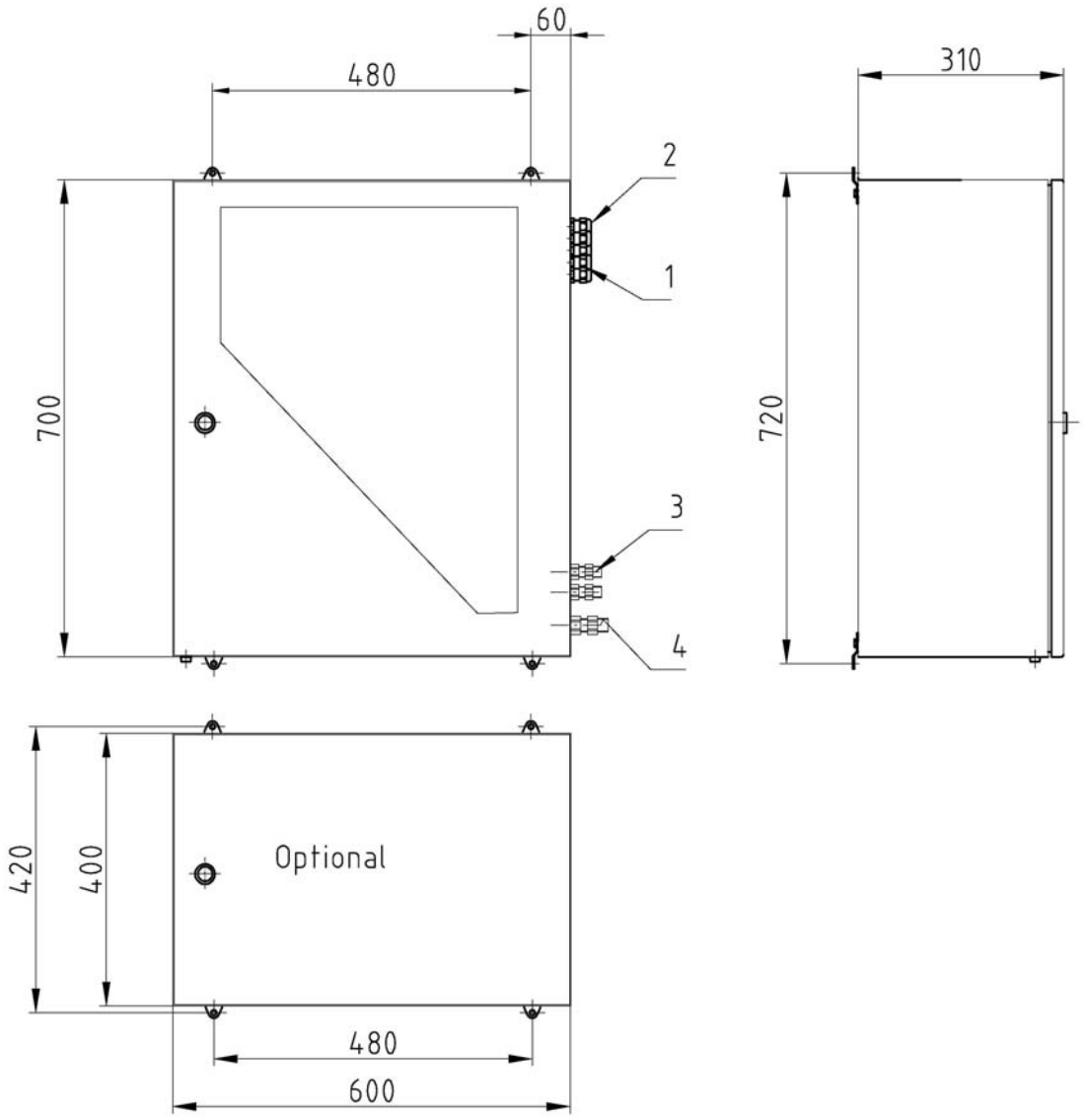


Fig. 4.1: Dimensional drawing of the PowerMon and the reagent cabinet

4.3.2 Electrical Installation

Danger:
The electrical installation has to follow the VDE regulations, the health and safety regulations or the local regulations. Only a qualified electrician may perform cabling and wiring.

- Follow these basic rules for installation:
- Lead all cables through PG cable fixings into the housing.
- Do not lay power and signal lines in the same cable or tubular cable protection.

- Lay the signal cables so that they will be free of inductive interference.
- Use only shielded cables for signal leads, and connect all shields to the device earth in the control section.
- All connections must have proper contact.

The following connections must be established:

- **Power supply line**

  The power cord and the power plug are led out of the housing.

  The PowerMon has as a standard a multi-purpose power supply unit. Voltage variations of ±10% and frequency variations of ±5% are acceptable.

  The power input is max. 150 VA.

  Warning:
  Do not plug in the power cord yet, because this would start the PowerMon. The analyzer may not run dry.

- **System and limit alarms and sample value signal outputs**

  Outputs are provided to transmit system failure and limit alarm signals for example to a central control room.

  The maximum contact loading for the alarm outputs is 25 V AC, 60 V DC, 3 A.

  In addition an analog signal output is provided for each sample stream to transmit the current sample values to a central room or computer.

  Maximum permissible load for these outputs is 500 Ω. The system program determines whether the zero point is at 0 or 4 mA.

  The accessory board is only installed on multi-stream devices (3 sample lines and more) and/or with additional inputs or outputs. It is mounted on spacing bolts.

  Free terminals are located on the contacts.

  - To access the control section, loosen the knurled nut on the left-hand side of the analyzer plate and swing the plate forward. The control section is mounted at the rear.
  - Lead the cables from the bottom through the matching rubber bushings.
  - Remove the cable insulation and fit the conductors with conductor end bushings. The shield is twisted and connected with the shielding bracket. The shielding bracket additionally functions as strain relief.
  - Now connect each conductor following the Wiring Diagram in Appendix C and close the control section.

4.3.3 Tubing connections

Make the following tubing connections:

- **Sample feed, rinsing solution (if required) and drain**

  These connections are led outwards the right side of the housing via bullhead unions. The wide hole is intended for the drain, the others can be allocated free. For analyzers without housing the screwed hose connections function as coupling. Keep the tubes as short as possible. Details are shown in the Tubing Diagram in Appendix C.

  Take care that the connections are free from leakages.

  It may be necessary to slightly stretch the tube end with needle-nose pliers and wet it with de-ionized water (PVC tubes may also be heated to about 35 °C, e.g. by a hair drier).

  Warning:
  Sample feed and drain need to be unpressurized.

  As some reagents are corrosive, the entire waste system must be chemically resistant.

  Observe local regulations concerning disposal of chemical waste into the public sewage system.

- **Connection of the peristaltic pumps**

  In order to prolong the life of the pump tubes, they are removed from the pumps before shipping. To install them proceed as follows:

  o Loosen the retaining plate and remove the tube-bed (see Fig. 4.2).

  o Place the pump tube around the rotor, being careful not to twist the tube.

  Warning:
  Make sure that the liquid is transported into the analyzer section according to the rolling direction of the pump (sample, reagent or dilution solution)!

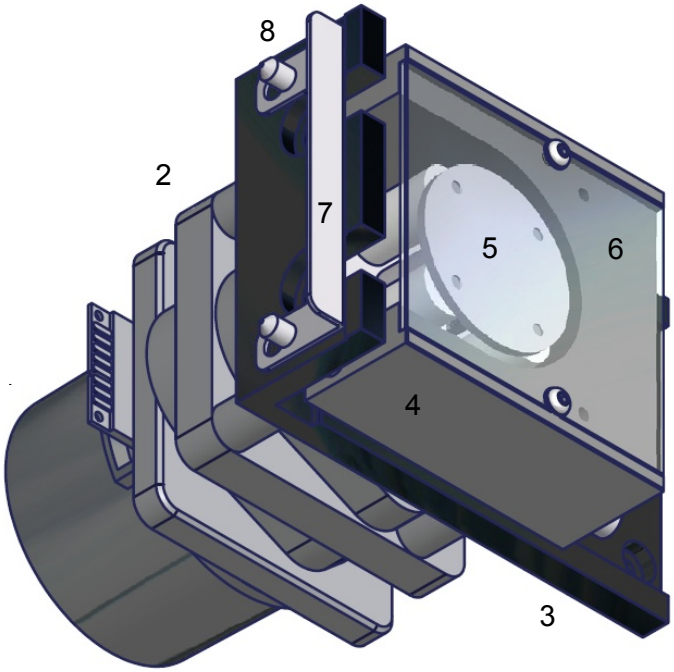
  o Plug in the power cord. After initialization the system enters the STOP mode. If the measurement starts anyhow, stop it by pressing **Menu – Service – Status – Stop**.

  o Via **Menu – Service – Status – Manual** the corresponding pumps can be started manually. Speed and direction are preadjusted.

  Warning:
  Danger of trapping fingers in rotating pumps without platen in place.

- Insert the tube-bed, press the fixing pins against the fixing bracket from behind until they lock and push on the retaining platen again. The rolling pumps prevent damage from the pump tubes.
- Stop the pumps by leaving the status **Manual**.
- Unplug the power cord.



1. Motor
2. Gear
3. Fixing bracket
4. Tube-bed
5. Rotor
6. Protective cover
7. Fixing bracket
8. Spring mounted fixing pin

Fig. 4.2: Drawing of a peristaltic pump

4.4 Operating area requirements

Because chemicals will be used in the operating area, some special requirements have to be fulfilled:

- **Good Ventilation**

  The exhaust air must be directed away from the area where people work, to prevent them from inhalation of harmful substances. Some Bran+Luebbe monitors have ventilation that disposes toxic gases such as reagent vapors. Lead exhaust air via a trunk to outside the working area.

- **Danger labeling**

  Working areas must be labeled by:

  - Warning signs which indicate dangers
  - Mandatory signs for required personal protective equipment
  - Prohibition signs (e.g. smoking or access restriction)

- Indicating label (e.g. first aid or emergency behavior)

- **Safety equipment for first aid**

  The working area must be equipped with eyewashes (recommended are 2 bottles; pay attention to the durability) and personal protective equipment as safety glasses, gloves, overalls and boots

5 COMMISSIONING/DECOMMISSIONING

5.1 Overview

After installation the system can be started up. This consists of the following steps:

- Preparing the system, e.g. connection of the necessary reagents (section 5.2).
- Starting the measuring process (section 5.3).
- Decommissioning is described in section 5.4.

5.2 Commissioning the system

This section assumes that the system is ready for use, with the tubing and electrical connections prepared as described in the previous chapter.

1. Place the reagent containers below the analyzer or into the optional reagent cabinet. Take care that in the first case the distance between the containers and the corresponding pumps is not more than 1000 mm.
2. If dilution water is required, make sure that de-ionized or drinking water (as specified in the Method Description in Appendix C) is available and connected.
3. Place the dip tubes into the appropriate reagent and calibrator bottles and screw down the caps.

Caution:
Take care that the number of the reagents on the tubes corresponds with the bottles.

5.3 Starting the measuring cycle

After completing the preparations in section 5.2 the measurement can be started:

1. Plug in the power cord. After initialization the system will start the measurement automatically. Stop the measurement via **Menu – Service – Status – Stop**.
2. Start the sample flow by switching the filtration on (if connected). Adjust the sample flow depending on the application to approx. 1.5 – 3.0 l/h.

3. Start the pumps by pressing Menu **– Service – Status – Manual** until the tubes are filled.
4. Watch the filling process. Quit status **Manual** when all tubes are full.
5. If liquid is not drawn into a pump, as may occur with new, dry tubes, switch off this pump. Loosen the retaining plate, remove the tube-bed, loosen the lower pump tube connection and suck liquid up to the pump with a syringe. Insert the tube-bed, push on the retaining plate and connect the tube again.
6. Via **Menu – Service – Status – Measuring** the system is placed to MEASURE mode. The measuring cycle will start automatically.

Danger:
It is possible that by blockage in the flexible tubing system hose couplings come loose. Dangerous liquids can thereby spray.

If the analyzer is mounted in a housing the operator is protected against splashes by the closed door. It should be checked through the window of the housing door whether there is a leakage.

If the analyzer is not mounted in a housing the operator has to wear suitable protective clothing and eye protection when working near the system. Please refer to the safety advices on the mounting plate. The measures depend on the application. Pay attention to the reagents that are used and to the sample consistence.

Automatic analysis cycle

No further user action is normally necessary now as the program sequence and the operating parameters are factory-entered

Sample value(s) will be displayed on the Touch Screen after the first measuring cycle is complete. On single-stream monitors each new sample value over-writes the previous one, and the latest value is stored in the system memory and shown on the Touch Screen. On multi-stream systems you can choose between rolling and single display mode. The display mode can be chosen via the Touch Screen.

Some systems running at very low levels may show relatively high drift on start-up. This is due to tubing contamination, and will stabilize, normally after a few hours. It is advisable to perform some calibrations manually to check the stability of calibration factors. The procedure is described in the Operating Manual.

Monitors containing a heating element may show the error message "Low temperature" when switched on. When the set temperature is reached the warning will extinguish and the system will start the analysis cycle automatically.

If necessary you can display the parameters and alter them, e.g. the calibration frequency or the sample limits. The procedure is described in the Operating Manual. The parameter list for your individual system is shown in the Method Description in Appendix C.

Warning:
Do not go outside the limits shown in the Method Description in Appendix C, otherwise the measuring operation may be disturbed.

Follow the maintenance instructions in section 7.

5.4 Decommissioning

If taking the monitor out of service for a longer period, proceed as follows:

1. Stop the measurement via Menu – Service – Status – Stop.
2. Stop the sample supply (if connected stop the filtrate pump on the filtration system).
3. Unscrew dip tubes from reagent bottles.
4. Place all reagent dip tubes into a container of de-ionized water and start the corresponding pumps by pressing **Menu – Service – Status – Manual**. Pump water through the whole system for about half an hour.
5. Remove tubes from water and leave to pump air until all tubes are empty.
6. Press **Manual** again to switch off the pumps.
7. Loosen the retaining plate, remove the tube-bed and take the pump tubes out of the pumps. They can be fixed to the pumps with rubber bands.
8. Unplug the power cord.

6 OPERATING SOFTWARE

The handling of the operation software is described in the Operation Manual.

Keep the operation manual together with this user manual near the system.

7 MAINTENANCE

7.1 Overview

The analyzer must be regularly maintained to ensure proper operation.

We recommend that a maintenance log is kept, to have an overview of routine servicing and system performance data and to serve as a useful data sheet for Bran+Luebbe service engineers. A blank log sheet which can be copied easily is provided at the end of this chapter.

A summary of routine maintenance is shown below. Refer to the following sections for complete description of maintenance activities.

The maintenance intervals given below are only reference values. Depending on the environmental conditions shorter intervals may be necessary.

- **daily (refer to section 7.2):**
  - Visual check
  - Enter calibration parameters on maintenance log (see section 7.7)
- **weekly (refer to section 7.3):**
  - Check valves for proper function
  - Check drain for proper function
  - Check reagent supply and refill if necessary
- **Monthly (refer to section 7.4:**
  - Check valves for leaks
  - Check pumps
  - Check pump rotors
  - Check tubing
  - Clean flow-cell
  - Check the calibration factors for plausibility
- **Quarterly (refer to section 7.5)**

  Additional to the monthly maintenance the pump tubes of the peristaltic pumps have to be changed.

- **Yearly (refer to section 7.6)**

  Within the scope of a Bran+Luebbe service contract following should be performed by a service engineer:

  - Change all tubes
  - Check pump rotors and replace if necessary
  - Check low-reagent detector (optional)

7.2 Daily Maintenance

- **Visual check of the analyzer**

  Daily check for leaks or obvious faults should be performed.

- **Enter calibration parameters on maintenance log**

  Writing down the calibration data daily is very useful for evaluating the proper function of the system and helps the service engineer to solve problems more quickly. After the system has been running for approx. 3 months it is sufficient to collect the data twice a week. By pressing **Menu – Service –History** you can read the data.

7.3 Weekly Maintenance

- **Check valves for proper function**

  Make sure the valves click audibly when they operate.

- **Check the drain**

  The sample and reagent drain must be clear and unpressurized.

- **Check the reagent supply**

  Furthermore it should be checked whether the reagents have to be refilled. Keep new reagents ready if needed.

7.4 Monthly Maintenance

- **Check valves for leaks**

  - o Press STOP.
  - o Disconnect the tube for the calibration solution to prevent that it runs back. Carefully loosen the middle tube of the sample valve with a screwdriver.

  When working properly, no liquid should leave the nipple.

  If sample leaks through the valve and reducing the sample flow (or filtrate flow if filtration system is connected) does not solve the problem, the valve must be replaced.

  - o Put the tube onto the valve nipple again.
  - o Return to normal measuring mode.

- **Check pumps**

  Check that the pumps are delivering liquid by sucking in an air bubble and watch its progress along the tube.

  To check the reagent pumps, briefly lift the dip tube out of the reagent bottle while the pumps are running.

  To check the sample pump you have to disconnect the tubing in one place. Compress the lower end of the tubing and then open the upper end for a short moment to suck in an air bubble.

  If the air bubble does not move the pump tube may be worn out, the tube-bed is not proper mounted or the rolls of the rotor are defective.

- **Check pump rotors**

  If scratches or defects are visible on the surface of the rollers or if they are beat-up and have too much slackness, the rotor must be replaced.

- **Check tubing**

  Check all tubes for proper connection, dirt, algae, obstruction and leaks.

  If the tubes are very dirty, clean them with diluted hypochlorite solution:

  - o Press STOP.
  - o Carefully loosen the sample supply tube from the sample pump with a screwdriver.
  - o Inject approx. 50 ml diluted hypochlorite solution slowly with a syringe (commercially available hypochlorite with 13 % chlorine is diluted 1:10 with tap water). Repeat this cleaning if necessary.

Danger:
Avoid hypochlorite contact with skin, mucous membranes or eyes!
Wear protective glasses and gloves.

- Tygon tubing that has become milky in appearance will not interfere with correct function.
- Using a syringe rinse at least 3 times with water to remove all traces of hypochlorite.
- Reconnect the tube to the sample pump and exit STOP mode.

If a filtration (with rinsing system) is connected, you can also pump diluted hypochlorite solution from the filtration to the analyzer if the filter tubes are cleaned there.

If this cleaning procedure is not sufficient or if tubes are leaking, the tubes should be replaced. When installing new tubing, slightly stretch the end with needle-nose pliers and moisten the tubes before pushing it onto the connectors.

7.5 3-monthly maintenance

- **Change pump tubes**
  - Press STOP.
  - Clamp off the tube to the reagent bottle or sample line with an artery forceps.
  - Loosen the suction-sided tube connection from the peristaltic pump. Start the corresponding pump by pressing Menu **- Service - Status - Manual** and open the drain valve. Wait until all tubes within the analyzer are free in order that no reagents can spill out. Exit **Manual** and loosen pressure-sided tube connection.
  - Remove the retaining platen and the tube-bed.
  - Clean the tube-bed and lubricate rotor and springs in the tube-bed with a drop of oil (see Fig. 4.2).
  - Remove old pump tube.
  - Place the new pump tube without twisting it. Rotating pumps prevent the tubes from being damaged.
  - Press **Menu – Service – Status – Manual**, to start the pumps.
  - Remount the tube-bed and the retaining platen. Rotating pumps prevent the tubes from being damaged.

Warning:
Danger of trapped fingers in rotating pump while tube-bed is removed.

  - Exit **Menu – Service – Status – Manual** to stop the pumps
  - Reconnect tubing, referring to the Tubing Diagram in Appendix C.
  - Remove artery forceps.

- Press **Menu – Service – Status – Manual** to fill the tubes.
- Exit **Menu – Service – Status – Manual** when all tubes are filled.
- New, dry tubes may not pump properly. If so, stop the corresponding pump, loosen the retaining platen, remove the tube-bed and the lower tube end, and suck liquid through the pump tube with a syringe. Afterwards remount the tube-bed and the retaining platen and reconnect the tube.
- Exit STOP mode and return to the MEASURE mode.

New pump tubes require a run-in period of a few hours before they are rinsed dirt-free and stable values are obtained. Afterwards It is recommended to start a calibration manually.

7.6 Yearly maintenance

The yearly maintenance as described in section 7.1 should only be performed by Bran+Luebbe service staff.

7.7 Maintenance Log

The next page shows an example for this log.

Maintanance Log for Bran+Luebbe PowerMon

❑ KOLORIMETER ❑ SILIKOMETER ❑ NATRIOMETER ❑ IONOMETER ❑ TITROMETER

Month/Year ____________________

Parameter: _____________________ Range: ____________________

System in operation since: _______

Maintanance carried out:

Daily					Weekly	Monthly
Date	Time	Cal. Factor 1	Cal. Factor 2	Signature		
					☐ Valves checked ☐ Drain free ☐ Reagent OK *Date:* *Signature:*	☐ Valves leak-proofed ☐ Pump operation OK ☐ Rotors checked ☐ Tubing checked *Date:* *Signature:*
					☐ Valves checked ☐ Drain free ☐ Reagents OK *Date:* *Signature:*	
					☐ Valves checked ☐ Drain free ☐ Reagents OK *Date:* *Signature:*	
					☐ Valves checked ☐ Drain free ☐ Reagents OK *Date:* *Signature:*	

3-monthly	Yearly
☐ Pump tubes changed ☐ Measuring cell tested *Date:* Signature:	*Bran+Luebbe Service personnel:* ☐ Flow-cell cleaned ☐ Tubes renewed ☐ Rotors checked ☐ Valves checked ☐ Electrodes checked ☐ Seals and O-rings changed *Date:* Signature:

8 TROUBLESHOOTING

8.1 Overview

Faults are shown by error messages on the Touch Screen. They can be initiated by faults during the analysis cycle or by failure within the control section.

There are two classes of errors:

- **Errors stopping the analysis**

  If one of these errors occurs the analysis is normally interrupted and the system enters ERROR mode.

- **Errors not stopping the analysis**

  If one of these errors occurs the analysis continues and the error is shown on the Touch Screen.

After an error is cleared the analysis normally restarts automatically.

Some errors however require remedial action with the analyzer. In this case the error must be acknowledged

The following section contains:

- **Malfunctions (section 8.2)**

  This section lists every error and describes the measures to fix it.

If you have any problems or questions please contact your local supplier.

8.2 Malfunctions

System failures are described in the following:

- General problems (section 8.2.1)
- Problems within the analyzer (section 8.2.2)
- Problems with the measuring values (section 8.2.3)
- Problems with the calibration (section 8.2.4)

Possible reasons and adequate counter-measures are described.

8.2.1 General problems

Switching on does not start the device

Possible reason	Counter-measure
1. Connection to supply system OK?	Check whether the device is plugged or a defect exists.
2. Fuse within the control section is blown (control section may only be opened by a qualified electrician!).	Replace the fuse.

8.2.2 Problems within the analyzer

Sample valve is leak

Possible reason	Counter-measure
1. Solids within the sample.	Clean, respectively replace the valve. Check the upstream filtration for dirt and replace the filter pipes if necessary.

Reagent dosage failed

Possible reason	Counter-measure
1. Bottle is empty.	Refill reagents and then fill the tubes by starting the corresponding pumps via **Menu – Service – Status – Manual.**
2. Reagent tubes are leak.	Check, respectively replace.
3. Low-reagent detector (optional) is defective.	Check and clean or replace tube, if necessary contact Bran+Luebbe Service personnel.
4. Dosing tube is defective.	Replace the dosing tube (see section □).
5. Tube-bed has broken or jams.	Check tube-bed to be smooth and lubricate the rods. Replace the tube-bed if necessary.

Calibration solution bottle is flooding

Possible reason	Counter-measure
1. Calibrating valve is leak.	Replace valve.
2. Sample contact pressure is too high.	Reduce the pump delivery rate of the upstream filtration and if necessary install a decompression device.
3. Tubes are not proper connected.	Check the connections by means of the Tubing Diagram in Appendix C and adjust if necessary.

Liquid dams in the drain

Possible reason	Counter-measure
1. Liquid bag or negative pressure in the outlet.	Lay pipes with constant sloping and free flow.

8.2.3 Problems with the measuring values

Analyzer shows constantly exceeding limit values

Possible reason	Counter-measure
1. Limit values wrong.	Adjust the limit values.
2. Limit delay too short.	Extend delay.

Display is always too high

Possible reason	Counter-measure
1. Contamination of storage container.	Protect the devices from larger dust exposure, e.g. building activity or coal pulverizes.
2. Outdated reagents.	Pay attention to the minimum durability when storing reagents.
3. Dilution water contaminated.	Use only sufficient clean dilution water. If necessary an ion-exchanger has to be connected.
4. Concentration of the calibration solution is lower than specified.	Replace the calibration solution or adjust the configuration.

Measured values are too high, too low or not precise in general

Possible reason	Counter-measure
1. Concentration of the calibration solution is wrong.	Renew the calibration solution and calibrate again.
2. Sample pressure too high or instable.	Use a decompression device or an overflow vessel.

Display remains at zero or at a constant value near zero

Possible reason	Counter-measure
1. Reagents contaminated.	Replace reagents.
2. Dilution water contaminated.	Replace dilution water or renew ion-exchanger.
3. Sample valve is defective.	Check function. If necessary the valve has to be replaced by Bran+Luebbe service personnel.
4. Reagents have been permuted.	Connect reagent bottles according to the Flow Diagram in Appendix C.

Despite of exceeding limit values the system does not show an error message

Possible reason	Counter-measure
1. Limit delay too long.	Shorten the delay.
2. Limit back-spacing.	Extend back-spacing or set to zero.

Measured values spread sporadic with additional outliners or analysis result is wrong

Possible reason	Counter-measure
1. Has the measuring range been changed?	Enter the value(s) again. Refer to the Method Description in Appendix C).
2. Are the entries in the sequence programs not identical with those listed in Appendix C, or have they been changed?	Enter data again. Refer to the Sequence program in Appendix C.
3. Has the conversion factor been changed?	Enter data again. Refer to the Method Description in Appendix C.
4. Do the concentrations of the calibration solutions agree with the values in the system?	Enter correct values.
5. Air bubbles or out gassing in the flow-cell or the reagent tubes.	Put new parts of the flow-cell for 5 days into 5% sodium hydroxide solution before using them (degreases and increases wet ability). Check the dip tubes of the reagent bottles for obstruction.
6. Parts of the photometer are loose, e.g. photodiodes, flow-cell, photo sensors.	Replace parts if possible.
7. Pigtail of the photo sensors or the photo electrodes partially broken.	Contact Bran+Luebbe Service.

Measured values jumps sporadic back and force although the sample concentration has not changed

Possible reason	Counter-measure
1. Sample dosage is faulty.	Check the pump and replace the dosing tubes (see section 7.4 and 7.5). In case of bacterial contamination the tubing within the analyzer should be rinsed with diluted hypochlorite solution (diluted 1:10 with tap water).
2. Rotor, respectively tube-bed works unbalanced.	Demount the pump, clean the tube-bed and lubricate the rotor bearings (see Fig. 4.2).
3. Has the measuring range been changed?	Enter the value again. Refer to the Method Description in Appendix C.
4. Static mixer contaminated.	Clean the mixer by backwashing.
5. Valve is leak.	Clean the valve and replace if necessary.

8.2.4 Problems with the calibration

System does not calibrate automatically

Possible reason	Counter-measure
1. Calibration release has not been activated.	Change parameter.

Calibration is not released at a given time

Possible reason	Counter-measure
1. Date or time is not set to local time or start of calibration has been set incorrect.	Enter actual data.

APPENDIX A INDEX

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V

W

Appendix B Technical data

The following pages list the technical data for your Bran+Luebbe PowerMon in detail. The documents serve et al. as a reference for our service engineers. You should note any modifications on the relevant sheets.

- Method Description
- Wiring Diagram
- Terminal Diagram
- Additional Information (if any)