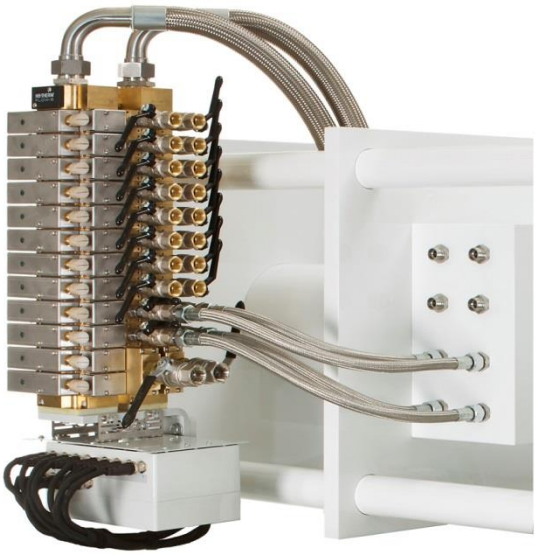
HB-Therm®
FLOW-5

Instruction Manual

HB-FM160/180/200

Flow meter



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Translation of original instruction

(Typenschild)

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1 General

1.1 Information about this manual

This manual enables the safe and efficient handling of the external flow meter.

The manual is a component part of the flow meter and must always be kept close to the flow meter readily accessible for personnel. Before starting any work, the personnel must have carefully read through and understood this manual. A basic requirement for safe work is the observance of all safety and handling instructions in this manual.

Furthermore, the local accident prevention regulations and general safety regulations are valid for the application area of the external flow meter.

Illustrations in this manual serve the basic understanding and can deviate from the actual design.

We reserve the right to make technical modifications in order to improve usability.

1.2 Explanation of symbols

Warnings

Warnings are identified by symbols. These warnings are introduced by signal words, which express the severity of a danger. Adhere to these warnings and act cautiously in order to avoid accidents, personal injuries and damage to property.

DANGER!

… indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!

… indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION!

… indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

ATTENTION!

… indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Hints and recommendations

NOTE!

… emphasizes useful hints and recommendations as well as information for efficient and trouble-free operation.

1.3 Limitation of liability

All information and notes in this Manual were compiled under due consideration of valid standards and regulations, the present status of technology and our years of knowledge and experience.

The manufacturer can not be made liable for damage resulting from:

- disregarding this Manual
- unintended use
- employment of untrained personnel
- unauthorized conversions
- technical modifications
- use of unapproved spare parts

In case of customised versions the actual scope of delivery can vary from the explanations and representations in this Manual, because of the utilization of additional options or due to latest technical changes.

Apart from this, the obligations agreed upon in the delivery contract, the general terms and conditions and the delivery conditions of the manufacturer and the legal regulations valid at the time of contract do apply.

1.4 Copyright

This Manual is protected by copyright law and exclusively to be used for internal purposes.

Passing this Manual on to third parties, duplication of any kind – even in form of excerpts – as well as the use and/or disclosure of the contents without the written consent of the manufacturer is not permitted, except for internal purposes.

Violations oblige to compensation. The right for further claims remains reserved.

1.5 Warranty terms

The warranty terms are provided in the manufacturer's terms and conditions.

1.6 Customer Service

For technical information, please contact the HB-Therm representatives or our customer service department → www.hb-therm.ch.

Furthermore, our employees are always interested in new information and experiences resulting from the application that could be valuable for the improvement of our products.

2 Safety

This paragraph provides an overview of all important safety aspects for optimal protection of personnel as well as safe and trouble-free operation.

Disregarding this Manual and safety regulations specified therein may result in considerable danger.

2.1 Intended Use

The external flow meter is designed and constructed exclusively for the intended use described here.

The external flow meter serves exclusively for the measurement of temperature and flow rate. It is not designed for use as a heat meter.

The external flow meter must only be operated in accordance with the values specified in the technical data.

Observance of all information in this manual also pertains to the intended use.

Any use of the external flow meter other than or going beyond the intended use is deemed as misuse and can lead to dangerous situations.

WARNING!
Danger on misuse!

Misuse of the external flow meter can lead to dangerous situations.

In particular, refrain from the following applications:

– Use of a heat transfer medium other than water resp. heat transfer oil.
– Use with pressures, temperatures higher than those specified.

Claims of any nature regarding damage caused by improper use are excluded.

2.2 Customer’s responsibility

The device is implemented commercially. Thus the owner of the device is subject to legal industrial safety obligations.

In addition to the safety instructions in this Manual, the safety, accident prevention guidelines and environmental protection regulations, applicable at the site of implementation must be complied with. In particular:

- Owner must inform himself of applicable industrial safety regulations and determine additional hazards that arise due to the specific working conditions prevailing at the site where the device is implemented, in a risk analysis. The risk assessment must be implemented in the form of work instructions for device operation.
- Owner must check throughout the entire implementation period of the device, whether the work instructions that owner has created satisfy current legislation, and must adapt the instructions if necessary.
- Owner must clearly regulate and specify the responsibilities for installation, operation, maintenance, and cleaning.
- Owner must ensure that all employees who deal with the device have read and understood this Manual.
  In addition, owner must train personnel at regular intervals and inform personnel of the hazards.
- Owner must provide personnel with the required protective equipment.

In addition, owner is responsible to ensure that the device is always in a technically perfect condition, and therefore the following applies:

- Owner must ensure that the maintenance intervals described in these operating instructions are complied with.
- Owner must have all safety devices inspected regularly for function and completeness.

2.3 Personnel requirements

2.3.1 Qualifications

WARNING!
Danger of injury if insufficiently qualified!

Improper operation can lead to serious personal injuries or property damage.

Therefore:

– Have all activities performed only by qualified personnel.

The following qualifications are specified for different areas of activity listed in the Manual.

- **An instructed person**
  has been instructed by the customer in an orientation session on the assigned tasks and possible dangers in case of improper behavior.
- **Qualified personnel**
  based on their professional training, know-how and experience as well as knowledge of the applicable standards and regulations is able to perform assigned work activities and to detect and avoid possible dangers on their own.
- **Hydraulic specialist**
  based on his or her technical training, knowledge and experience as well as knowledge of the relevant standards and regulations, is able to carry out work on hydraulic systems and to independently recognise and avoid possible dangers.
  The hydraulic specialist is trained for the specific location at which he or she is employed and is familiar with the relevant standards.
- **A professional electrician**
  based on his/her professional training, know-how and experience as well as knowledge of the applicable standards and regulations is able to perform work on electrical systems and to detect and avoid possible dangers on his/her own.
  The professional electrician has been trained for the special location where he/she works and knows the relevant standards and regulations.

2.3.2 Unauthorized persons

WARNING!
Danger for unauthorized persons!

Unauthorized persons not meeting the requirements outlined here are not aware of the dangers in the work area.

Therefore:

– Keep unauthorized persons away from the work area.
– If in doubt, address the persons and direct them to leave the work area.
– Interrupt work activities as long as unauthorized persons are present in the work area.

2.4 Personal protective equipment

When working, it may be necessary to wear personal protective equipment in order to minimise dangers to health.

- During work, always wear the protective equipment necessary for the particular work.
- Follow the information placed in the working area with regard personal safety equipment.

Personal protective equipment for special tasks

When performing special tasks it is necessary to wear personal protective equipment. This personal protective equipment will be separately specified in the chapters of this Manual. This special protective equipment is explained below.

Protective clothing

means close-fitting working clothes with long arms and long trousers. It serves primarily as protection against hot surfaces.

Protective gloves

to protect the hands against abrasions, cuts or deeper wounds as well as against contact with hot surfaces.

Safety goggles

to protect the eyes against parts flying around or squirts of fluids.

Safety boots

to protect against heavy parts falling down or slipping on slippery ground.

2.5 Specific dangers

The following section lists the residual risks that have been determined by the risk assessment.

- Heed the safety instructions listed here, and the warnings in subsequent chapters of this Manual, to reduce health hazards and to avoid dangerous situations.

Hot materials

WARNING!
Danger of burns due to hot working materials!

During operation, working materials can reach high temperatures and pressures and can cause burns on contact.

Therefore:

– Only allow work on the hydraulics to be carried out by qualified personnel.
– Before beginning work on the hydraulics, check whether working materials are hot and under pressure. If necessary, cool the unit down, depressurise and switch off. Check that the unit is free of pressure.

Hot surfaces

CAUTION!
Danger of burning on hot surfaces!

Contact with hot components can cause severe burns.

Therefore:

– Always wear protective clothes and protective gloves when working on hot components.
– Before starting work make sure that all components have cooled down to ambient temperature.

2.6 Stickers and decals

The following symbols and information decals can be found in the danger zone. They refer to the immediate vicinity around their location.

WARNING!
Danger of injury because of illegible symbols!

Over the course of time stickers and decals may become dirty or illegible for any other reason.

Therefore:

– Keep any safety, warning and operation related decals in legible condition at all times.
– Replace damaged decals or stickers immediately.

Hot surfaces

Hot surfaces, like hot machine parts, tanks or materials, but also hot fluids, are not always detectable. Do not touch without protective gloves.

2.7 EU Declaration of Conformity

(CE-Directive 2014/30/EC, Annex IV)

Product	Flow Meter HB-Therm Flow-5
Unit types	HB-FM160 HB-FM180 HB-FM200
Manufacturer Address	HB-Therm AG Piccardstrasse 6 9015 St. Gallen SWITZERLAND www.hb-therm.com
CE guidelines Note on the pressure equipment line 2014/68 / EU	2011/65/EU The above products are in accordance with Article 4 (3). This means that interpretation and production are consistent with good engineering practice in the Member State.
Responsible for documentation	Martin Braun HB-Therm AG 9015 St. Gallen SWITZERLAND
Standards	EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019; EN 61326 1:2013; EN IEC 63000:2018; EN ISO 13732 1:2008

We declare of our own responsibility that the above mentioned products, to which this declaration refers, comply with the appropriateregulations of the EMC Directive (CE-Directive 2014/30/EC) including its appendices and the corresponding legal remission for implementation of the directive in national law.
Furthermore, the above mentioned standards (or parts/clauses thereof) are applied.

St. Gallen, 2023-08-17

Reto Zürcher
CEO

Stefan Gajic
Compliance & Digitalisation

2.8 UK Declaration of Conformity

(The Electromagnetic Compatibility Regulation 2016, Statutory Instrument 2016 No. 1091)

Product	Flow Meter HB-Therm Flow-5
Unit types	HB-FM160 HB-FM180 HB-FM200
Manufacturer Address	HB-Therm AG Piccardstrasse 6 9015 St. Gallen SWITZERLAND www.hb-therm.com
UK guidelines	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 Statutory Instruments 2012 No. 3032
Note on The Pressure Equipment (Safety) Regulations 2016 Statutory Instruments 2016 No. 1105	The above products are in accordance with regulation 8. This means that interpretation and production are consistent with good engineering practice.
Responsible for documentation	Martin Braun HB-Therm AG 9015 St. Gallen SWITZERLAND
Standards	EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019; EN 61326 1:2013; EN IEC 63000:2018; EN ISO 13732 1:2008

We declare of our own responsibility that the above mentioned products, to which this declaration refers, comply with the appropriate regulations of the Electromagnetic Compatibility Regulations 2016, including its appendices. Furthermore, the above mentioned Statutory Instruments and standards (or parts/clauses thereof) are applied.

St. Gallen, 2023-08-17

Reto Zürcher
CEO

Stefan Gajic
Compliance & Digitalisation

3 Technical data

3.1 General Information

Construction: Unit mounting

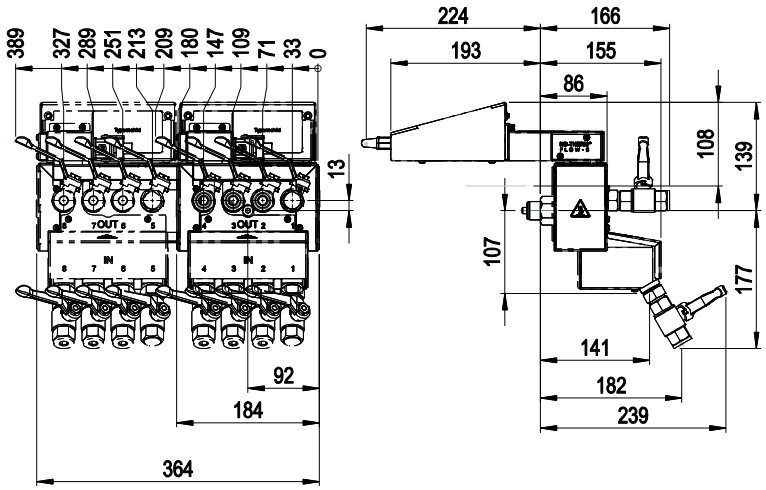


Fig. 1: Construction dimensions: Unit mounting Thermo 5

Construction:
Unit mounting Series 4

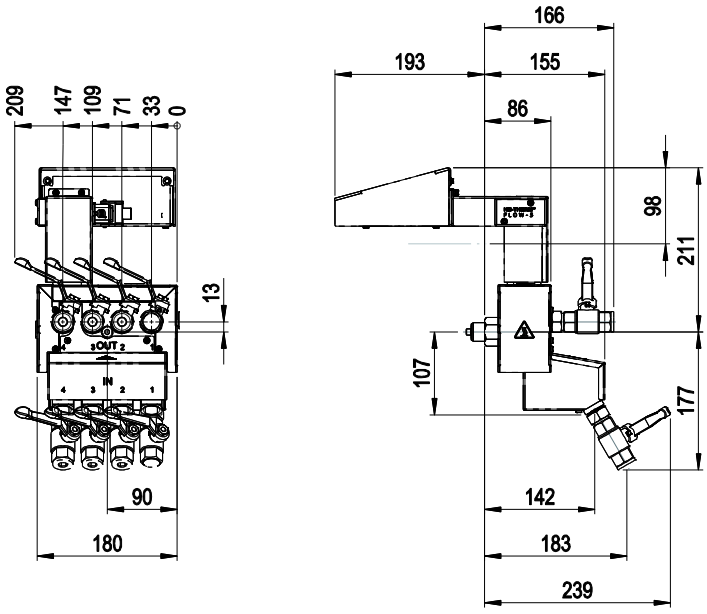


Fig. 2: Construction dimensions: Unit mounting Series 4

Technical data

Construction: Stand-alone

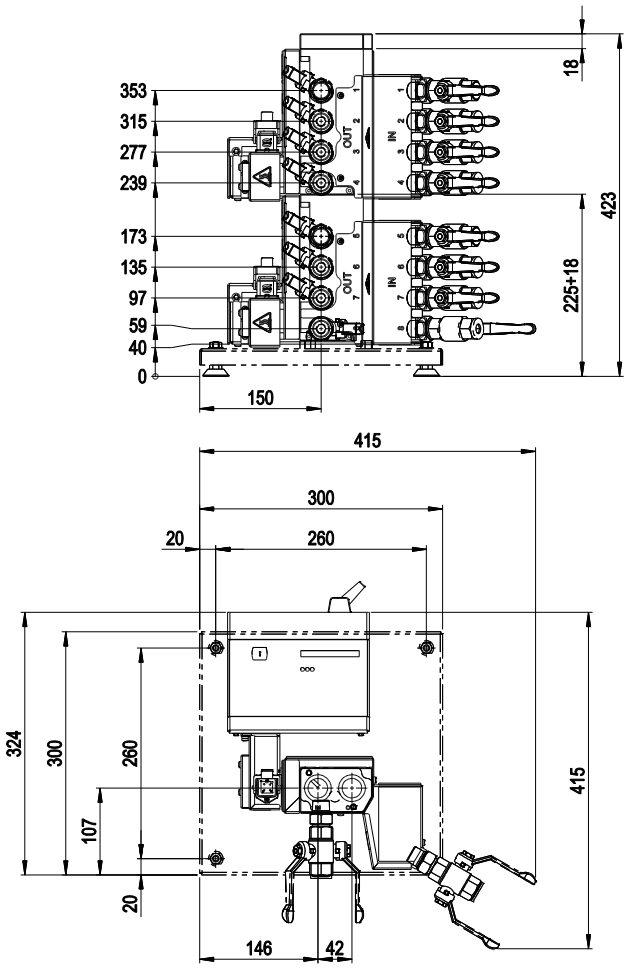


Fig. 3: Construction dimensions: Stand-alone

Construction: Autonom. (up to 8 circuits)

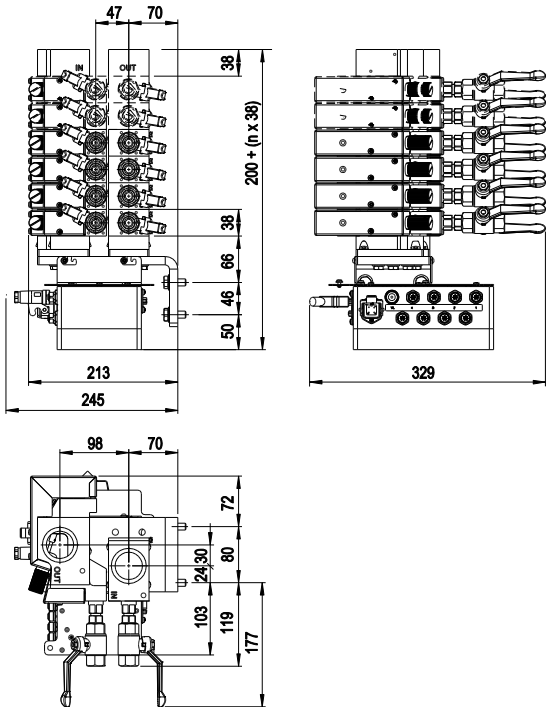


Fig. 4: Construction dimensions: Autonom. (e.g. HB-FM160L8-6)

Construction: Autonom. (up to 16 circuits)

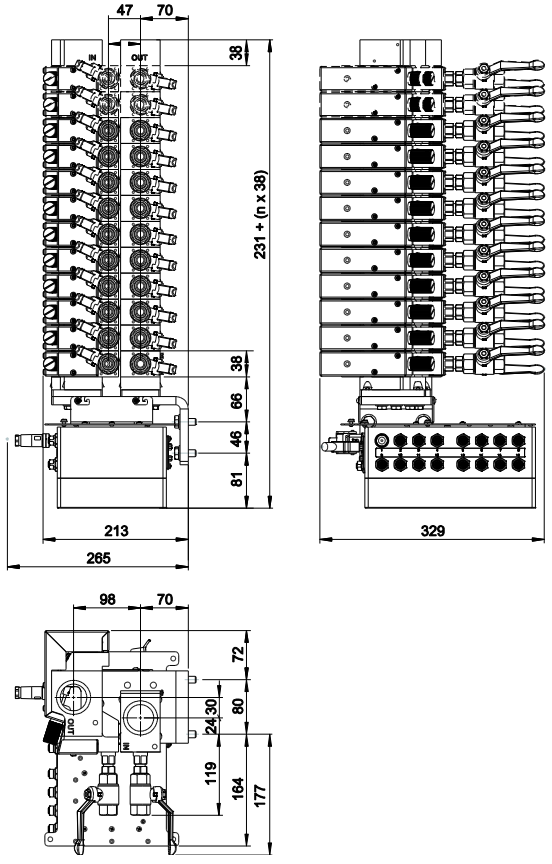


Fig. 5: Construction dimensions: Autonom. (e.g. HB-FM160L16-12)

n = number of circuits

Technical data

Max. weight

Construction: Unit attached

Model	Value	Unit
HB-FM160G4	9	kg
HB-FM180G4		
HB-FM200G4		
HB-FM160G4	20	kg
HB-FM180G8		
HB-FM200G8		

Construction: Stand-alone

Model	Value	Unit
HB-FM160G4	13	kg
HB-FM180F4		
HB-FM200F4		
HB-FM160F8	24	kg
HB-FM180F8		
HB-FM200F8		

Construction: autonom.

Model	Value	Unit
HB-FM160	9 + (n x 4)	kg
HB-FM180		

n = number of circuits

Temperature measurement

	Value	Unit
Measuring range	0-400	°C
Dissolution	0.1	°C
Tolerance	±0,8	K

Flow measurement

	Value	Unit
Measuring range	0,4–20	L/min
Dissolution	0,1	L/min
Tolerance	±(5 % of the measured value + 0,1 L/min)	

3.2 Emissions

	Value	Unit
Surface temperature (rear)	>75	°C
Surface temperature (operation)	<50	°C

3.3 Operating conditions

Environment

The Flow-5 flow meter may only be used indoors.

	Value	Unit
Temperature range	5–60	°C
Relative humidity *	35–85	% RH

* non-condensing

Assembly positions (only for construction: autonom)

Following assembly positions for the construction autonom are allowed:

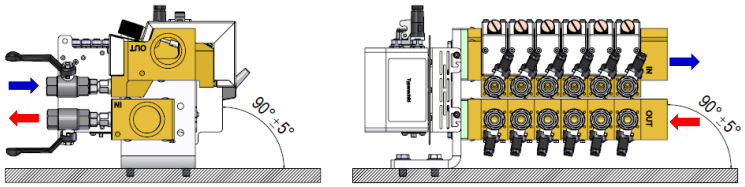


Fig. 6: Assembly position horizontal, version to the left

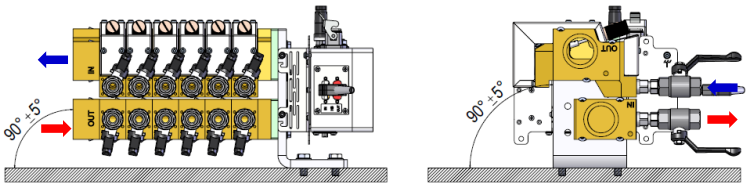


Fig. 7: Assembly position horizontal, version to the right

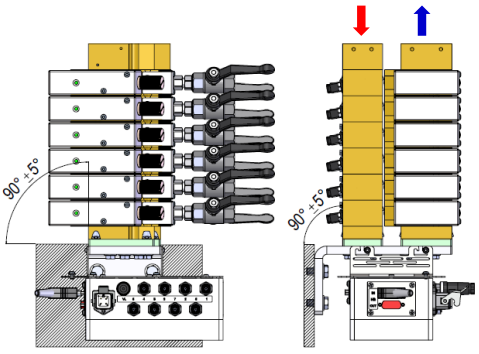


Fig. 8: Assembly position vertical an version to the left

3.4 Connection values

Electrical connection

see nameplate on unit or on page 2

Frequency output connection (only for Construction: Unit mounting / Stand-alone)

	Value	Unit
Frequency / flow rate	10	Hz / l/min
Frequency range	0–400	Hz

Connection main and return line (supply)

	Value	Unit
Thread (Construction: Stand-alone)	G¾ 1)	
Thread (Construction: Autonom)	G1 ¼	
HB FM160	20, 180	bar, °C
Resistance HB FM180	25, 200	bar, °C
Resistance HB FM200	10, 220	bar, °C

G… Connector inside thread in inches
1) for construction: Stand-alone version optional G1

Connection main and return line (circuits)

	Value	Unit
Thread	G½	
HB FM160	20, 180	bar, °C
Resistance HB FM180	25, 200	bar, °C
Resistance HB FM200	10, 220	bar, °C

G… Connector inside thread in inches

3.5 Operating fluids

ATTENTION!
Incorrect measurements due to additives in the heat transfer media

Therefore:

– For perfect operation of the flow measurement, no frothing additives should be mixed with the heat transfer medium.

Depending on the model, the following materials are used in the temperature control unit:

- Copper
- Brass
- Bronze
- Nickel
- Chrome steel
- MQ (silicon)
- Titan
- NBR (Nitrile rubber)
- FPM (Viton®)
- PTFE (Teflon)
- FFKM (Perfluorinated rubber)
- PEEK (Polyether ether ketone)
- Ceramic (Al_2O_3)

Viton® is a registered trade mark of Dupont Dow Elastomers

Heat transfer medium water (HB-FM160/180)

Hydrological data	Temperature range	Guideline value	Unit
pH	-	7.5, – 9	
Conductivity	up to 110 °C	<150	mS/m
	110–180 °C	<50	
	over 180 °C	<3	
Total hardness	up to 140 °C	<2.7	mol/m³
		<15	°dH
	over 140 °C	<0.02	mol/m³
		<0.11	°dH
Carbonate hardness	up to 140 °C	<2.7	mol/m³
		<15	°dH
	over 140 °C	<0.02	mol/m³
		<0.11	°dH
Chloride ions (Cl) -	up to 110 °C	<50	mg/L
	110–180 °C	<30	
	over 180 °C	<5	
Sulphate SO4 2-	-	<150	mg/L
Ammonium NH4 +	-	<1	mg/L
Iron Fe	-	<0.2	mg/L
Manganese Mn	-	<0.1	mg/L
Particle size	-	<200	µm

Heat transfer oil (HB-FM200)

Suitable heat transfer oils must be used for operation with oil.

WARNING!
Danger may result if unsuitable heat transfer oils are used

Using unsuitable oil poses the risks of cracking, overheating and fire.

Therefore:

– The maximum permitted main line temperature must exceed the maximum working temperature of the unit.
– The permitted film temperature and the boiling point must be at least 340 °C.

Do not use any aggressive medium that can destroy materials in contact with the heat transfer medium.

NOTICE!

For further information, you can go to www.hb-therm.ch to download "Oil recommendation for temperature control units (DF8082-X, X=language).

3.6 Nameplate

The nameplate is located on the housing of the evaluation unit and on page 2 of these operating instructions.

The following information can be taken from the nameplate:

- Manufacturer
- Type designation
- Unit number
- Year of manufacture
- Performance data
- Connection data
- Type of protection
- Additional equipment

4 Structure and function

4.1 Overview

Construction: Unit mounting / Stand-alone

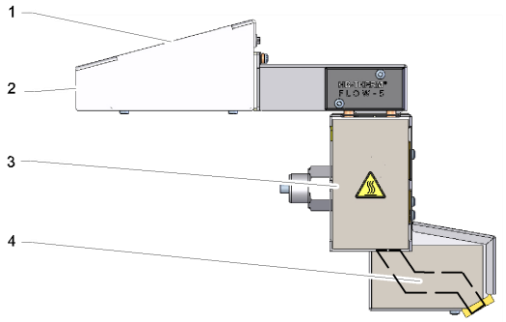


Fig. 9: Construction overview: Unit mounting

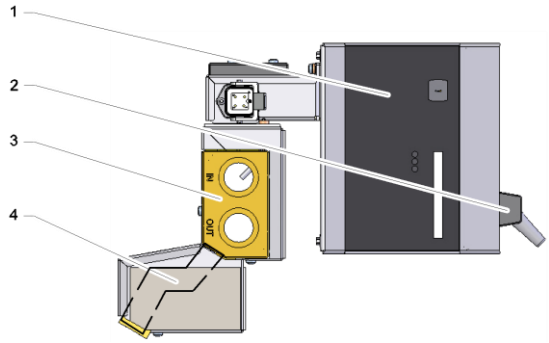


Fig. 10: Construction overview: Stand-alone

1 Evaluation unit with operating panel and LED display
2 Interface connections
3 Main and return line distribution
4 Circuits

Construction: Autonom

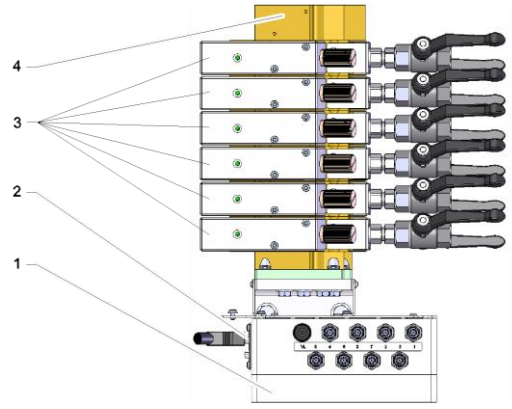


Fig. 11: Construction overview: Autonom

1 Evaluation unit
2 Interface connections
3 Circuits
4 Main and return line distribution

4.2 Functional principle

The external flow meter serves the measurement of temperature and flow rate from 2 up to 16 circuits (depends on construction) The flow measurement is done with ultrasound. The temperatures are measured with resistance thermometers.

The measurement signals are processed by the evaluation unit and then transmitted to a temperature control unit (interface HB for Thermo-5 or Panel-5 or frequency output for Series 4 or third-party product). From there a further transfer of the data to the machine is possible (→ page 61).

Different measurement values are available depending of the temperature control unit (→ page 40).

4.3 Circuit connections:

Construction: Unit mounting / Stand-alone

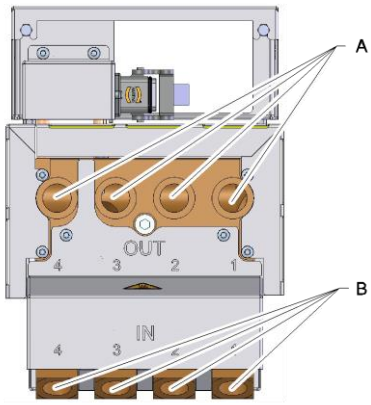


Fig. 12: Construction connections: Unit mounting / Stand-alone

The connections are marked as follows:

A	**OUT**	Main line	1–4 or 1–8
B	**IN**	Return line	1–4 or 1–8

Construction: Autonom.

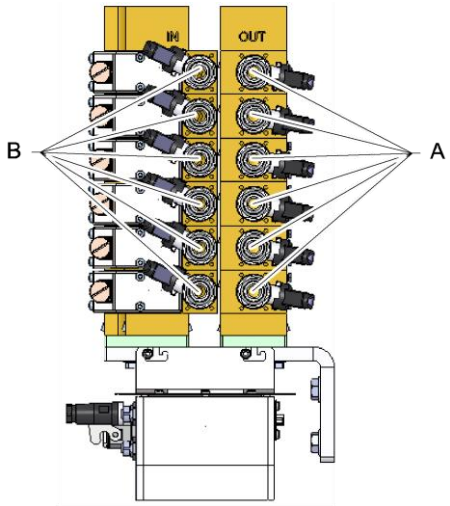


Fig. 13: Construction connections: Autonom.

The connections are marked as follows:

A	**OUT**	Main line	1–n
B	**IN**	Return line	1–n

n = number of circuits

4.4 Supply connections

Construction: Stand-alone

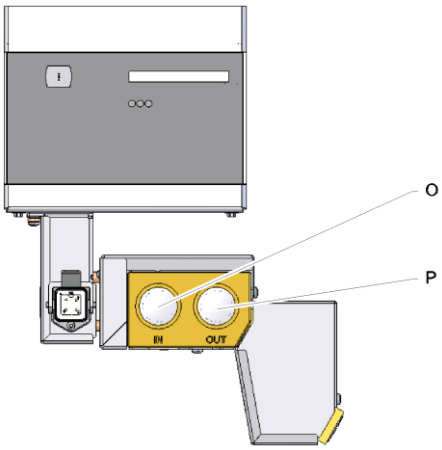


Fig. 14: Construction connections: Stand-alone

The connections and important components on the rear are marked as follows:

O	**IN**	Supply inlet
P	**OUT**	Supply outlet

Construction: Autonom.

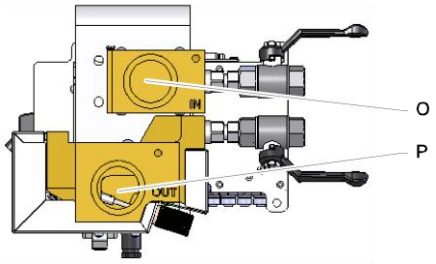


Fig. 15: Construction connections: Autonom.

The connections and important components on the rear are marked as follows:

O	**IN**	Supply inlet
P	**OUT**	Supply outlet

4.5 Additional equipment

The following additional equipment can be installed in addition to the basic equipment for the unit (→ nameplate):

	Additional equipment	Description
ZA	Connection for alarm	Alarm using potential-free contact (rating max. 250 VAC, 4 A)
		1 socket Harting Han 3A (male)
ZH	Shut-off valves	Shut-off valves for all circuits (without parallel connections)

5 Transport, packing and storage

5.1 Safety notes for transport

Improper transport

ATTENTION!
Damage due to improper transport!

Improper transport can result in considerable material damage.

Therefore:

– Only use original or equivalent packaging.
– On delivery as well as during internal transport, proceed carefully when unloading the packages and observe the notices on the packaging.
– Only remove the packaging shortly before assembly.

Transport, packing and storage

5.2 Transport inspection

Check the delivery immediately on receipt for completeness and transport damage.

If externally detectable transport damage is found, proceed as follows:

- Do not accept the delivery, or only with reservation.
- Record the extent of transport damage in the transport documents or on the delivery note of the forwarding agent.
- Start complaints procedure.

NOTE!

Claim any damage as soon as it is detected. Compensation claims can only be submitted within the applicable complaints periods.

5.3 Packing

Fig. 16: Packaging

The external flow meter is packed in a cardboard box appropriate to the expected transport conditions.

Only environmentally compatible materials have been used for the packaging.

The packaging should protect the individual components from transport damage, corrosion and other damage. Therefore, do not destroy the packaging.

Handling packing materials

If there is no returns agreement for the packing, separate materials according to type and size and direct to further use or recycling.

ATTENTION!
Environmental damage caused by incorrect waste disposal!

Packing materials are valuable raw materials and can continue to be used in many cases or sensibly reconditioned and recycled.

Therefore:

– Dispose of packing materials environmentally.
– Follow the locally valid waste disposal regulations. If necessary employ a special waste disposal company to dispose of packing material.

Transport, packing and storage

Recycling codes for packaging materials

Recycling codes are markings on packaging materials. They provide information about the type of material used and facilitate the disposal and recycling process.

These codes consist of a specific material number framed by an arrow-triangle symbol. Below the symbol is the abbreviation for the respective material.

Transport pallet

→ Wood

Folding carton

→ Cardboard

Strapping band

→ Polypropylene

Foam pads, cable ties and quick release bags

→ Polyethylene low density

no recycling code

Stretch film

→ Polyethylene linear low density

Transport, packing and storage

5.4 Symbols on the packing

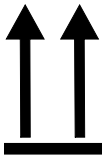
Protect against wetness

Protect packages against wetness and keep dry.

Fragile

Identifies packages with fragile or sensitive content.

Handle package with care, do not drop and do not subject to shock loads.



Top

The arrows in this sign symbolize the top side of the package. They must always point up, as otherwise the content may get damaged.

5.5 Storage

Storing the packages

Store the packages under the following conditions:

- Do not store out of doors.
- Store dry and dust-free.
- Do not expose to aggressive media.
- Protect from sunlight.
- Avoid mechanical vibrations.
- Storage temperature: 15 to 35 °C.
- Relative humidity: max. 60 %.

6 Installation and initial commissioning

6.1 Safety

Personnel

- The installation and commissioning must only be carried out by qualified personnel.
- Work on the electrical system must only be carried out by certified electricians.
- Work on the hydraulic system must only be carried out by qualified hydraulics technicians.

Special dangers

The following dangers exist:

- Danger of fatal injury by electric current.
- Risk of burns due to hot materials.
- Risk of burns due to hot surfaces.
- Danger of crushing due to rolling away or tipping.

Improper installation and initial commissioning

WARNING!
Risk of injury due to improper installation and initial commissioning!

Improper installation and initial commissioning can lead to severe personal injury or material damage.

Therefore:

– Before starting work, ensure that there is sufficient space for assembly.
– Open components with sharp edges should be handled carefully.

Installation and initial commissioning

6.2 Make connections

Model: Unit attached

Fig. 17: Model: Equipment extension

Proceed as follows in order to connect the external flow meter (model: equipment extension) to the temperature control unit:

1. Prepare the unit.
2. Attach the external flow meter to the temperature control unit and tighten the hexagon socket head screw with max. 20 Nm torque.
3. Connect main and return lines 1–n to consumers.

n = number of circuits

Model: Stand-alone

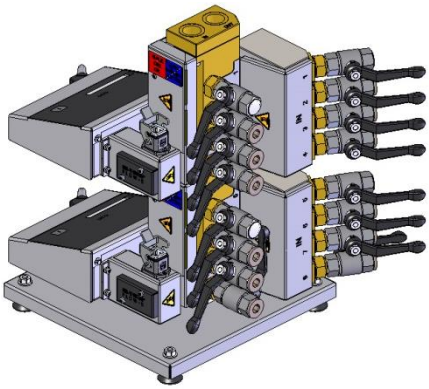


Fig. 18: Model: Stand-alone

Proceed as follows in order to operate the external flow meter (model: Stand-alone):

1. Position the external flow meter on a level and load-bearing surface.
2. Connect main and return lines from supply.
3. Connect main and return lines 1–n to consumers.

n = number of circuits

Model: autonom

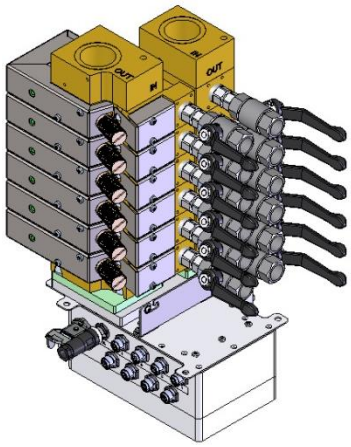


Fig. 19: Model: autonom

Proceed as follows in order to operate the external flow meter (model: autonom):

1. Mount the external flow meter onto the tool.
2. Connect main and return lines from supply.
3. Connect main and return lines 1–n to consumers.

n = number of circuits

6.3 Connect functional earth

only with construction: autonom

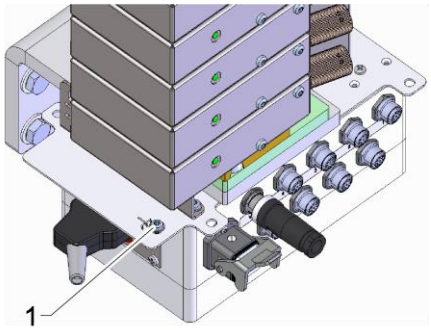


Fig. 20: Functional earth

Large EMC sources of interference close to the flow rate meter can influence its functioning. In this case the housing of the evaluation unit of the flow rate meter must be earthed with an earthing strap.

(Connecting point for functional earth see (1) Fig. 20)

6.4 Connect data-interfaces

6.4.1 For Series 5

HB interface

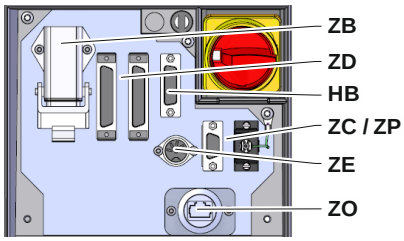


Fig. 21: Interfaces individual unit

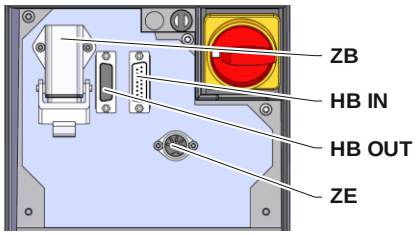


Fig. 22: Interfaces modular unit

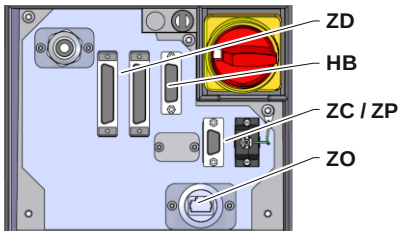


Fig. 23: Interfaces Panel-5

Fig. 24: Interfaces Flow-5
Modul: Unit attached/ stand-alone

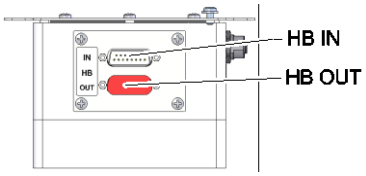


Fig. 25: Interfaces Flow-5
Modul: Autonom.

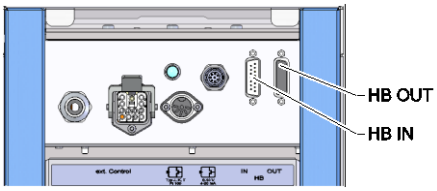
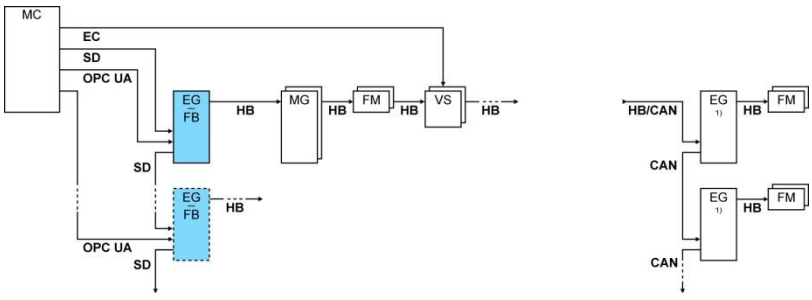


Fig. 26: Interfaces Vario-5

To operate or monitor a modular unit Thermo-5 Ext. Flow meter Flow-5 or a switching unit Vario-5, a control cable must be connectedto the device:

1. Loop the control cable between the front and the service cover at Thermo-5 resp. Panel-5.
2. Plug the control cable into socket HB IN.
3. Attach the other side of the control cable to the HB-Therm Thermo-5, Flow-5 or Vario-5 through the HB IN plug.
4. Attach additional HB-Therm products through the socket HB OUT.
5. Close the service lid.

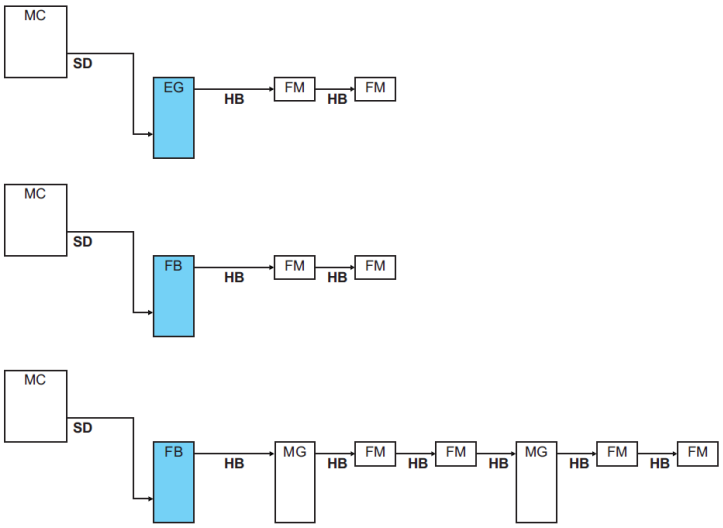
Legend	Designation	Comment
MC	Machine controller	max. 1
FB	Operating module Panel-5	max. 1
EG	Temperature thermostat Thermo-5 singular unit	max. 16 (per operation)
MG	Temperature thermostat Thermo-5 modular unit	
FM	Flow meter Flow-5	max. 32 (with 4 circuits)
VS	Switching unit Vario-5	max. 8
SD	Communication via serial data interfaces DIGITAL (**ZD**), CAN (**ZC**), PROFIBUS-DP (**ZP**)	Maximum number of sim. modules, operatingvolume and transfer of flow rate values depend on the machine controller or protocol
OPC UA	Communication OPC UA via Ethernet (**ZO**)	
HB 2)	Communication Interface HB	Order of connection not relevant
HB/CAN	Communication Interface HB/CAN	For remote control of singular units
CAN	Communication Interface CAN (**ZC**)	
EC	External control (ext.) Control)	Configuration depends on machine controller



1) operation switched OFF

2) Max. length cable HB: Total 50 m

Communication examples



Measured values

The following values are transmitted during connection to a temperature control unit or an operating modular unit:

- External flow rate per circuit
- External return line temperature per circuit
- External main line temperature per ext. flow meter

Data interface (additional equipment ZD, ZC, ZP, ZO)

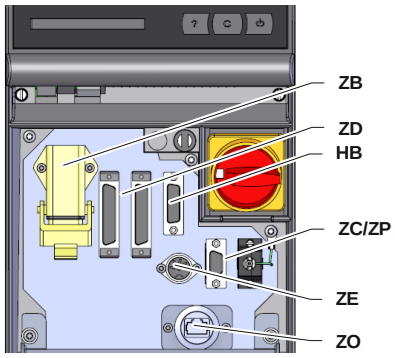


Fig. 27: Interfaces individual unit

In order to control the unit via an external controller, a control cable can be connected to the unit:

1. Pull the control cable between the front and the service cover.
2. Plug the control cable into socket ZD, ZC, ZP or ZO.
3. Close the service lid.
4. Settings for Address resp. of the Protocol (→ page 61)
5. Setting of the network configuration
   (only with additional equipment ZO → Instruction Manual Thermo-5)

6.5 For Series 4 or third-party products

Frequency output (only for Construction: Unit mounting / Stand-alone)

To connect an ext. flow meter to a Series 4 temperature control unit or third-party product, proceed as follows:

1. Plug the cable into socket AUX.
2. With Series 4 units plug the cable into socket X75. (Connect third-party products in accordance with the instructions for the third-party product.)

NOTICE!

With Series 4 units, the additional equipment ZV must be available for evaluating frequency signals.

Measured values

When connecting Series 4 units or third-party products, the following measured values are transmitted per external flow measuring unit:

- 4 x flow rate external

NOTE!

The pin assignment for the various control cables is given in chapter 15 on page 88.

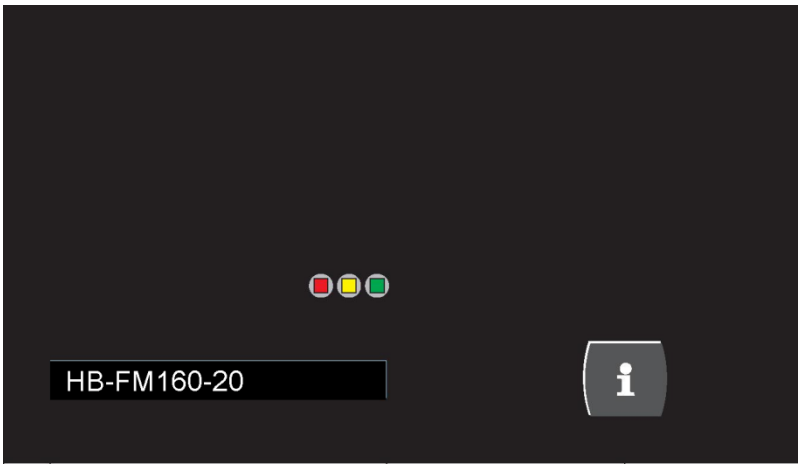
7 Control

NOTICE!

The external flow meters have no operation of their own. Operation and display take place via an individual Thermo 5 unit or an operating Panel 5 modular unit.

7.1 Keyboard

(only for Construction: Unit mounting / Stand-alone)



Key	Key function
	Switch to menu page Display \ Actual value, to the fourth or eighth external flow rate actual value.

Control

Basic display (only for operation of modular units)

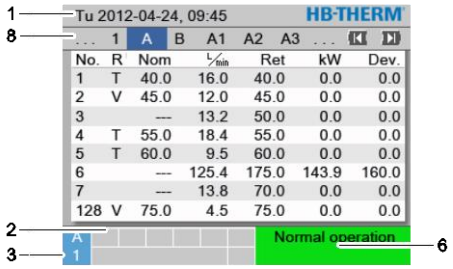


Fig. 28: Basic display table (only for operation of modular units)

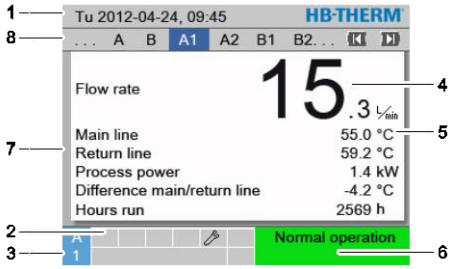


Fig. 29: Basic display text (only for operation of modular units)

Pos. No.	Designation	Display
1	Menu bar	Date and time
2	Symbol field	Display active functions and details
3	Address field	Display of module address or DFM module address
4	Actual value display (large)	Display of the current measured flow rate or return line temperature
5	Unit	Unit for nominal value
6	Operating mode and colour-coded condition display	Display of current operating mode / pending alarms and warnings
7	User values	Display of max. 5 freely selectable actual values
8	Module bar	Display of the registered modules or flow meters

Control

Status display external flow meter

(only for Construction: Unit mounting / Stand-alone)

NOTICE!

The status display is only active when connected to a Series 5 or Panel 5 unit.

The status display lights up in a different colour depending on the operating condition. The following conditions are defined:

Display	Description
green	trouble-free
green flashing	start-up phase, limit values not set
green flashing fast	flow measurement selected on the operating panel
yellow	warning
red	fault
yellow/red flashing	software update

Status display individual circuit

(only for construction: autonom.)

Depending on the operating condition, the status lights of the individual circuits flash in different sequences. The following conditions are defined:

Condition	flashing sequences of status lights
Normal operation	Flashing relative to current flow rate. 0–10 s ON → 0–20 l/min
Fault	1 s OFF, 1 s ON, 1 s OFF, 7 s ON
Software update	1 s ON, 1 s OFF,

Status indicator operating module or singular unit

The condition display lights in a different colour depending on the operating condition. The following conditions are defined:

Display	Description
green	trouble-free
green flashing	Start-up phase, limiting values not set
yellow	Warning
red	Fault

7.2 Operating structure

Navigate through the menu structure as follows:

- Use the OK key to display step-by-step the next lowest hierarchy level starting from the basic display.
- Press the C key to display step-by-step the next highest hierarchy level up to the basic display.
- Press and hold the C key for more than 1 second to directly display the basic display from a lower hierarchy level.
- Press the ◀ and ▶ arrow keys to toggle between the individual modules.

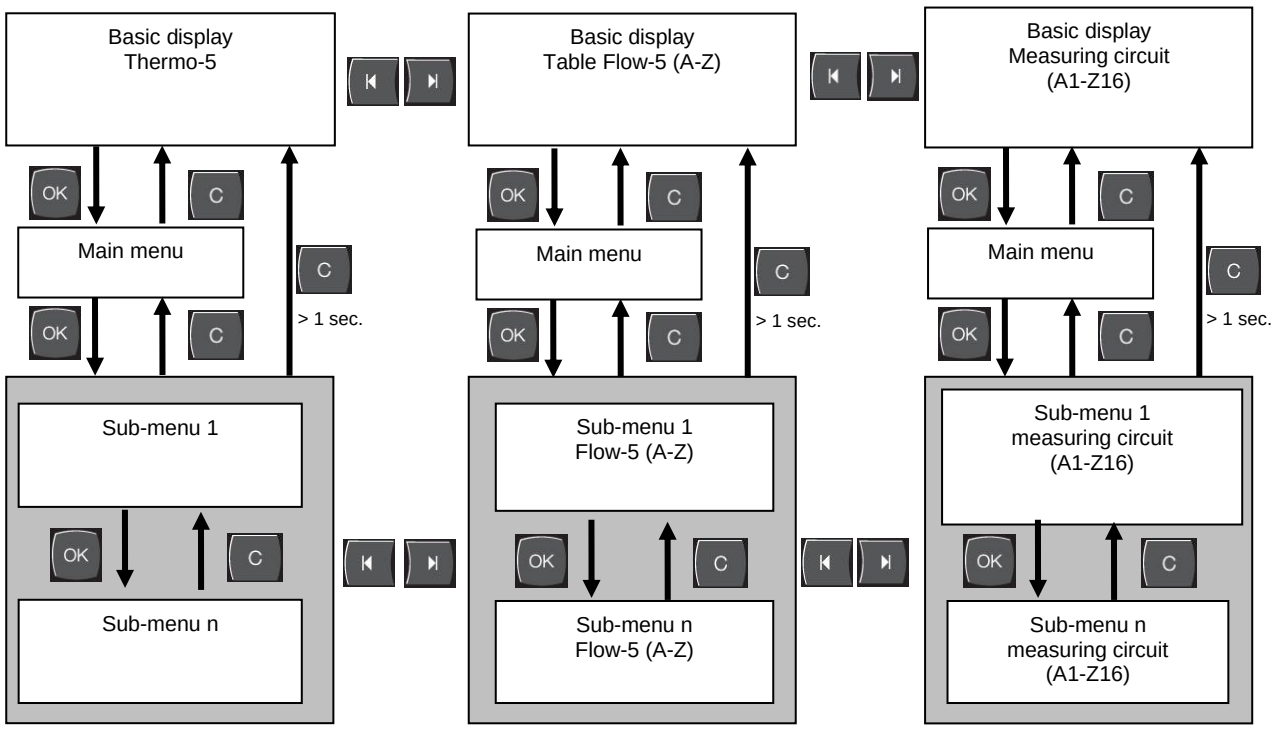


Fig. 30: Operating structure

7.3 Menu structure

Integrated operation

Flow-5 has an own menu structure with the integrated operation. The menu structure of Thermo-5 is extended with actual values (→ page 69)

Operation Modular

Flow-5 has an own menu structure with the modular operation.

NOTICE!

Depending on the software version used, the menu structure and the parameter values can deviate from the following table.

Display	User profile	Operating-release	Default value	Unit	Additional-equipment	Type
Nominal values	S	-	-	-	-	-
Nominal value flow rate	S	1	5.0	L/min	-	Z
Functions	S	-	-	-	-	-
Remote mode	S	1	OFF	-	ZD, ZC, ZP	Y
Switch clock	S	1	OFF	-	-	A
Teaching	S	1	OFF	-	-	Z
Display	S	-	-	-	-	-
Screen type FM	S	2	autom.	-	-	A
Actual values	S	-	-	-	-	-
Hold screen	S	1	OFF	-	-	A
Main line	S	-	-	°C	-	Y
Return line	S	-	-	°C	-	Z
Difference return/main line	S	-	-	K	-	Z
Flow rate	S	-	-	L/min	-	Z
Process power	S	-	-	kW	-	Z
Operating hours FM	S	-	-	h	-	Y
Selection	S	-	-	-	-	-
Main line	S	3	OFF	-	-	Y
Return line	S	3	ON	-	-	Z
Difference return/main line	S	3	ON	-	-	Z
Flow rate	S	3	ON	-	-	Z
Process power	S	3	ON	-	-	Z
Operating hours FM	S	3	OFF	-	-	Y
Ext. Flow rate meter	S	-	-	-	-	-
Ext. Flow rate meter	S	3	-	-	-	Z
Monitoring	S	-	-	-	-	-
Monitoring	S	3	autom.	-	-	A
Monitoring level	S	3	rough	-	-	Z
Reset monitoring	S	3	no	-	-	Z

Control

Startup-alarm suppression	S	3	complete	-	-	A
Alarm contact function	S	3	NO1	-	-	Y
Horn volume	S	3	10	-	-	A
Temperature	S	-	-	-	-	-
Difference return/main line	S	3	-	K	-	Z
Main line max.	S	3	-	°C	-	Y
Main line min.	S	3	-	°C	-	Y
Return line max.	S	3	-	°C	-	Z
Return line min.	S	3	-	°C	-	Z
Delay Diff. main/return line	S	3	0	min	-	A
Flow rate	S	-	-	-	-	-
Flow rate max.	S	3	OFF	L/min	-	Z
Flow rate min.	S	3	1.0	L/min	-	Z
Setting	S	-	-	-	-	-
Remote mode	S	-	-	-	-	-
Address	S	3	OFF	-	-	Y
Protocol	S	3	1	-	-	A
Master alarm contact	E	3	autonom.	-	-	A
Transfer rate	E	4	4800	B/s	-	A
Transfer rate CAN Bus	E	4	250	k/s	-	A
Decimal flow rate CAN	S	4	ON	-	-	A
Parity	E	4	even	-	-	A
Data bit	E	4	8	-	-	A
Stop bit	E	4	1	-	-	A
Cycle serial recording	S	4	1	s	-	A
Delay emergency switch off	U	4	30	s	-	Y
Profibus node 1	S	4	5	-	-	A
Profibus node 1	S	4	6	-	-	A
Profibus node 1	S	4	7	-	-	A
Profibus node 1	S	4	8	-	-	A
Simulate DFM as device	E	3	OFF	-	-	Y
Switch clock	E	-	-	-	-	-
Time	E	3	MEZ	HH:MM	-	A
Date	E	3	MEZ	-	-	A
Status	E	3	inactive	-	-	A
Day	E	3	Mo-Fr	-	-	A
Switch mode	E	3	OFF	-	-	A
Switch time	E	3	06:00	HH:MM	-	A
Date/Time	S	-	-	-	-	-
Time	S	3	MEZ	HH:MM	-	A
Date	S	3	MEZ	-	-	A
Time zone	S	3	MEZ	-	-	A
Switch over summer/winter	S	3	autom.	-	-	A
Units	S	-	-	-	-	-
Temperature scale	S	2	°C	-	-	A

Flow rate scale	S	2	L/min	-	-	A
Recording USB	S	-	-	-	-	-
Cycle serial recording	S	4	1	-	-	A
Activate all values	S	3	OFF	-	-	Z
Deactivate all values	S	3	OFF	-	-	Z
Main line	S	3	ON	-	-	Z
Return line	S	3	ON	-	-	Z
Difference return/main line	S	3	ON	-	-	Z
Flow rate	S	3	ON	-	-	Z
Process power	S	3	ON	-	-	Z
Operating hours FM	S	3	OFF	-	-	Z
Operating hours USR	S	3	OFF	-	-	Z
Total number of alarms	S	3	OFF	-	-	Z
Switching cycles alarm relay	S	3	OFF	-	-	Z
Average main line	S	3	OFF	-	-	Z
Average return line	S	3	OFF	-	-	Z
Average flow	S	3	OFF	-	-	Z
Miscellaneous	E	-	-	-	-	-
Restart interlock	E	3	OFF	-	-	A
DFM recognition	U	4	integrated	-	-	A
Profile	S	-	-	-	-	-
User profile	S	3	Standard	-	-	A
Operating release	S	0	2	-	-	A
Code	S	3	1234	-	-	A
Language	S	0	-	-	-	A
Key press volume	S	3	5	-	-	A
Fault finding	S	-	-	-	-	-
Logbook Alarms	S	-	-	-	-	-
Save/Load	S	-	-	-	-	-
Start USB Software Update	E	4	OFF	-	-	A
Recording USB	S	3	OFF	-	-	Z
load configuration data	E	4	OFF	-	-	Y
Save Configuration data	S	4	OFF	-	-	Y
load Parameter data	E	4	OFF	-	-	Y, Z
Save Parameter data	S	4	OFF	-	-	Y, Z
Save Error and Operation data	S	4	OFF	-	-	Y
Save Serviceinfo	S	4	OFF	-	-	A

8 Operation of Series 5

8.1 Integrating flow meters into operation

There are two ways of integrating an ext. flow meter into the operation of a temperature control unit or an operating modular unit.

8.1.1 Integrated operation

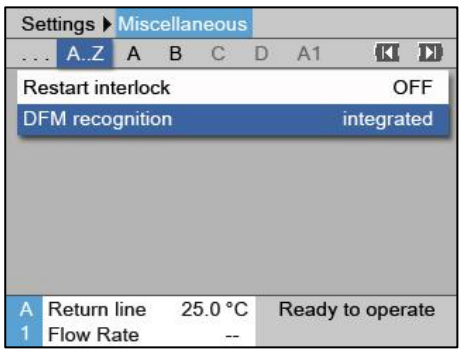


Fig. 31: DFM detection

You can integrate an external flow meter into the operation of a temperature control unit or an operating modular unit and assign the unit an address directly. The flow meter does not have its own basic display, hence you can only view the flow values under Display \ Actual value or via Display \ Selection to display these on the basic display. You can only assign a maximum of 2 flow meters with 4 circuits each to a temperature control unit.

To set DFM detection, proceed as follows:

1. Open menu page Setting \ Miscellaneous.
2. Set parameter DFM recognition to the value “integrated”.

8.1.2 For operation of modular units

Flow meters are integrated into the operation of a temperature control unit or an operating modular unit. The ext. flow meter is available as an independent modular unit and has its own basic display. You can display and monitor up to a maximum of 128 circuits.

To set DFM detection, proceed as follows:

1. Open menu page Setting \ Miscellaneous.
2. Set parameter DFM recognition to the value “modular”.

8.2 Registering new ext. flow meters (for integrated operation)

8.2.1 Integrated operation

Initialisation window

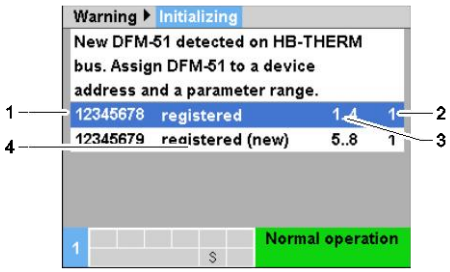


Fig. 32: Initialisation window

The initialisation window is displayed on the individual unit or operating module, as soon as a new external flow rate meter is identified.

Pos. No.	Display
1	Flow meter ID
2	Unit address (address of individual or modular unit)
3	Parameter range (Flow rate external 1..4 or 5..8)
4	Status of the external flow rate meter

Address setting and assignment

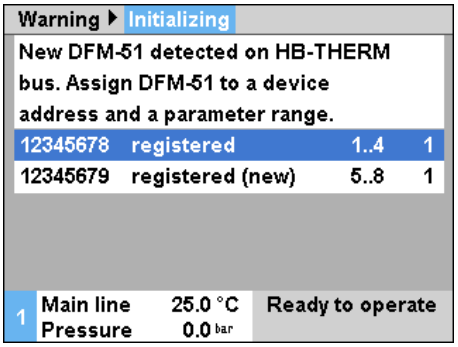


Fig. 33: Setting the address assignment

The external flow rate meter can be assigned a unit address and parameter range, for this, proceed as follows:

NOTICE!

Unassigned external flow meters are indicated with "--". An assignment is not absolutely necessary, however only the data from assigned external flow meters can be displayed.

1. . Set parameter range 1..4 or 5..8.
2. Set external flow meters to a unit by entering the unit address.
3. Acknowledge assignment with the OK key.

NOTICE!

An address can only be assigned once to parameter range 1..4 and 5..8. The menu page can not be exited as long as multiple settings are available.

Change assignment

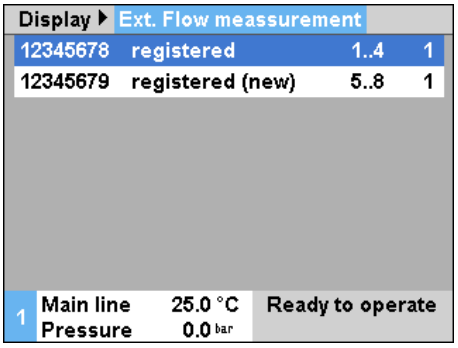


Fig. 34: External flow measurement

Proceed as follows in order to subsequently change the assignment and/or the parameter range:

1. Display menu page Display \ External flow measurement.
2. Set parameter range and unit address.
3. Acknowledge assignment with the OK key.

NOTICE!

With the selected external flow rate meter, the status indicator flashes green (fast).

8.2.2 Operation Modular

If a new external flow meter is detected, the initialisation window appears on the individual unit or operating modular unit.

Initialisation window

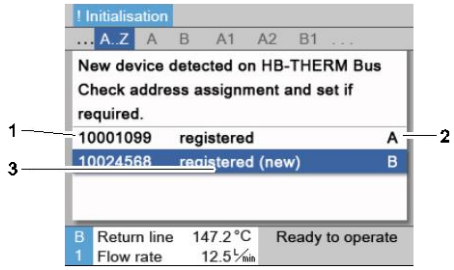


Fig. 35*: Initialisation*

Pos. no.	Display
1	Modular unit ID
2	DFM modular unit address
3	Status of the external flow meter

Assigning adresses

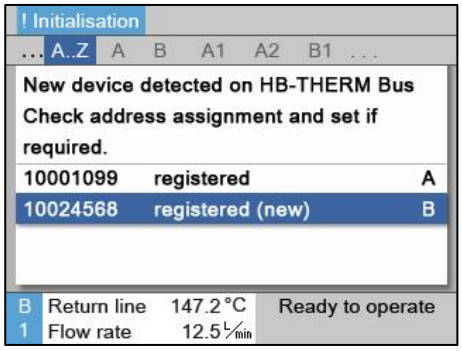


Fig. 36*: Setting an address*

The external flow meter needs to be assigned an A-Z address. Proceed as follows:

NOTICE!

A set address may only exist once in a network. The menu page cannot be exited if the address is repeatedly assigned.

1. Select modular unit ID.

NOTICE!

All the status lights in the circuits concerned of the selected ext. flow meter flash.

2. Set the DFM modular unit address.
3. Acknowledge assignment with the key OK.

Changing an address

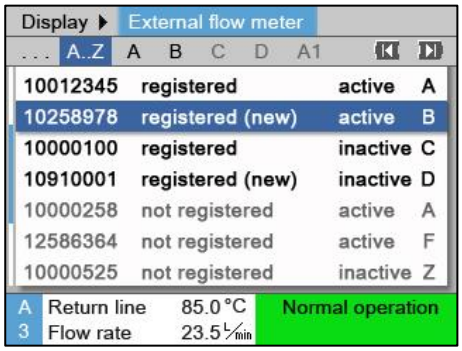


Fig. 37: Display \ ext. flow meter

Proceed as follows in order to change the address subsequently:

1. Open menu page Display \ External Flow meter.
2. Select “All” in the module bar.
3. Select DFM modular unit address and confirm with the key OK.
4. Set the address.
5. Acknowledge assignment with the key OK.

NOTICE!

All the status lights in the circuits concerned of the selected external flow meter flash.

Activating and deactivating

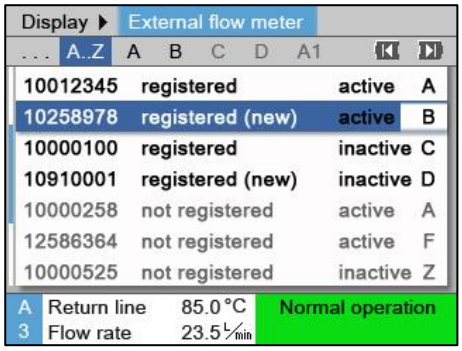


Fig. 38: Activating and deactivating a DFM modular unit

You can activate and deactivate external flow meters. If you deactivate an ext. flow meter, its actual values are not displayed and its limit values not monitored. To activate or deactivate an ext. flow meter, proceed as follows:

1. Open menu page Display \ External Flow meter.
2. Select “All” in the module bar.
3. Select the DFM modular unit address.
4. Set ext. flow meter to active or in active.
5. Confirm with the key OK.

8.3 Special features for operation of modular units

Parameter types:

When operating modular units the distinction is made between 3 types of parameter:

A Module independent (value adjustment only possible for "All")

Y Module dependent (value adjustment only possible for "All") Example A, B, etc.

Z Circuit dependent (value adjustment only possible for "All") Example A1, B7 etc.

NOTICE!

The parameters that can be set module independently or module dependently can be taken from the menu structure (→ page 47)

Module No. “All” or DFM modular unit selected

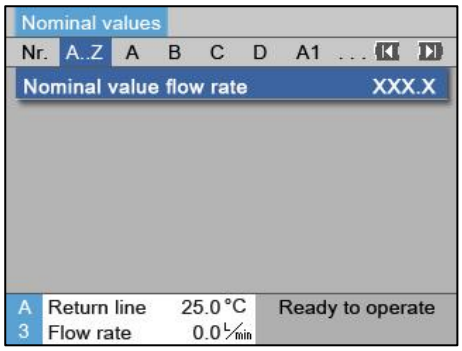


Fig. 39*: Nominal value Flow rate All*

If the modular unit no. “All” is selected, the value of a parameter is displayed with X (grey) if the setting is not identical for all modular units. Otherwise, the value is displayed normally in black. (→ example, Fig. *39*)

If a DFM modular unit is selected, the value of a parameter is displayed with X (grey) if the setting is not identical for all modular units.

Value adjustment for all modular units

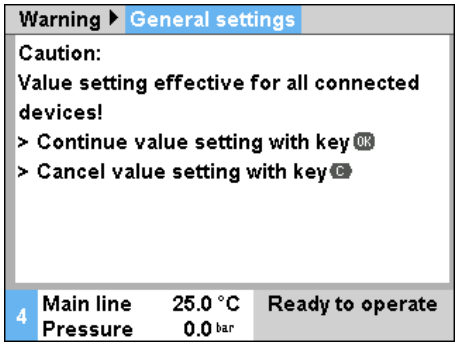


Fig. 40: Value adjustment All

Proceed as follows in order to make a setting for all detected DFM modular units simultaneously:

1. Select All with the key or module No.
2. Select the desired parameter and press the OK key.

   → Confirm warning text with the OK key.
3. Set the desired value and confirm with the OK key.

   → Value adjustment takes place simultaneously for all detected modular units.

Value adjustment for all circuits of a DFM modular unit

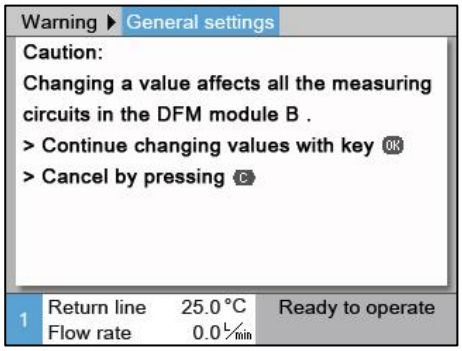


Fig. 41: Value adjustment for DFM modular unit B

Proceed as follows in order to make a setting for all circuits of a DFM modular units simultaneously:

1. Select All with the key or DFM modular unit.
2. Select the desired parameter and press the OK key.

   → Confirm warning text with the OK key.
3. Set the desired value and confirm with the OK key.

   → Value adjustment takes place simultaneously for all circuits.

8.4 Settings

8.4.1 Activate / deactivate individual measuring circuits

Individual measuring circuits can be activated or deactivated depending on their use. Deactivated circuits have no actual values displayed and have no control on limiting values.

Operation Modular

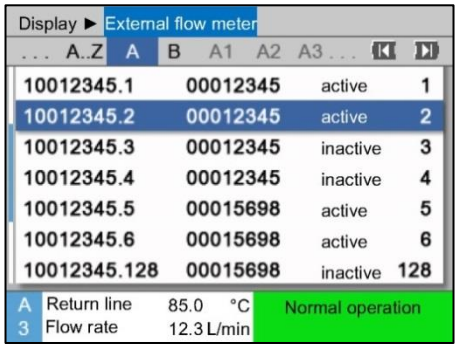


Fig. 42: Activate / deactivate measuring circuits

1. Select menu page Display \ ext. Flow rate meter.
2. Select the desired DFM module from the module bar
3. Select the desired circuit.

NOTICE!

The status indicator flashes at the selected circuit.

4. Put the circuit active or inactive.

NOTICE!

Inactive circuits are not displayed in the module bar and can not be selected.

Integrated operation

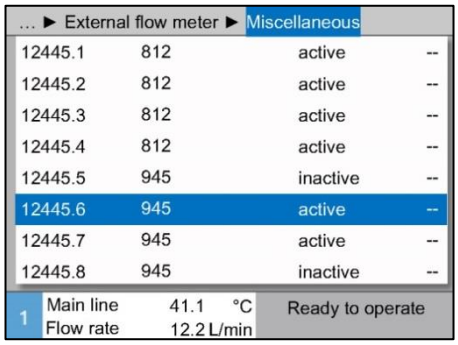


Fig. 43: Activate / deactivate measuring circuits

1. Select menu page Display \ ext. Flow rate meter \ Miscellaneous.
2. Select the desired circuit.
3. Put the circuit active or inactive.

8.4.2 Switching circuits in parallel (only for operation of modular units)

You can combine 2 circuits hydraulically. This allows you to measure circuits with higher flow rates, by distributing the total flow rate between more than one circuit. To configure the combined circuits accordingly, proceed as follows:

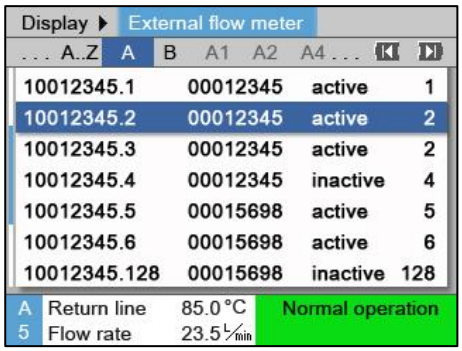


Fig. 44: Switching 2 circuits in parallel

1. Display menu page Display \ External flow meter to select flow meter.
2. Select the desired DFM modular unit in the module bar.
3. Give all the hydraulically combined circuits the exact same address.

8.5 Functions

8.5.1 Teaching (only for operation of modular units)

The Teaching function enables you to regulate each circuit manually using the fine control valve, to the Nominal values defined under Nominal value flow rate and to keep this within sight without operating the display.

NOTICE!

The Teaching function is only available for construction: autonom. and setting DFM recognition available on "modular operation".

Setting flow rate nominal value

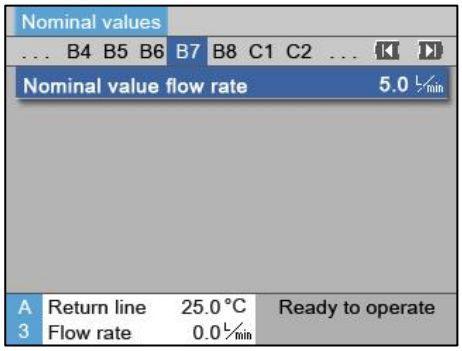


Fig. 45: Example of setting for B7 flow rate

You can set a Nominal value flow rate for each individual circuit. Proceed as follows in order to define a nominal value:

1. Open menu page Nominal values .
2. Select with the key or circuit.

NOTICE!

The status light for the selected circuit flashes.

3. Set the parameter Nominal value flow rate for a circuit.

Teaching function

You can activate the Teaching function for individual circuits or for DFM modular units. Proceed as follows in order to activate the Teaching function:

1. Open menu page Functions.
2. Select All with the key or selected DFM modular unit.
3. Select Teaching and activate with the key OK.
   The activated function is indicated with the ✔ symbol.
4. The status light of the activated circuits with active Teaching function flash according to the following table:

Condition	Flashing sequences of status light
Actual > nominal*	Status light is switched 1 s on and 0.5 s off.
Actual = nominal*	Status light is switched 1 s on and 1 s off.
Actual < nominal*	Status light is switched 0.5 s on and 1.5 s off.

* Nominal = Flow rate nominal value ± 0.5 l/min

NOTICE!
Changing the flow rate of a circuit also affects the flow rates in the other circuits of a DFM modular unit to change.
You are advised always to perform the Teaching function for all the circuits of a DFM modular unit at the same time.

5. Set the flow rate-rate per circuit with the fine control valve until the status light 1 s on and 1 s off has switched off.

→ The Teaching function stops automatically as soon as all circuits are in the tolerance band or all the status lights 1 s on and 1 s off have switched off.

Operation of Series 5

8.5.2 Display measured values

8.5.3 Integrated operation

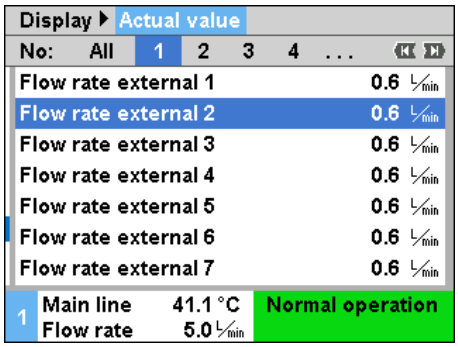


Fig. 46: Display / Actual values

To display the measured values of an ext. flow meter, proceed as follows:

1. Display menu page Display \ Actual values or press the "i" key on the ext. flow meter.

   Read off → Flow rate external 1 to 4 or 5 to 8.

   Read off → Return line external 1 to 4 or 5 to 8.

8.6 Remote mode

In remote mode the flow meter Flow-5 is being controlled by external signals and actual values are being transmitted.

There are 3 ways the flow meter Flow-5 can communicate with machine control. These are as follows:

- Simulate flow meter as device (→ page 63).
- Extended interface protocol with ext. flow rate 1–8 and ext. return line temperature 1–8 (→ page 64).
  Following machine manufacturers have implemented the extension:

Protocol	Manufacturer	Display ext. flow rate 1–8	Display ext. return line temp. 1–8
1	Arburg	Yes	No
1	Sumitomo Demag	Yes	Yes

- Engel flomo interface protocol (→ page 65).

NOTE!

For the pin assignment of the various interface cables → chapter 15 on page 88.

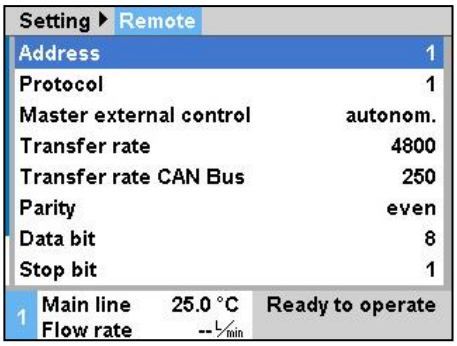


Fig. 47: Set address, protocol

The following settings must be made in order to communicate with an external controller:

1. Display the menu page Setting \ Remote operation .
2. Set parameter Address to the desired value.
3. Set parameter Protocol to the desired value.

NOTE!

A set address may only exist once in a network.

Operation of Series 5

Protocol	Used for
HB	Internal communication (only use when setting is operate unit as module)
0	Recording text
1	Arburg, Billion, Bühler, Dr. Boy, Ferromatik Milacron, KraussMaffei, Negri Bossi, Sumitomo Demag, Wittmann Battenfeld, Zhafir
2	Sumitomo Demag (CAN)
4	Engel, Haitian
5	Stork
9	EUROMAP 66 (CANopen; Netstal, etc.)
14	MODBUS (RTU-Mode)
15	Profibus-DP
16	SPI (9600 8-N-1; 1. Adr. =1)
17	Engel flomo
19	EUROMAP 82.1 (OPC UA)

Turn remote mode on or off

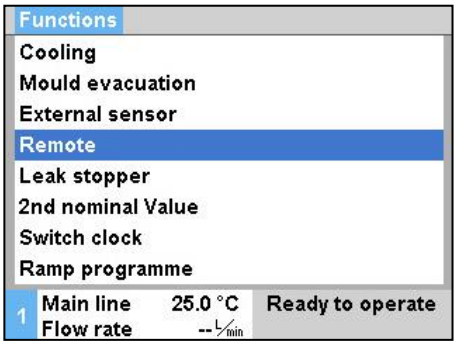


Fig. 48: Remote mode

Proceed as follows in order to switch the remote mode on and off:

1. Display menu page Functions .
2. Select the functionRemote and activate or deactivate with the OK key.

   The activated function is indicated with the ✔ symbol.

→ When the remote mode is switched on, the symbol appears on the basic display.

NOTE!

When the remote mode is active, all parameters and functions that are defined via the protocol are blocked at the unit.

8.6.1 Simulate flow rate meters as units

The Simulate DFM as device function enables the transfer of the flow rate values of Flow-5 without a software change of the injection moulding machine.

Each measuring circuit of the flow rate meter Flow-5 simulates an address of a temperature control unit. The flow rate of Flow-5 can be transferred through the simulated address of the unit.

Requirement

Following software version or higher is needed for the Simulate DFM as device function:

- Integrated operation: as of version SW51-1_1129
- Modular operation: as of version SW51-2_1549

Possible protocols

Following protocols support the function:

- Integrated operation Protocol 1, 4, 5 and 16
- Operation Modular Protocol 1, 2, 4, 5 and 16

Switch simulation on or off

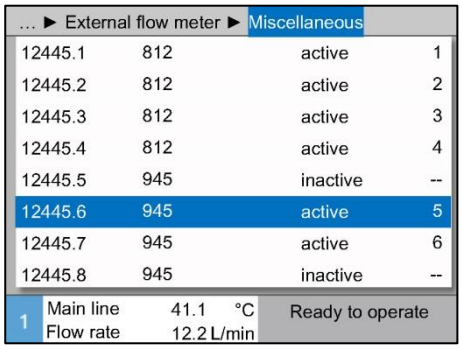


Fig. 49: Examples of automatic address attribution for Integrated operation.

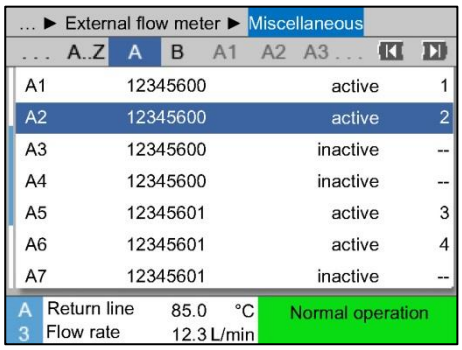


Fig. 50: Examples of automatic address attribution for Operation Modular.

To operate an external flow rate meter as module, proceed as follows:

1. Display the menu page Setting \ Remote operation.
2. Set the parameter Simulate DFM as device to „ON“ or „OFF“.

→ A simulated unit address is automatically attributed to each measuring circuit..

→ Inactive measuring circuits do not obtain an address.

→ With the menu page Display \ Ext. Flow rate meter \ Miscellaneous the automatic address attribution is displayed. (Integrated operation → Fig. 49, fourth column) (Operation modular → Fig. 50 fourth column)

NOTICE!

A manual attribution of the address in not possible.

8.6.2 Extended interface protocol

The extended interface protocol is enhanced with the actual values for Flow rate ext. 1..8 and Return line ext 1..8. In order to transfer the actual values of Flow rate ext. 1..8 and Return line ext 1..8 of Flow-5 to the machine, the relevant protocol needs to be enhanced also on the machine side.

NOTICE!

The necessary hard- and software for the injection moulding machine needs to be clarified with the machine manufacturer.

Requirement

Following software version or higher is needed to transfer Flow rate ext. 1-8 and Return line ext. 1-8:

- Integrated operation: as of version SW51-1_1120
- Modular operation: as of version SW51-2_1549

Possible protocols

Following protocols support the function:

- Protocol 1, 4, 5 and 16

Assignment of measuring circuits to interfaces

The assignment of measuring circuits on the interface corresponds to a physical address allocation.

Special features Remote (only for Operation modular)

The remote controlled operation differs from the temperature-control unit as follows:

- Switching on the flow rate meter through the ‘Regulate(normal operation)‘ command
- Switching off the flow rate meter through all the other commands
- The transferred nominal value is ignored
- The flow temperature of the flow rate meter is being transmitted as the actual temperature value
- The sum of all measured flows of active measuring circuits is being transmitted as the actual flow rate value
- The respective measured flow rate is being transmitted as actual value of the flow rate ext. 1-8
- The respective measured return line temperature is being transmitted as actual value of the Return line ext. 1-8
- "0 %" is always being transmitted as temperature control capacity (regulation ratio)
- The actual value "0" is being transmitted for the respective inactive measuring circuits (Ex. Flow rate 0 L/min).

8.6.3 Engel flomo interface protocol

Requirement

The following requirements are necessary for communication between the autonom. Flow-5 and the Engel machine:

- Software version SW51-2_1645 and higher
- Modular operation (→ page 50)
- Support Engel personnel

NOTICE!

Integration into the Engel machine can only be carried out by Engel personnel.
Contact the ENGEL representative in this regard (→ www.engelglobal.com).

Setting the flomo protocol

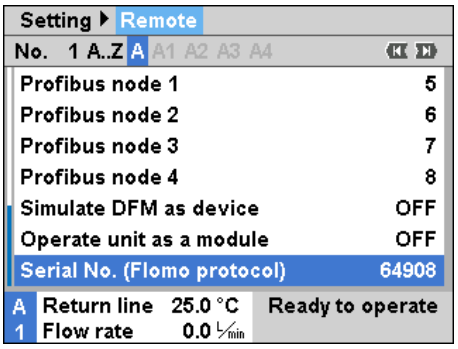


Fig. 51: Serial nr. (flomo protocol)

Proceed as follows to integrate a Flow-5 into the Engel machine using the flomo protocol:

1. Display the menu page Setting \ Remote.
2. Set parameter Protocol to the value "17".
3. Display menu page Functions.
4. Select the parameter Remote and activate with the OK key.

→ Flow-5 is switched on automatically
(key has no function).

→ Monitoring is deactivated automatically (Monitoring takes place via the Engel machine).

5. Carry out integration of Flow-5 into the Engel machine analogous to that for Engel-flomo.

→ Serial No. (flomo protocol) can be read on menu page Setting \ Remote.

NOTE!

For the pin assignment of the various interface cables → chapter 15.1.1 on page 90.

8.7 Process monitoring

8.7.1 Monitoring limit valuesMonitoring limit values (for integrated operation)

The actual values of an ext. flow meter can be monitored on an operating modular unit or individual unit. For the procedure, see the operating instructions for the individual unit or operating module.

8.7.2 Monitoring limit values (for operation of modular units)

Function

After each unit start-up, the limit values for process monitoring are automatically determined and set in the standard settings according to the set monitoring level.

NOTICE!

If the limit values have not been set, the operating mode indicator flashes green.

Cancelling monitoring

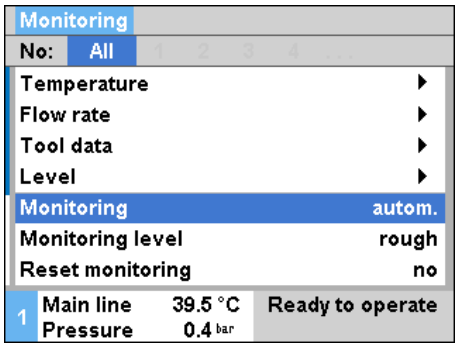


Fig. 52: Monitoring

If automatic limit value calculation is not desired, make the following setting:

1. Open menu page Monitoring.
2. Set parameter Monitoring to "manual" or "OFF".

NOTICE!

If monitoring is set to "OFF", the process will not be monitored. This can lead to unnecessary connections.

Reset monitoring

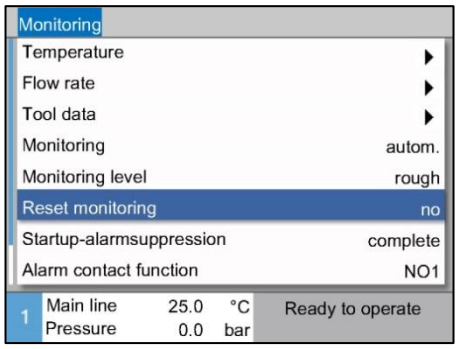


Fig. 53: Reset monitoring

Proceed as follows in order to automatically adjust the limit values during operation:

1. Open menu page Monitoring.
2. Set parameter Reset monitoring to "yes".
3. Press the key OK.

NOTICE!

Limit values that are set to "OFF" will not be adjusted.

Set monitoring level

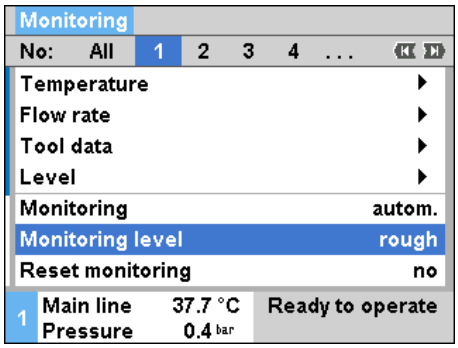


Fig. 54: Monitoring level

The tolerance range is determined with the parameter Monitoring level and can be adjusted as follows:

1. Open menu page Monitoring.
2. Set parameter Monitoring level to fine, medium, rough.

The limit values for temperature and flow rate are calculated according to the following table:

Designation	Monitoring level						Reference
	fine		medium		rough		
	Factor	min.	Factor	min.	Factor	min.	
Main line Y max.	1.01	+0.5 K	1.05	+2.5 K	1.1	+5 K	Main line Y temperature
Main line Y min.	0.99	-0.5 K	0.95	-2.5 K	0.9	-5 K	
Return line YZ max.	1.01	+0.5 K	1.05	+2.5 K	1.1	+5 K	Return line YZ temperature
Return line YZ min.	0.99	-0.5 K	0.95	-2.5 K	0.9	-5 K	
Difference main/return line	1.1	1.0 K	1.5	5.0 K	2.0	10.0 K	Difference main/return line
Flow rate YZ max.	1.2	0.8 L/min	1.4	1.3 L/min	1.7	2.5 L/min	Flow rate YZ max.
Flow rate YZ min.	0.8	0.5 L/min	0.6	0.5 L/min	0.3	0.5 L/min	

Y = DFM modular unit (e.g. A or B etc.), Z = circuit (e.g. 1 or 2 etc.)

8.7.3 Alarm contact

Function
(Additional equipment ZA)

The potential-free alarm transmits the condition of the flow meter to the machine controller. Each flow meter can activate the alarm via its own alarm contact or the alarm contact of another flow meter. You can set this via the Master alarm contact parameter.

Setting Master alarm contact

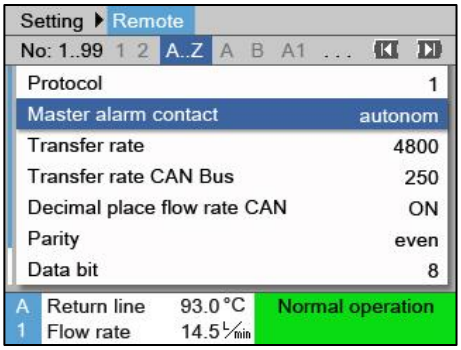


Fig. 55: Setting alarm contact master

Proceed as follows in order to set the assignment of the alarm contact:

1. Display the menu page Setting \ Remote operation.
2. Set parameter Master alarm contact to the desired value.
   “autonom” → Alarm is transmitted via its own alarm contact
   “A, B,…” → Alarm is transmitted via the alarm contact of the set flow meter (DFM modular unit)

NOTICE!

The setting for the Master alarm contact parameter applies to all connected flow meters.

9 Operation of Series 4

9.1.1 Display measured values

NOTICE!

On a Series 4 unit only the flow rate actual values are displayed.

Setting

In order to display the measured values of the external flow meter correctly, proceed as follows:

1. Display the menu page Setting \ Service \ Calibration \ Inputs-Outputs.
2. Set parameter Flow rate external 1..4 Factor to the value "600".
3. Set parameter Flow rate external 1..4 Filter to the value "1".

Display

In order to display the measured values of the external flow meter, proceed as follows:

1. Display the menu page Display \ Actual value.
   Read off → Flow rate external 1..4.

10 Maintenance

10.1 Safety

Personnel

- Maintenance tasks described here can be performed by the operator, unless otherwise indicated.
- Some maintenance tasks must only be carried out by qualified personnel or by the manufacturer exclusively. If this is required, it is pointed out separately in the description of the respective faults.
- As a rule, work on the electrical system must only be carried out by certified electricians.
- Work on the hydraulic system must only be carried out by qualified hydraulics technicians.

Personal protective equipment

Wear the following protective equipment for all maintenance/repair work:

- Safety goggles
- Protective gloves
- Safety shoes
- Protective clothing

NOTE!

For specific work, the warning notices in this chapter draw special attention to further protective equipment.

Special dangers

The following dangers exist:

- Danger of fatal injury by electric current.
- Risk of burns due to hot materials.
- Risk of burns due to hot surfaces.
- Danger of crushing due to rolling away or tipping.

Maintenance / repair work carried out improperly

WARNING!

Danger of injury due to maintenance / repair work carried out improperly!

Improper maintenance / repair work can lead to severe personal injury or material damage.

Therefore:

– Cool, depressurize and switch off the unit before maintenance, repair and cleaning work. Check that the unit is free of pressure.
– Before starting work, ensure that there is sufficient space for assembly.
– When assemblies are removed, observe correct assembly, re-assemble all fixing elements and observe screw torque specifications.

10.2 Maintenance schedule

Maintenance tasks that are required for optimum and trouble-free operation are described in the sections below.

If increased wear is detected at regular inspections then the required maintenance intervals must be shortened by the customer to correspond with the actual signs of wear.

Contact the HB-Therm distributors for questions on maintenance work (→ www.hb-therm.ch).

Interval	Assembly / Component	Maintenance work	Carried out by
quarterly or ~1000 hrs	Screw connectors	Check for firm seating and damage	Qualified personnel
		If necessary tighten or replace	
	Fixing screw (Construction: Unit attached)	Check screws for length and contractions	Qualified personnel
		HB-FMxxx-20 Replace if nominal dimension > 70 mm.	
		HB-FMxxx-20 with distance adapter set Replace if nominal dimension > 110 mm.	
		HB-FMxxx-Gx Replace if nominal dimension > 100 mm.	
	Seals	Check for damage	Qualified personnel
		Replace if necessary	
Every 1½ years or ~6000 hrs	Flow measurement	Check accuracy of flow measurement (→ page 73)	Qualified personnel
	Temperature measurement	Check accuracy of temperature measurement (→ page 75)	Qualified personnel

10.3 Maintenance tasks

10.3.1 Cleaning

CAUTION!
Risk of burns due to hot surfaces!

Contact with hot parts can cause burns.

Therefore:

– Wait for the unit to cool down, depressurise it and switch it off.

– Before carrying out any work, ensure that all parts have cooled down to ambient temperature.

Clean the flow measuring unit under the following conditions:

- Only clean the outer parts of the unit with a soft, moist cloth.
- Do not use any aggressive cleaning agents.

10.3.2 Flow measurement

Checking the flow measurement

- Must only be carried out by qualified personnel.

Necessary equipment

- Connection hoses between main and return lines with shut-off valves in all circuits.

Procedure

1. Switch on temperature control unit with ext. flow rate meter.
2. Adjust temperature to 40 °C (HB-FM160/180) resp. 80 °C (HB-FM200).
3. Only with construction: Unit attached/ stand-alone: Read off Flow rate external 1 to 4 or Flow rate external 5 to 8 on menu page Display \ Actual value.
4. only with construction: Autonom
   Read off Flow rate external n on menu page Display\ Actual value.
5. Close shut-off valves between main and return lines.

→ Flow rate external n has to show 0.0 L/min.

Maintenance

Calibrate flow measurement

If there is a deviation, the flow measurement must be calibrated.

1. Switch on temperature control unit with ext. flow rate meter.
2. Adjust temperature to 40 °C (HB-FM160/180) resp. 80 °C (HB-FM200).
3. Only with HB-FM160/180:
   Set parameter Pressure relief with unit OFF on menu page Setting \ Miscellaneous to the value "OFF".
4. Only with HB-FM200:
   Set parameter Safety cut-off temperature on menu page Nominal values to 90 °C.
5. Switch the unit off with the  key.
6. Only with operation integrated:
   Set Flow rate ext. 1..4 Calibration or Flow rate ext. 5..8 Calibration on menu page Service \ Calibration \ Flow rate external 1..4 or Service \ Calibration \ Flow rate external 5..8 to the value "ON".
7. Only with operation modular:
   Set Flow rate calibration on menu page Service \ Calibration \ Flow rate FM to the value "ON".

NOTICE!

The calibration has to be processed with pure water (without additives).

→ The flow rate is calibrated automatically. After calibration, check the flow measurement again

8. Set the Pressure relief with unit OFF or Safety cut-off temperature again to standard values after successful calibration.

If you have any questions, please contact your nearest HB-Therm representative (→ www.hb-therm.ch).

10.3.3 Temperature measurement

Checking the accuracy of temperature measurement

- Only to be carried out by a specialist.

Necessary equipment

- Temperature control unit Thermo-5.
- Main and return line connecting hoses with built-in temperature sensors (minimum inner diameter 8 mm, maximum length 1 m).
- Fully tested temperature measuring instrument released for reference measurement (calibrated to the temperature sensor used).
- Test protocol to document the measured values.

Procedure for temperature measurement

1. Connect main and return line connecting hoses between the main and return line connections on circuit.
2. Switch on temperature control unit with external flow meter.
3. Set nominal value to 40 °C.
4. Wait until the required temperature has been reached and remains constant.
5. Read Return line external Z resp. Return line Z on the individual unit or operating modular unit and compare it against the displayed temperature on the reference measuring instrument.

Z = Circuit

Calibrating temperature sensor

- With a deviation of <3 °C, the temperature measurement lies within the tolerance range.
- With a deviation of >3 °C, the temperature sensor in the flow meter must be checked. With larger linear errors, the individual temperature sensors can be calibrated on menu page Service \ Calibration \ Temperature.
  If you have any questions, please contact your nearest HB-Therm representative (→ www.hb-therm.ch).

10.4 Software update

10.4.1 Series 5

NOTICE!

The software on the modular unit Thermo-5, flow rate meter Flow-5 or switching unit Vario-5 is automatically brought to the same status as the software on the operating module Panel-5 or the singular unit Thermo-5.

To install a new application program on the connected products Thermo-5 temperature control unit, Flow-5 flow rate meter or Vario-5 switching unit, proceed as follows:

NOTICE!

The "gba03Usr.upd", "SW51-1_xxxx.upd" or "SW51-2_xxxx.upd" software must be in the root of the data carrier. It may not be stored in a folder.

NOTICE!

During the software update, the Thermo-5 unit or the Panel-5 control model and all products connected to them may not be switched off.

Necessary tools:

- USB data carrier with the current software

→ The latest software can be acquired from the HB-Therm representative (→ www.hb-therm.ch).

NOTICE!

Only USB data carriers in FAT32 format are supported.

Run software update

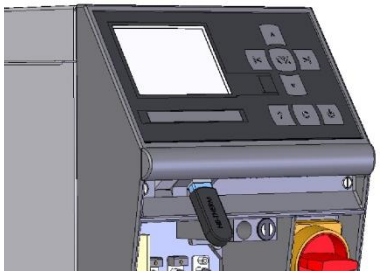


Fig. 56: Connect USB data carrier

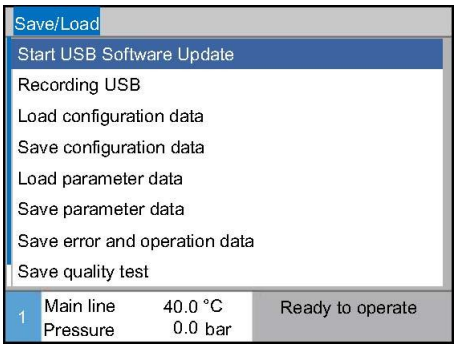


Fig. 57: Start USB software update

1. Switch on main switch.
2. Connect USB data carrier (Fig. 56).
3. Display menu page Profile.
4. Set parameter User profile to "Enhanced".
5. Display menu page Save/Load.
6. Select function Start USB Software Update and confirm with the OK key.

→ The data is loaded from the USB data carrier to the memory in the USR-51. Do not disconnect the USB connection.

→ Conclusion of data transfer is indicated on the display. The USB connection can now be disconnected.

→ The new software is written to the USR-51 flash. On completion, an automatic restart is initiated.

7. If required, the USB connection must be re-established to install further data.

→ If necessary, the new software is written to the connected GIF-51, DFM-51 or VFC-51 after the restart. This process can take a few minutes. On completion, another restart takes place.

→ The message *Ready to operate* appears on the display.

Checking the software version

1. In the basic display, press the ? key.

→ The current software version appears at the top right.

10.4.2 Series 4 or third-party product

NOTICE!

For a software update, you must return the flow meter unit to representatives at (→ www.hb-therm.ch).

11 Faults

The following chapter describes possible causes of malfunctions and what to do to remove them.

In the case of increased disturbances, reduce the maintenance intervals according to the actual burden.

In the case of faults, which can not be remedied by the following instructions, contact the HB-Therm representative (→ www.hb-therm.ch). For error diagnoses, service information can be saved to a USB data carrier and sent to the HB-Therm representative (→ Instruction Manual Thermo-5).

11.1 Safety

Personnel

- Tasks for troubleshooting described here can be performed by the operator, unless otherwise indicated.
- Some tasks must only be carried out by qualified personnel or by the manufacturer exclusively. If this is required, it is pointed out separately in the description of the respective faults.
- As a rule, work on the electrical system must only be carried out by certified electricians.
- Work on the hydraulic system must only be carried out by qualified hydraulics technicians.

Personal protective equipment

Wear the following protective equipment for all maintenance/repair work:

- Safety goggles
- Protective gloves
- Safety shoes
- Protective clothing

NOTE!

For specific work, the warning notices in this chapter draw special attention to further protective equipment.

Special dangers

The following dangers exist:

- Danger of fatal injury by electric current.
- Risk of burns due to hot materials.
- Risk of burns due to hot surfaces.
- Danger of crushing due to rolling away or tipping.

Faults

Maintenance / repair work carried out improperly

WARNING!

Danger of injury due to maintenance / repair work carried out improperly!

Improper maintenance / repair work can lead to severe personal injury or material damage.

Therefore:

– Before starting work, ensure that there is sufficient space for assembly.

– When assemblies are removed, observe correct assembly, re-assemble all fixing elements and observe screw torque specifications.

In case of faults:

The following general rules apply:

1. In the event of faults that pose immediate danger to man or machine, activate the emergency shutoff function immediately.
2. Determine cause of fault.
3. If elimination of the fault requires working in the danger zone, switch off unit and secure against being switched on again.
4. Immediately inform the person in charge at the equipment location of the fault.
5. Depending on the type of fault, eliminate the fault or have it eliminated by an authorized specialist.

NOTE!

The chapter "Troubleshooting" below provides information on who is authorised to eliminate the fault.

Faults

11.2 Troubleshooting chart

Fault	Possible cause	Rectification	Rectified by
No flow rate available or Flow rate too low	Filter in main or return line contaminated.	Clean filter in main or return line.	Operator
	Parameter Flow rate external .. min. or Flow rate internal min. set too low.	Increase Flow rate external .. min. or Flow rate internal min. parameter (when flow rate too low).	Operator
	Quick-release connectors closed or blocked.	Check quick-release connectors, clean or replace as necessary.	Qualified personnel
	Hose connection bent.	Rectify bends in hose connection.	Qualified personnel
	Consumer blocked.	Check consumer, clean as necessary.	Qualified personnel
Flow too high	Parameter Flow rate external .. max. or Flow rate internal max. set too low	Increase parameter Flow rate external .. max. or Flow rate internal max. (if flow too low)	Operator
Diff. main line - return line to large	Low flow rate	Clean filter in main or return line.	Operator
	Parameter Diff. return/main line ext. 1..8 or. Difference return/main line set too low.	Adjust limit value	Operator
Temperature of main or return line too high	Parameter main max. or return line max. set too low	Increase parameter main max. or return line max.	Operator
	Regulation parameter not optimally set	Optimise regulation parameter	Qualified personnel
Temperature of main or return line too low	Parameter main min. or return line min. set too low	Increase parameter main min. or return line min.	Operator
	Regulation parameter not optimally set	Optimise regulation parameter	Qualified personnel
Communication disrupted	Transmission error or control cable defective	Check for possible interference factors or replace control cable	Certified electrician

12 Disposal

12.1 Safety

Personnel

- Disposal must only be carried out by qualified personnel.
- Work on the electrical system must only be carried out by certified electricians.
- Work on the hydraulic system must only be carried out by qualified hydraulics technicians.

12.2 Disposal of materials

Once the end of the useful life has been reached, the unit must be disposed of in an environmentally compatible manner.

As long as no return or disposal agreement was made, dismantled constituent parts are to be recycled:

- Metals should be scrapped.
- Plastic elements should be passed on for recycling.
- Other materials should be sorted and disposed of according to material composition.

ATTENTION!
Environmental pollution on wrong disposal!

Electrical waste, electronic components, grease and other additives are subject to the treatment of special refuse and may only be disposed of by approved specialised companies.

The local authority or specialised disposal companies can give information on environmentally compatible disposal.

13 Spare parts

WARNING!
Safety risk due to wrong spare parts!

Wrong or defective spare parts can impair safety as well as leading to damage, malfunctions or total breakdown.

Therefore:

– Only use original spare parts from the manufacturer.

Purchase spare parts through the HB-Therm representative (→ www.hb-therm.ch).

The spare parts list can be found in Appendix B of this operating manual.

On use of non-approved spare parts, any guarantee or service claims are forfeited.

13.1 Ordering spare parts

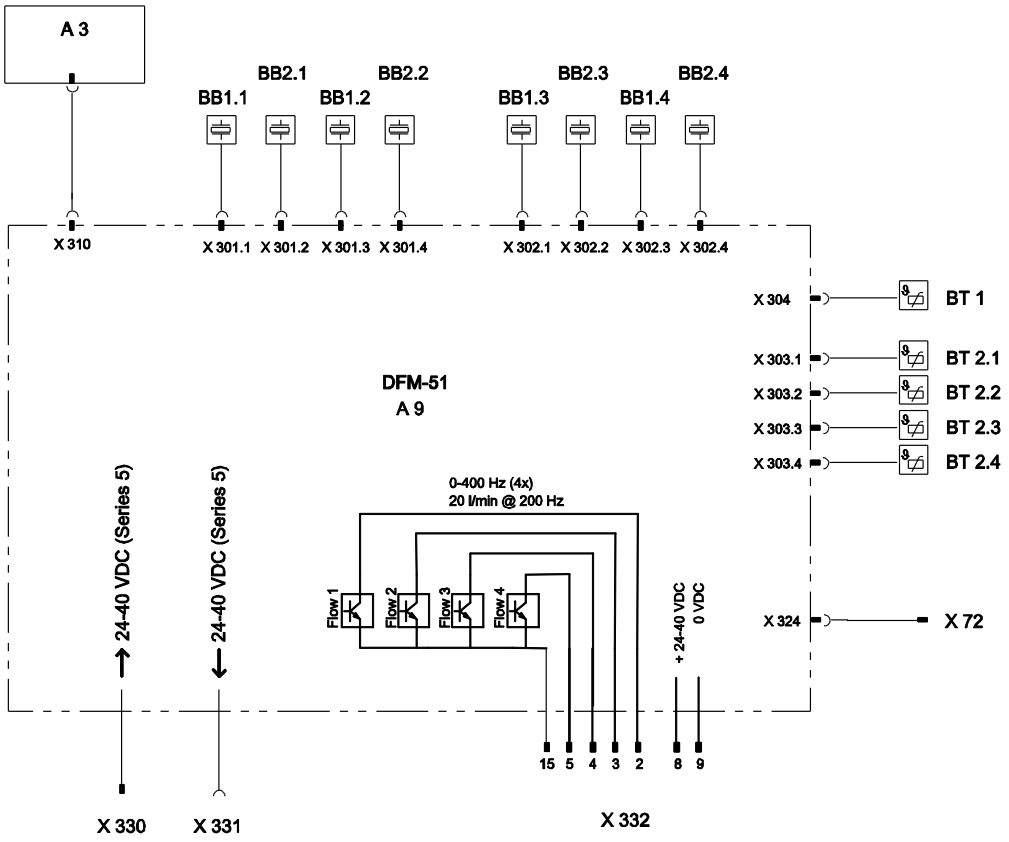
When ordering spare parts, always indicate:

- The designation and ID No. of the spare part.
- Amount and unit.

14 Technical information

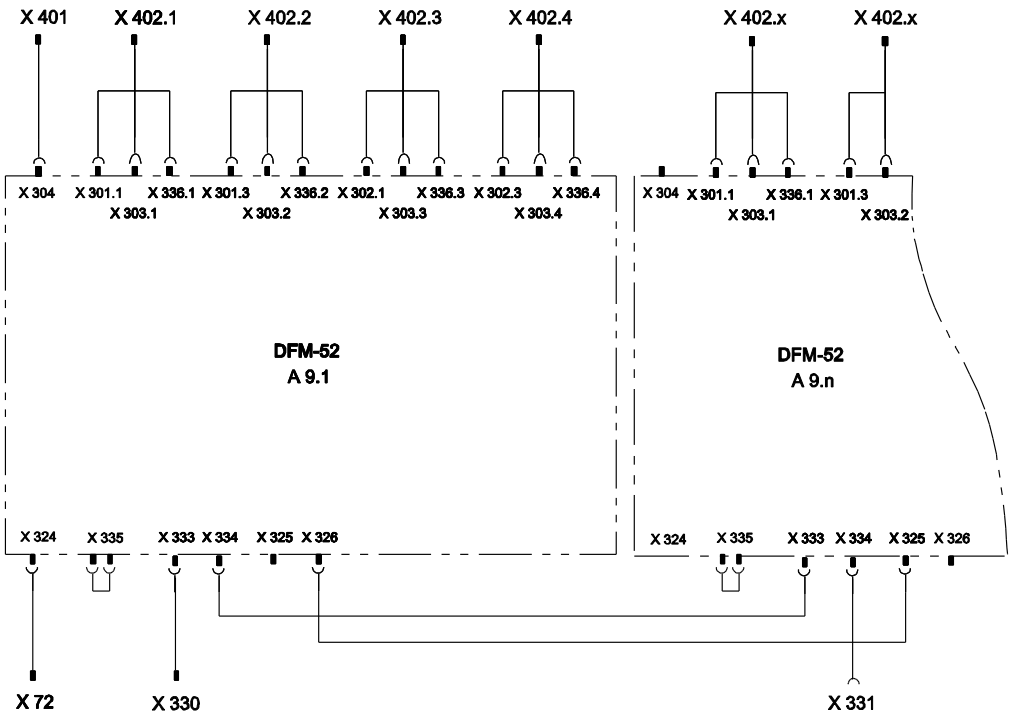
14.1 Electrical circuit diagram

14.1.1 Construction: Device mounting / Stand-alone

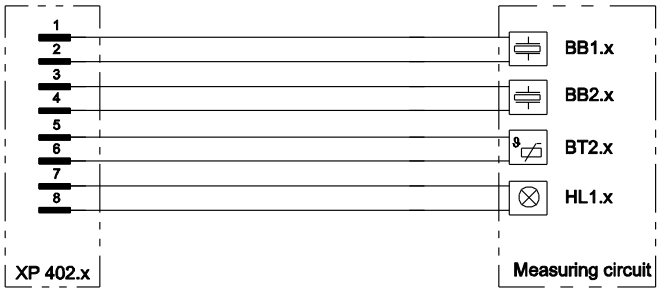


Technical information

14.1.2 Construction: Autonom.



Circuit

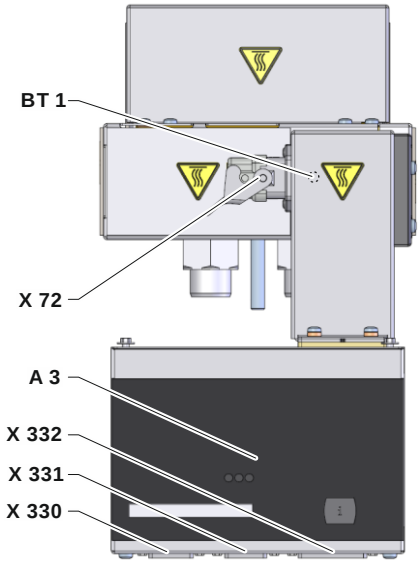


x.. Circuits (1 to 16)

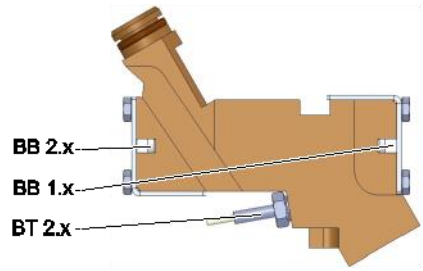
14.2 Item location

14.2.1 Construction: Device mounting / Stand-alone

View from above



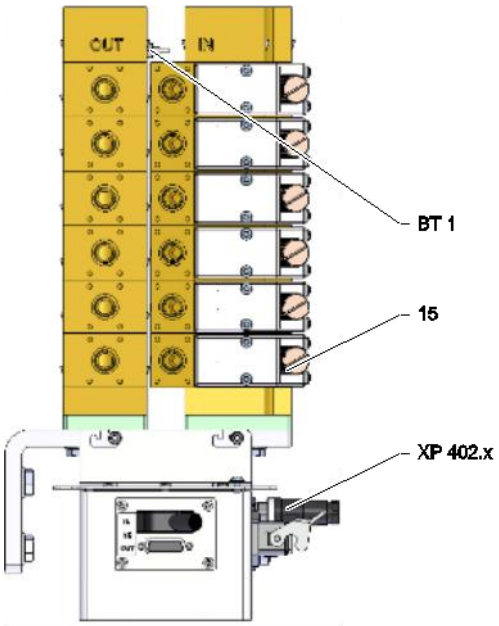
Circuit view



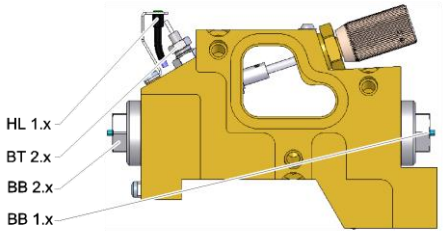
Technical information

14.2.2 Construction: Autonom.

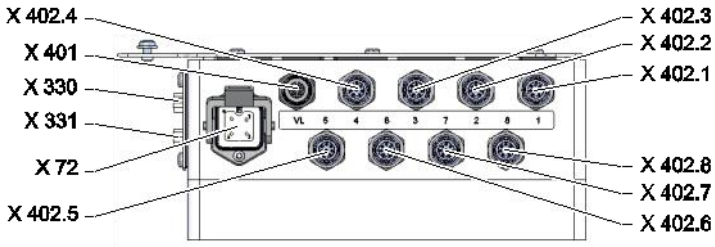
Front view



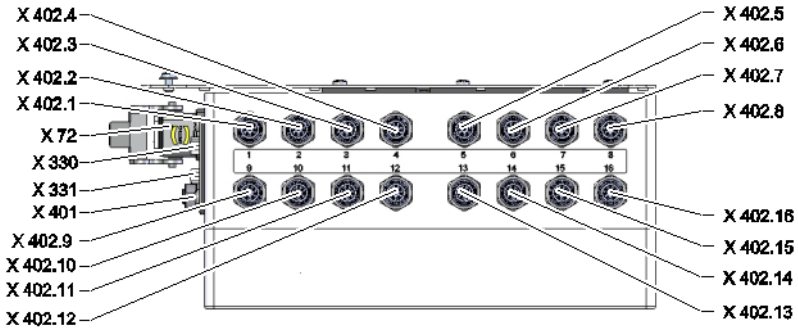
Circuit view



View of evaluation unit for up to 8 circuits



View of evaluation unit for up to 16 circuits



14.3 Legend

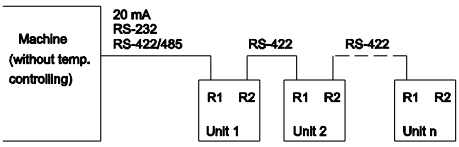
KZ	Designation	only with version
15	Fine control valve	Construction: Autonom.
A 3	Keyboard	
A 9.x	Flow measuring board DFM	
BB 1.x	Sound transducer 1 circuit x	
BB 2.x	Sound transducer 2 circuit x	
BT 1	Heat sensor main line	
BT 2.x	Temperature sensor in return line circuit x	
HL 1.x	Circuit status light	Construction: Autonom.
X 72	Connector alarm contact	ZA
X 330	Connector HB IN	
X 331	Connector HB OUT	
X 332	Connector frequency output / power input (not series 5)	
X 401	Main line temperature sensor socket	Construction: Autonom.
X 402.x	Circuit socket x	Construction: Autonom.

x.. Circuits (1 to 16)

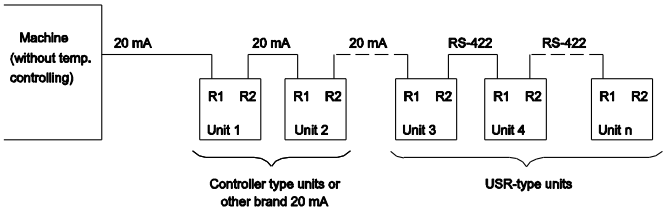
15 Interface cables

15.1 Serial data interfaces

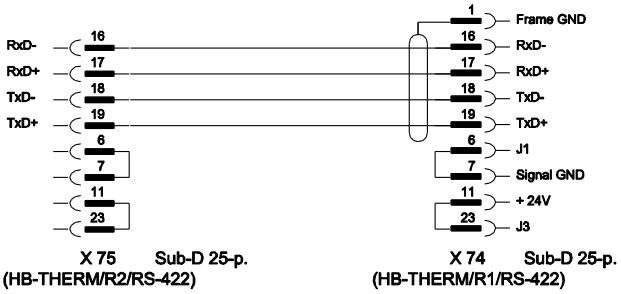
Operation with USR type units



Operation with USR and controller type units



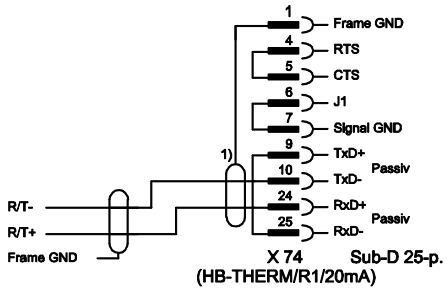
Connection cable RS-422 (between 2 USR units)



Interface cables

20 mA (current loop)

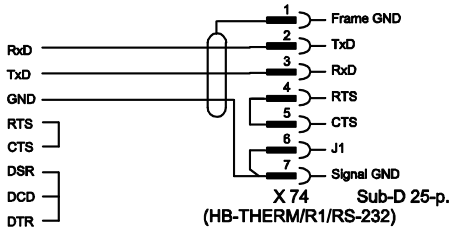
KM 1 Sub D-25	Ferromatik Sub D-25	ENGEL Sub D-25	DEMAG Sub D-25	Battenfeld Sub D-9	ARBURG 2 Sub D-9	ARBURG Audio 3-p.
10	19	10	13	3	3	3
24	13	24	19	2	2	1
-	-	-	1	-	-	-



1) not applicable if shield exists on machine side

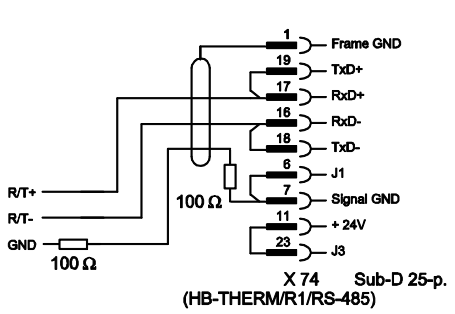
RS-232

KM Sub D-25	Ferromatik Sub D-25	Engel Sub D-25	Dr. Boy B Sub D-9	PC Sub D-25	PC Sub D-9
3	3	2	3	3	2
2	2	3	2	2	3
7	7	7	5	7	5
4	4	-	7	4	7
5	5	-	8	5	8
-	-	-	-	6	6
-	-	-	-	8	1
-	-	-	-	20	4



RS-485

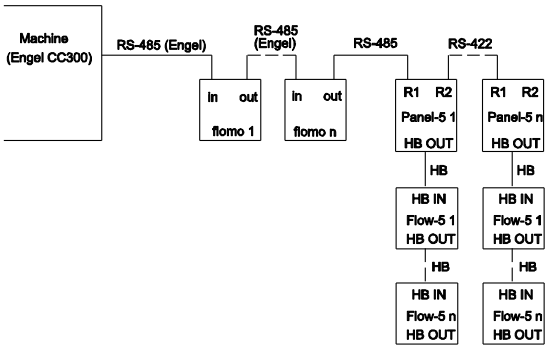
Haitian / Zhafir Sub D-9	Dr. Boy Sub D-9	Böhler Sub D-9	Ferromatik Sub D-25	Engel Sub D-9	EUROMAP HAN 3A	NEGRI BOSSI HAN 3A	FANUC SPI
3	3	3	2	9	1	1	+
8	9	8	6	4	2	2	-
5	5	5	7	8	3	3	GND



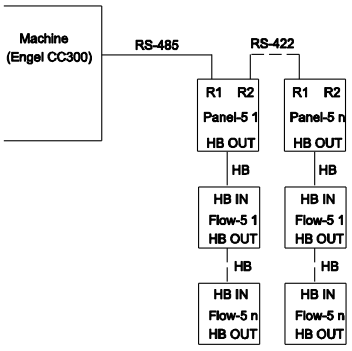
Interface cables

15.1.1 Serial data interfaces Engel flomo

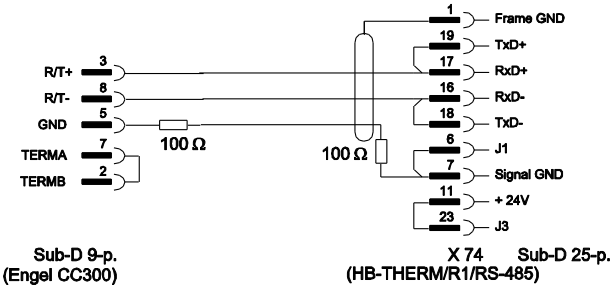
Operation Flow-5 and flomo (through Engel flomo protocol)



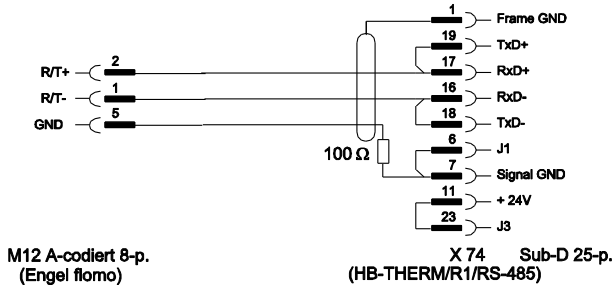
Operation Flow-5 (through Engel flomo protocol)



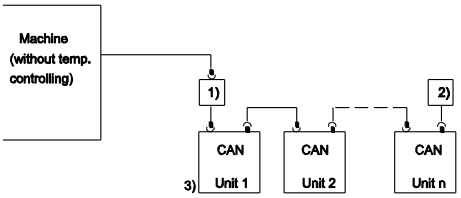
Connection cable Engel machine RS-485 for Panel-5



Connection cable Engel flomo RS-485 for Panel-5

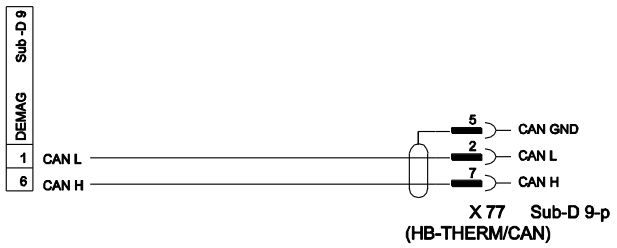


15.2 CAN-Bus interfaces

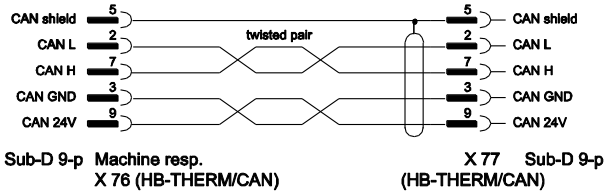


No.	Description		
1)	Adapter u/ID No. 22590 (only for DEMAG machine)		
2)	Terminator 120 Ω (not for older DEMAG machines with integrated connector)		
3)	Address	DEMAG	Unit 1 with address 13, unit 2 with address 14, etc.
		Netstal	Unit 1 with address 31, unit 2 with address 32, etc.

Adapter

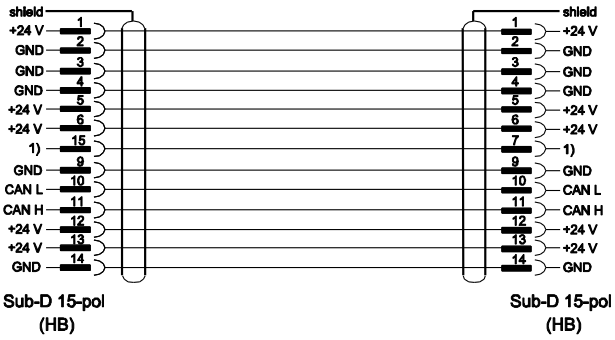


Connection cable CAN



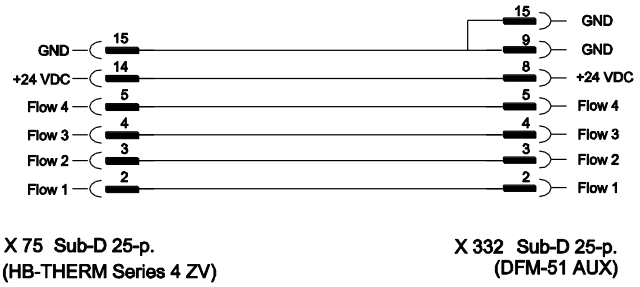
Interface cables

15.3 Interface HB

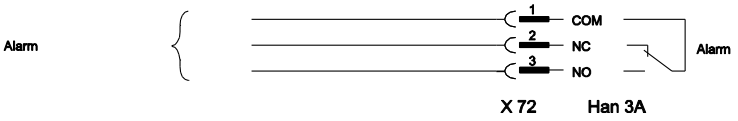


1) An automatic terminal resistance is connected over this contact.

15.4 Flow rate 5 connection for Series 4



15.5 Alarm contact



Function		Contact	Load
Alarm contact	---	---	250 VDC, 4 A