HYGROPHIL® F 5673

Series A

Operating manual

Software version 1.8.x

387896MDHEN

Contents

Contents

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Author:	G. Rothe	
Translation	E. Bauernfeind	

1 System description

1.1 Measurement principle, Function and applications

HYGROPHIL® F 5673 is a high-quality, microprocessor-controlled fibre-optic hygrometer for measuring the moisture or trace humidity at low dew-point temperatures in gases and liquids.

HYGROPHIL® F 5673 works in multi-channel operation with a temperature-compensated fibre-optic sensor developed especially for measuring the moisture content in gas mixtures and liquids.

Measurement of water dew point temperature (Gas humidity)

The water dew point is measured with the HYGROPHIL® F and sensor type L166x.
The moisture sensor, type L166x, consists of a robust multi-layer of optically high and low refractive layers connected to 2 fibre-optical cables.
Due to a special thermal coating technique, pores with the diameter of a water molecule are generated on the layer.
Due to the moisture equilibrium content, water is deposited in the layer and changes the refractive index of the irradiating light (air: 1,00/water 1,33).
Within the layer system this results in a wavelength shift in proportion to the moisture prevailing in the medium.
This shift is measured by the evaluation unit and assigned to a dew point.
The L166x probe makes measurements which are temperature compensated (by the integrated Pt100).
In short, the HYGROPHIL® F 5673 works in conjunction with a combination sensor which fibre-optically determines the moisture content and measures the temperature in the medium with a Pt100.
Apart from the extremely robust construction of the sensor, it is above all else, the measurement technique which offers several decisive advantages.

Some of the advantages of this patented measuring method are as follows:

● High measuring confidence, including precision, reproducibility and low hysteresis.

● Long-term stability of the sensor (no drift!)

● Measurement is possible on the high-pressure side (pressure dew point!)

● Application in explosive areas (zone 0 and higher)

● Simple installation and upgrading (Swagelok, Parker, …)

The L166x was developed especially for natural gas applications and is now applied in trace moisture measurement for a large number of different gases and liquids.
Due to the usage of high-quality materials, the sensor is extremely robust and resistant to most media.

1.2   Declaration of Conformity

BARTEC

Erklärung der EG-Konformität
Declaration of EC-Conformity
Attestation de conformité CE

BARTEC GmbH
Schulstraße 30
94239 Gotteszell

Wir	We	Nous
BARTEC GmbH **Werk Gotteszell**		
erklären in alleiniger Verantwortung, dass das Produkt	declare under our sole responsibility that the product	attestons sous notre seule responsabilité que le produit
HYGROPHIL F **Typ 5673-xx**	**HYGROPHIL F** **Type 5673-xx**	**HYGROPHIL F** **Type 5673-xx**
auf das sich diese Erklärung bezieht den Bestimmungen der folgenden Richtlinien entspricht	to which this declaration relates is in accordance with the provision of the following directives	se référant à cette attestation correspond aux dispositions des directives suivantes
2004/108/EG **2006/95/EG** **94/9/EG**	**2004/108/EC** **2006/95/EC** **94/9/EC**	**2004/108/CE** **2006/95/CE** **94/9/CE**
und mit folgenden Normen oder normativen Dokumenten übereinstimmt	and is in conformity with the following standards or other normative documents	et est conforme aux normes ou documents normatifs cidessous

$C\epsilon$

EN 55011:2007 + A2:2007 Group1 Class A
EN 61000-3-2:2006
EN 61000-3-3:1995 + A1:2001 + A2:2005
EN 61000-6-2:2005
EN 61010-1:2001
EN 60079-0:2004
EN 60079-11:2007

Kennzeichnung	Marking	Marquage
$C\epsilon$ 0123	⟨Ex⟩ II (1) G	[Ex ia] IIC PTB 04 ATEX 2076 0102

Gotteszell, 26.08.2009

Alois Süß
Technische Leitung

BARTEC BENKE

Erklärung der EG-Konformität	**BARTEC BENKE GmbH**	
Declaration of EC-Conformity	Schulstraße 30	
Attestation de conformité CE	94239 Gotteszell	

Wir	We	Nous
BARTEC GmbH **Werk Gotteszell**		
erklären in alleiniger Verantwortung, dass das Produkt	declare under our sole responsibility that the product	attestons sous notre seule responsabilité que le produit
Feuchtemesssonde Typ L166x	**Humidity measuring probe Type L166x**	**Sonde de humidité Type L166x**
auf das sich diese Erklärung bezieht den Bestimmungen der folgenden Richtlinien entspricht	to which this declaration relates is in accordance with the provision of the following directives	se référant à cette attestation correspond aux dispositions des directives sulvantes
2004/108/EG **94/9/EG**	**2004/108/EC** **94/9/EC**	**2004/108/CE** **94/9/CE**
und mit folgenden Normen oder normativen Dokumenten übereinstimmt	and is in conformity with the following standards or other normative documents	et est conforme aux normes ou documents normatifs cidessous

CE

EN 61000-6-2:2005
EN 61000-6-4:2007
EN 60079-0:2009
EN 60079-11:2007
EN 60079-26:2007

Kennzeichnung	Marking	Marquage
CE 0123	⟨Ex⟩ II 1/2 G	Ex ia IIC T6 Ga/Gb PTB 04 ATEX 2075 0102

Gotteszell, 14.09.2010

Alois Süß
Technische Leitung

1.3 Layout of the humidity measurement system

The measurement system consists of an evaluation unit and up to three humidity sensors.

The evaluation unit is designed as a 19"rack which can take several plug-in units. The evaluation unit can also be installed as a desktop device.

The humidity sensor consists of a sensor layer and an integrated temperature sensor, the fibre-optic cable and the plug connector, which also contains the sensor´s adjustment data.

The humidity sensor is available in three standard dimensions: 36 mm, 100 mm and 225 mm. Sensors with length of 407 mm and 458 mm are available on request.

1.3.1 Operator controls and display elements

All operator controls and display elements are at the front side of the evaluation unit. The device is not equipped with a mains switch. If required, you have to disconnect the device from the mains supply (mains plug). If operated as a desktop device, the two front feet of the evaluation unit can be swivelled out for easier operation and a better viewing angle.
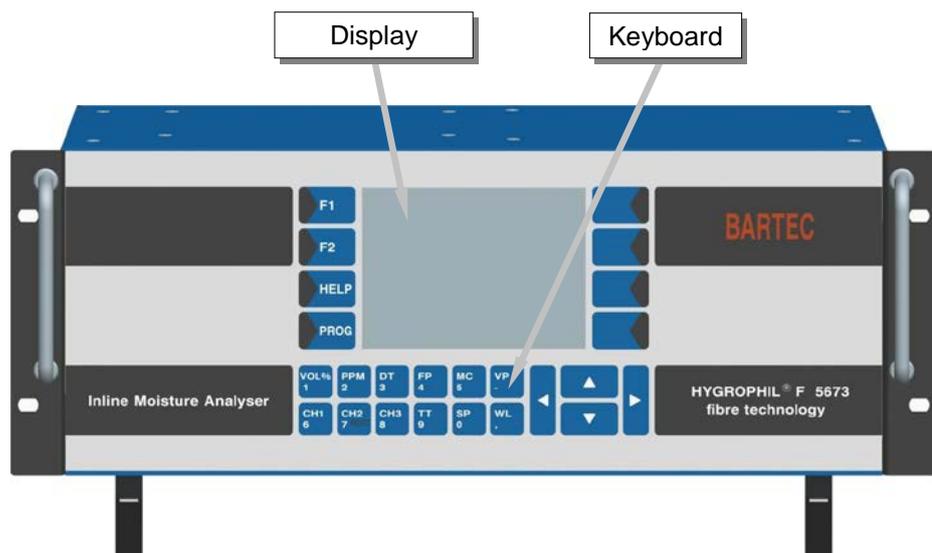
HYGROPHIL® F 5673, front view

1.3.1.1 Keyboard

The device is operated via touch-sensitive keys on the front side of the device (numeric and measurement variable keys) and via certain key functions of the touch-screen. All keys are touch-sensitive, i.e. you don't need to press them, only touch them.

Key functions

VOL%
1 Indication of the water vapour content [Vol%], optional relative humidity [RH] (see section 4.3.1.3)

PPM
2 Indication of the water vapour content in parts per million volume or in parts per million weight

DT
3 Indication of the Dewpoint Temperature

FP
4 Indication of the Frost Point Temperature

MC
5 Indication of the Moisture Content [mg/m^3] or [lb/MMscF]

VP
- Indication of the water Vapour Pressure

(1)

CH1
6

CH2
7 Selection of the measurement channel (see section 4.3.1.2)

CH3
8

TT
9 Indication of the temperature at the measuring point (True Temperature)

SP
0 Indication of the pressure at the measuring point (Sample Pressure)

WL
, Indication of the Wave Length

(1) In the entering mode or programming mode, these keys serve to enter numerical values.

(2)

F1 Trigger the sensor equalizing (see section 4.2)
Call up the history setup (see section 4.3.5.1)

F2 Switch from online graphic mode to history graphic mode (see section 4.3)

(2) If these two keys are not labelled with F1 and F2 at your measuring device, this does not mean its functional range is restricted. The function of the keys is available anyhow.

HELP Display of warnings and error messages

PROG Call up the programming mode (see section 5.2)
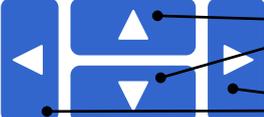
Selection keys (see section 5.3),
Switch between the display modes (see section 4.3)

Change the cursor position in entry fields (see section 5.4.3)

The four keys to the right of the display are not labelled. Depending on the operating status of the measurement system, different functions are assigned to them. The current function is marked by a symbol next to the key in the display (for the meaning of the symbols see section 5.1).

Example
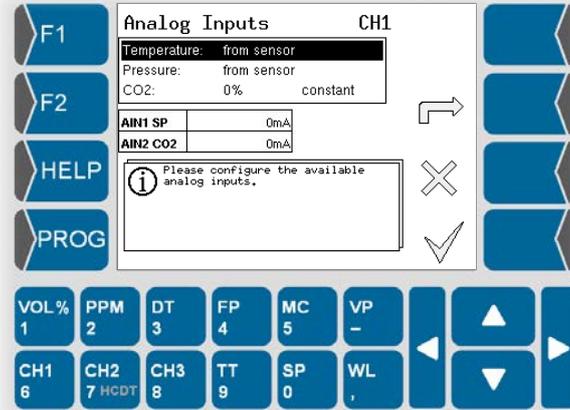
In several operating situations is the current function of the $\boxed{F1}$ and $\boxed{F2}$ keys as well as the four keys to the right of the display only displayed when touching one of these keys.

Example
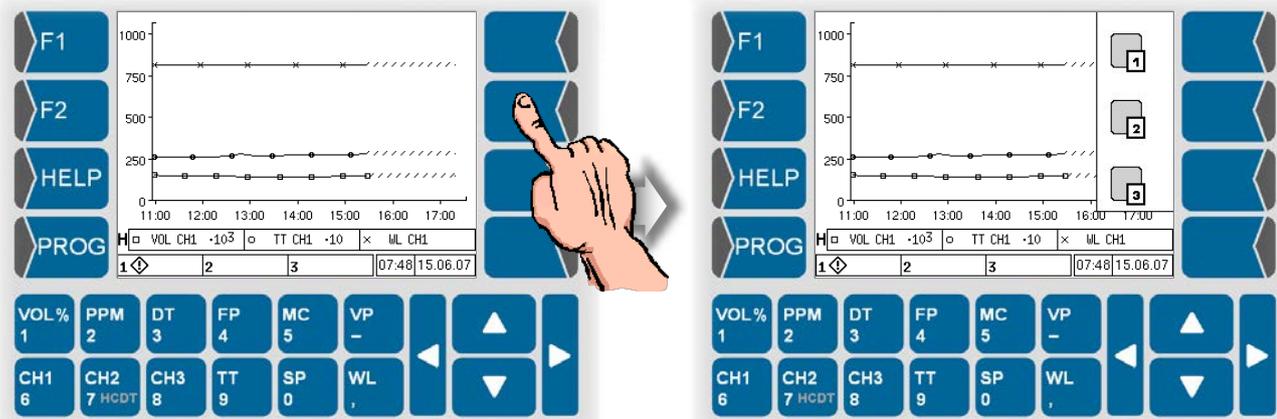
When the function is displayed you can start the function by touching this key.

1.3.1.2   **Display**

A graphic display screen designed as a touch-screen is used for display purposes.

Some functions are operated by means of key functions located on the display screen in dependence on the situation.

Example

1.3.2   Interfaces

Channel boards Analog/Digital I/O Ex

Channel 1   Channel 2   Channel 3

Relay module

Polychromator

Power supply module

CPU module

Interface module

Temperature sensor (PT100)

Pressure sensor (4...20 mA)

CO_2-sensor (4...20 mA)

3x Current output

Current output Ex i

COM

USB

Relay outputs see section 1.4.7

Earthing Grounding

Polychromator module 5673–302

WARNING: Do not disconnect while circuit is alive, unless area is known to be nonhazardous.

Power supply modules 5673–108 / 5673–109

POWER OUT 24 V, 500 mA

POWER IN ⎓DC 10–36V, 60W

~AC 100–240V 50Hz/60Hz, 110VA

Interface I/O Ex i 5673–114

free

CPU module incl. Ethernet 5673–113

Interface module 5673–110

Relay-Interface module 5673–115

Notes:

1. Maximum voltage in control room (nonhazardous) area shall not exceed 250V
2. Substitution of components may impair safety
3. Install according to CEC in Canada and NEC in US
4. Each intrinsically safe circuit is galvanically isolated
5. Intrinsically safe outputs shall be connected to certified intrinsically safe devices with entity parameters meeting the equations Vmax > Voc, Imax > Isc, Pmax > Po, Li+Lcable < Lo, Ci+Ccable < Ca
6. Each intrinsically safe circuit can be individually shielded at the adjacent terminals 205, 208, 211, 215, 218, 222, 311, S designated "shield". They are galvanically isolated from chassis and from intrinsic safe signal circuits
7. Indoor or control room use only, or installation in a suitable enclosure
8. WARNING: Do not disconnect non–I.S circuits while they are alive, unless area is known to be nonhazardous
9. Cross reference for EU (ATEX) entity parameters nomenclature: Uo = Voc, Io = Isc, Po = Po, Co = Ca, Lo = La, Ui = Vmax, Ii = Imax, Pi = Pmax, Ci = Ci, Li = Li
10. Ca (Co) and La (Lo) entity parameters have to be considered to be present at the same time, if the I.S. circuit is applied to an Ex ia category–1–circuit according to directive 94/9/EC (ATEX)

Revision history:

Revision c: Initial issue
Revision d: Changes due to ATEX issues
Revision e: Amendment page 3
Revision f: Substitution Power supplies 5673–108/109 and interface module 5673–110 synchronization with ATEX entity parameters
Revision g: Addendum of modules 5673–113, 5673–114, 5673–115

BARTEC GmbH

Control drawing Hygrophil F

CAD–Nr.: bs\bs567301

gez. 04.10.06 Sch.
gepr. Fs 5673
Fs 5673 Bl.1 v. 3

a	02.11.06	Sch.		
b	29.11.06	Sch.		
c	01.12.06	Sch.		
d	03.04.07	Sch.	page 2	
e	16.10.07	Sch.	page 3	
f	18.11.08		page 2+3	
g	02.12.08		page 2+4	

5673-110 (Interface module)

Design.	Signal	Design.	Signal
401	OUT 1+	404	OUT 2+
402	OUT 1–	405	OUT 2–
403	Shield	406	Shield
407	OUT 3+	410	free
408	OUT 3–	411	free
409	Shield	412	free
413	+24V	417	+24V
414	A1	418	A2
415	B1	419	B2
416	GND	420	GND
421	+24V	424	GND
422	RxD 1	425	TxD 1
423	CTS 1	426	RTS 1
427	+24V	430	GND
428	RxD 2	431	TxD 2
429	CTS 2	432	RTS 2
433	+5V	436	GND
434	PB_A	437	Shield
435	PB_B	438	Shield
USB 1		USB 2	

Analog Outputs 0...20mA
RS485, +24V, max 50mA
RS232, +24V, max 50mA
Profibus, +5V max 50mA
USB for servicing only

Modbus RS485, +24V, max 50mA

Terminals 206, 208, 209, 210
$V_{oc} = 28$ V $C_i \approx 0$ nF (between I.S wires)
$R = 300$ Ohm $C_i = 6$ nF (I.S wires to ground)
$I_{sc} = 93$ mA $L_i \approx 0$ mH
$P_a = 650$ mW $C_a = 83$ nF
$L_a = 3$ mH
C_a and L_a are present at the same time:
$C_a = 83$ nF @ $L_a = 0.2$ mH

Terminals 208, 209, 210
$V_{max} = 30$ V $C_i \approx 0$ nF (between I.S wires)
$I_{max} = 120$ mA $C_i = 6$ nF (I.S wires to ground)
$V_{oc} = 28$ V $L_i \approx 0$ mH
$I_{sc} \approx 0$ mA $C_a = 83$ nF

Terminals 216, 218, 219, 220
$V_{oc} = 28$ V $C_i \approx 0$ nF (between I.S wires)
$R = 300$ Ohm $C_i = 6$ nF (I.S wires to ground)
$I_{sc} = 93$ mA $L_i \approx 0$ mH
$P_a = 650$ mW $C_a = 83$ nF
$L_a = 3$ mH
C_a and L_a are present at the same time:
$C_a = 83$ nF @ $L_a = 0.2$ mH

Terminals 218, 219, 220
$V_{max} = 30$ V $C_i \approx 0$ nF (between I.S wires)
$I_{max} = 120$ mA $C_i = 6$ nF (I.S wires to ground/earth)
$V_{oc} = 28$ V $L_i \approx 0$ mH
$I_{sc} \approx 0$ mA $C_a = 83$ nF

Kanalerweiterung I/O Ex i 5673-114

Design.	Signal
201	I_OUT_Pt100
202	IN+_Pt100
203	IN–_Pt100
204	GND_Pt100
205	Shield
206	V+_1
207	n.c.
208	AIN+_1
209	AIN–_1
210	Shield
211	V+_2
212	n.c.
213	AIN+_2
214	AIN–_2
215	Shield
216	OUT Source
217	n.c.
218	OUT Sink
219	OUT COM
220	Shield

eigensichere Stromkreise

Entity parameters
Groups A, B, C, D [Ex ia]
II (1) G, [Ex ia] IIC

Terminals 201–205
$V_{oc} = 6.7$ V $C_i = 2.5$ µF
$R = 230$ Ohm $L_i = 0.3$ mH
$I_{sc} = 30$ mA $C_a = 15.4$ µF
$P_a = 50$ mW $L_a = 38$ mH
C_a and L_a are present at the same time:
$C_a = 0.3$ µF @ $L_a = 0.01$ mH
$C_a = 0.2$ µF @ $L_a = 0.1$ mH
$C_a = 0.1$ µF @ $L_a = 0.15$ mH

Terminals 211, 213, 214, 215
$V_{oc} = 28$ V $C_i \approx 0$ nF (between I.S wires)
$R = 300$ Ohm $C_i = 6$ nF (I.S wires to ground)
$I_{sc} = 93$ mA $L_i \approx 0$ mH
$P_a = 650$ mW $C_a = 83$ nF
$L_a = 3$ mH
C_a and L_a are present at the same time:
$C_a = 83$ nF @ $L_a = 0.2$ mH

Terminals 213, 214, 215
$V_{max} = 30$ V $C_i \approx 0$ nF (between I.S wires)
$I_{max} = 120$ mA $C_i = 6$ nF (I.S wires to ground)
$V_{oc} = 28$ V $L_i \approx 0$ mH
$I_{sc} \approx 0$ mA $C_a = 83$ nF

a	02.11.06	Sch.	
b	29.11.06	Sch.	
c	01.12.06	Sch.	
d	03.04.07	Sch.	
e	16.10.07	Sch.	
f	18.11.08		
g	01.12.08		

gez. 03.04.07 Sch.
gepr.
Fs 5673 Bl.2 v. 3

Revision g: Substitution of module 5673-114

Control drawing Hygrophil F

BARTEC GmbH
CAD–Nr.: bs\bs567301

controlled document

HYGROPHIL® F 5673 Operating manual, Software version 1.8.x, 387896MDHEN(14.06.2013)

1.4   Technical data

1.4.1   Evaluation unit F 5673

Evaluation unit			
Display ranges (not the measuring range)	*Measurement variable*	*Lower range limit*	*Upper range limit*
	Vol% [%]	0	100
	PPM [ppm]	0	25000
	DT [°C,°F,K]	-100	100
	FP [°C,°F,K]	-100	100
	MC [mg/m^3], [lb/MMscF]	0	30000
	VP [hPa]	0	250
	TT [°C,°F,K]	-50	100
	SP [bar,PSI,..]	0	250
	WL [nm]	780	830
Auxiliary variables	The temperature (TT) at the measuring point is measured via a sensor integrated in the humidity sensor or entered by hand. The pressure (SP) is measured via a 4...20 mA signal from an external pressure transmitter or entered by hand. CO_2-content (0...100%) is measured via a 4...20 mA-signal or entered by hand.		
Measurement channels	1, 2 or 3		
Measuring rate	Max. 3 measurements / minute per channel		
Inputs per measurement channel	- Light waveguide port for optical humidity sensor - 9-pole D-SUB plug for data memory with sensor characteristic - Clamp-type terminal for PT 100 measurement sensor in sensor head - Clamp-type terminal for signal from a pressure transmitter for absolute pressure (4...20 mA) - Clamp-type terminal for CO_2 content (4...20 mA) all inputs Ex ia, galvanically isolated		
Analog outputs per measurement channel	Clamp-type terminal 0/4...20 mA, EEx ia, galvanically isolated Source and sink Resolution 0.0003 mA Max. load: 500 Ω Accuracy: 0.03 mA Temperature drift: <0.001 mA/ °C		
Interfaces	RS 232, modbus, profibus		
Display	Graphic display 320 x 240 dots		
Keyboard	Red backlit touch-screen		
Auxiliary energy	DC 10...36 V max. 60 W (Si 6.3 A T) AC 100...240 V max. 110 VA (Si 3.15 A MT)		
Ambient conditions	Permissible working temperature: 0...+50 °C Permissible storage temperature: -20...+60 C Climatic category: IWI according to DIN 40040		
Dimensions (WxHxD)	483 x 192 x 212		
Approvals	ATEX, CSA, GOST		
Weight	approx. 8.5 kg		

1.4.2   CPU plug-in unit type 5673-113

Electrical data	
Operating voltage CPU	5.5 V $\pm$ 2 %
Power consumption	800 mA
Fuse of battery	3.5 A
Interfaces	
USB 2.0 Host	OHCI
Ethernet	100 MBit
Serial interfaces	5x up to 115200 Bit/s, 3.3 V LVTTL 2x up to 460800 Bit/s, 3.3 V LVTTL
Elektronics	
Realtime clock	32.768 kHz (battery buffered)
Ambient conditions	
Operating temperature	- 10 … + 50 °C
Storage temperature	- 20 … + 70 °C
Climatic class	JWF in accordance with DIN 40040
Protection type	IP00 in accordance with DIN 40050

1.4.3   Power supply plug-in unit DC 10..36V type 5673-108

Electrical data	
Input voltage	DC 10...36 V, fuse 6.3 A (T)
Output voltage	5,5 V 3.2 A short-circuit-proof 24 V 1.2 A short-circuit-proof 10 V max. 100 mA
Maximum output power	60 W
Ambient conditions	
Operating temperature	- 10 … + 50 °C
Storage temperature	- 20 … + 70 °C

1.4.4   Power supply plug-in unit AC 100..240V type 5673-109

Electrical data	
Input voltage	AC 100...240 V, fuse 3.15 A (MT)
Output voltage	5.5 V 3.2 A short-circuit-proof 24 V 1.2 A short-circuit-proof 10 V max. 100 mA
Maximum output power	110 VA
Ambient conditions	
Operating temperature	- 10 … + 50 °C
Storage temperature	- 20 … + 70 °C

1.4.5   Analog I/O Ex type 5673-114

Electrical data	
Operating voltage for CPU	DC 5.5 V ± 2 % 200 mA, fuse 400 mA
Operating voltage for sensor supply	DC 24 V ± 5 %, max. 480 mA, fuse 1 A
PT-100 [EEx ia]	
Type	Pt-100 (4 wires), I 1 mA -50...+100 °C
Resolution	0.005 °C (16 bit)
Separation	galvanically isolated
Analog Output [EEx ia]	
Current range	0/4-20 mA
resolution	0.0003 mA
Separation	galvanically isolated
Sampling	Max. 10 /s
Aktive	Load max. 500 Ω
Passive	U_{max} :36 V, U_{min} at 20 mA: 8 V
Analog Input [EEx ia]	
Quantity	2
Input current	4...20 mA
Resolution	0.005 mA
Separation	galvanically isolated
Sampling	Max. 10 /s
output voltage V+1 and V+2	DC 24 V ±10% max. 30 mA, short-circuit-proof
Ambient conditions	
Operating temperature	- 10 … + 50 °C
Storage temperature	- 20 … + 70 °C

201	I_OUT	PT100
202	IN+	PT100
203	IN−	PT100
204	GND	PT100
205	Shield	

206	V+ 1	
207	n.a.	
208	IN 1+	
209	IN 1−	
210	Shield	

211	V+ 2	
212	n.a.	
213	IN 2+	
214	IN 2−	
215	Shield	

216	OUT Source	
217	n.a.	
218	OUT Sink	
219	OUT COM	
220	Shield	

Analog I/O Ex
Type 5673-114

287836.dwg
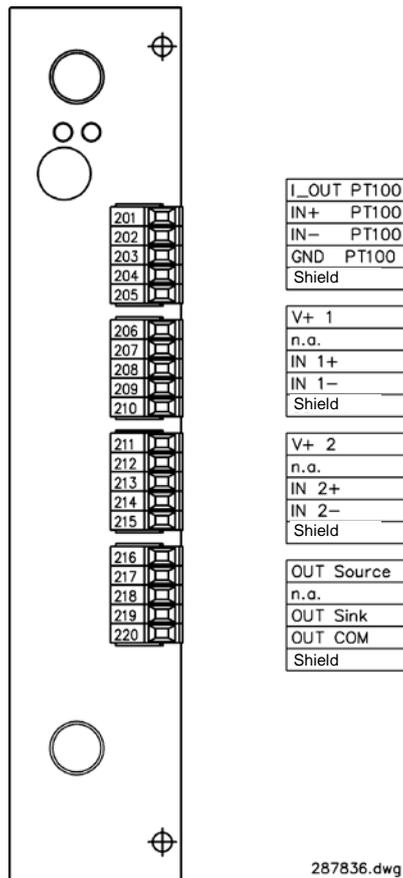
| **EMC:** | To the cables of the analog inputs IN1, IN2 and to the cable of the analog output OUT Source must be fixed ferrite noise filters (order no. 275368) (see section 3.2). |

1.4.6 Interface module type 5673-110

Electrical data	
Operating voltage for CPU	DC 5,5 V ± 2 %
Operating voltage for interfaces	DC 24 V ± 5 %
3 x Analog output	
Current range	0/4 – 20 mA, galvanically isolated, source
Resolution	0,0003 mA
Apparent ohmic resistance	< 800 Ω
Accuracy	± 0.15 %
Temperature drift	<0.001 mA/°C
2 x RS485	
Functionality	Modbus
Output voltage for each interface	24 V ± 5 %, max. 50 mA
2 x RS232	
Functionality	Logging
Output voltage for each interface	24 V ± 5 %, max. 50 mA
Profibus	
Functionality	Profibus DB (Slave)
Output voltage for each interface	5V ± 2 %, max. 50 mA
2 x USB	
Functionality	Standard USB interface
	Only for service and maintenance purposes
Ambient conditions	
Operating temperature	- 10 … + 50 °C
Storage temperature	- 20 … + 70 °C

Interface module

5673-110

Design.	Signal	Design.	Signal
401	OUT 1+	404	OUT 2+
402	OUT 1−	405	OUT 2−
403	Shield	406	Shield
407	OUT 3+	410	free
408	OUT 3−	411	free
409	Shield	412	free
413	+24V	417	+24V
414	A1	418	A2
415	B1	419	B2
416	GND	420	GND
421	+24V	424	GND
422	RxD 1	425	TxD 1
423	CTS 1	426	RTS 1
427	+24V	430	GND
428	RxD 2	431	TxD 2
429	CTS 2	432	RTS 2
433	+5V	436	GND
434	PB_A	437	Shield
435	PB_B	438	Shield

USB 1	USB 2

Analog Out 1
0/4−20mA

Analog Out 3
0/4−20mA

✶ MODBUS RTU
RS485, +24V,
max 50mA

Analog Out 2
0/4−20mA

RS485, +24V,
max 50mA

Serial Out (s. 5.6.9)
RS232, +24V,
max 50mA

MODBUS RTU ✶
RS232, +24V,
max 50mA

Profibus, +5V
max 50mA

281686.dwg

✶ Select the interface for MODBUS in the „Modbus/Profibus" menu (see section 5.6.7).

EMC:

To all cables of the analog outputs OUT1, OUT2, OUT3 must be fixed ferrite noise filters (order no. 275368) (see section 3.2).

⚠️

Do not use USB connectors, unless area is known to be nonhazardous. For service only!

1.4.7 Relay-Interface module Type 5673-115

Electrical Data	
Operating voltage CPU	DC 5.5 V ± 2 % 70 mA fuse 500 mA
Operating voltage 24 V	DC 24 V ± 5 % 60 mA fuse F3A
Relays	
Type	Change-over contact
Insulation	1500 vrms
Contacts	30V, 1A
Ambient conditions	
Operating temperature	- 10 … + 50 °C
Storage temperature	- 20 … + 70 °C

289079.dwg
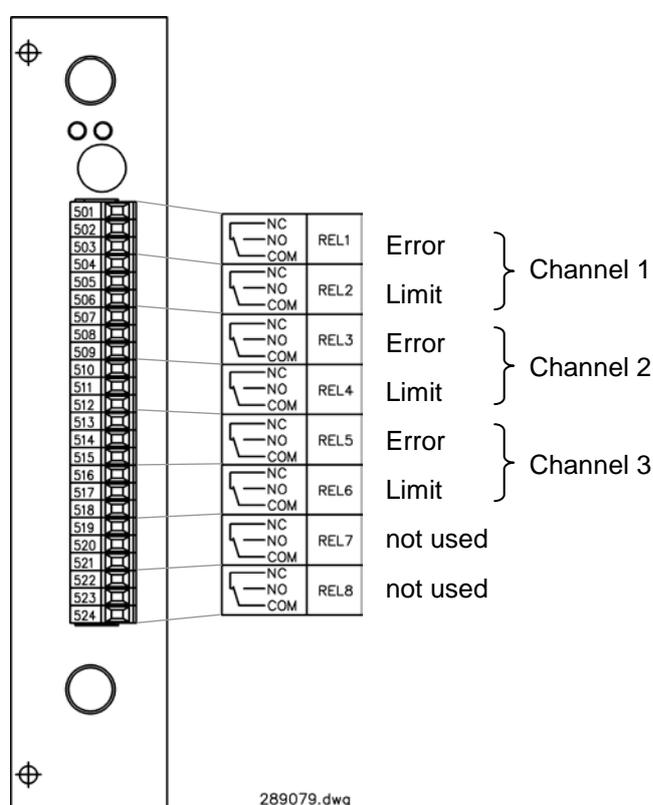
Switching operations:

From software version 1.7.7 the switching operations have changed as follows: The relays are activated in normal operation and deactivated when causing an ERROR- or LIMIT-signal.
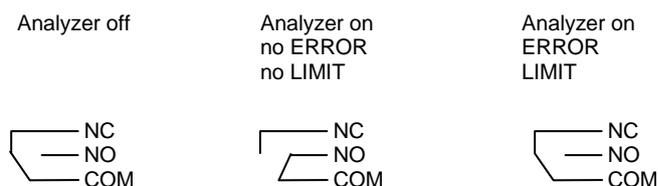
1.4.8   Polychromator plug-in unit type 5673-302

Electrical data	
Operating voltage	DC 5.5 V
Power consumption	200 mA
Connection type	ST plug optical (sensor)
Interface	USB 12 Mbit/s (full speed)
Measuring range	ca. 720...870 nm
Resolution	2000 Pixel $\cong$ 0.17 nm/Pixel
Ambient conditions	
Operating temperature	-10…+50 °C
Storage temperature	-20…+60 °C

1.4.9   Humidity sensor L166x

The sensor is designed with a pore structure suitable for trace humidity applications. A single sensor element covers the dew-point range from +20 °C DT to -80 °C DT at duty temperatures of up to 60 °C. Moisture condensation does not impair the sensor; once dry it can be used again without having to be recalibrated, i.e. it can be used without difficulty in most processes subject to temporary condensation.

Permissible working temperature	-30...+60 °C
Permissible storage temperature	-30...+ 60 °C
Integrated Pt100	DIN IEC 751, 4-wire class A
Max. permissible working pressure	100 bar, 200 bar on request with certificate (gas-pressure test)
Calibrated Range	-80 … +20 °C DT
Accuracy	+/- 1 K
Material	Shaft: 1.4571 Sensor head: POM
Protection type	IP 65 (in built-in state)
Approvals	ATEX, CSA, CRN, GOST
Dimensions in mm	

Sensor L 166x, Dew-point measuring range

① Out of calibrated range   ② Calibratable range   ③ Function range extrapolated
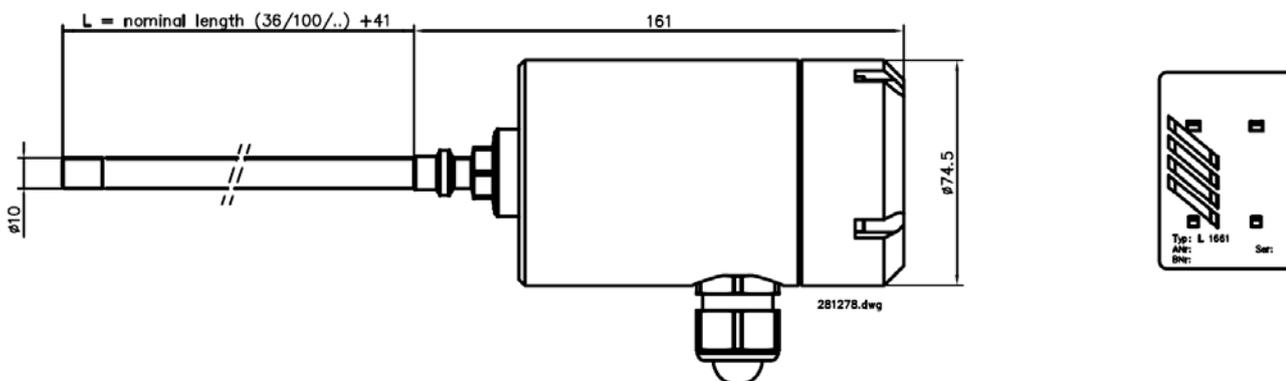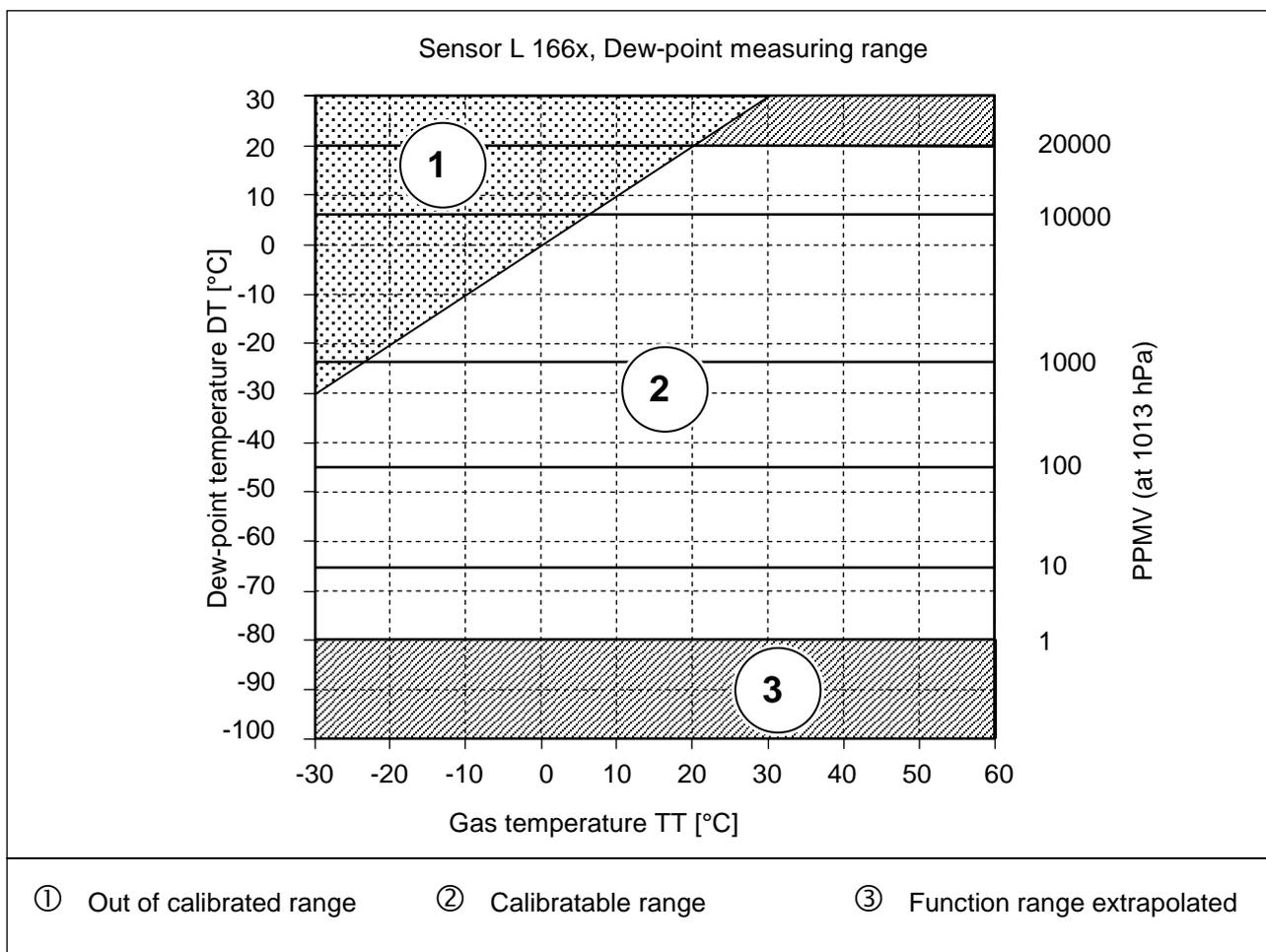
1.5 Spare parts, accessories

Designation	Type	Specification	Order No.
Evaluation unit			
	5673-10	AC 100...240 V Class1/Div.2 1 channel pre-installed	284492
	5673-11	AC 100...240 V Class1/Div.1 in EEx-d casing 1 channel pre-installed	242057
	5673-12	DC 10...36 V Class1/Div.2 1 channel pre-installed	246119
	5673-13	DC 10...36 V Class1/Div. 1 in EEx-d casing 1 channel pre-installed	242056
Accessories for evaluation unit			
	5673-110	Plug-in interface	281686
	5673-114	Channel extension	287836
	5673-115	Relay board	289079
	5673-107	Wall mount / mounting plate	246120
Humidity sensor with integrated Pt 100			
Diameter of measuring tube 10 mm, 100 bar, 200 bar against test certificate, calibrated from – 80...+ 20 °C DT			
	L 1661 Series B	Immersion depth 36 mm	287782
		Immersion depth 100 mm	281278
		Immersion depth 225 mm	302470
		Immersion depth 225 mm RT (for retraction tool)	302471
		Special calibration in natural gas (with DAP calibration certificate, calibrated from –20° C, -10° C, 0° C DT, at 41 bar)	232340
		Special calibration in hexane (freely selectable measurement range)	232165
		Special calibration in several gases and liquids (freely selectable measurement range)	239 022
	L 1661 LI Series B	Immersion depth 36 mm · for measuring in liquids	353632
		Immersion depth 100 mm · for measuring in liquids	353633
		Immersion depth 225 mm · for measuring in liquids	353634
		Protection cap with Teflon filter 10 µm	304746
Combined fibre-optic cable			
Including ST plugs, 2 optical fibres + 6 Cu leads for Pt 100 and pressure sensor, shielded, protected and flame-retardant according to IEC 332-3A, suitable for field application, temperature range from -20°C to 70°C			
	1631-112	Length 2 m	242445
		Length 5 m	247283
		Length 10 m	245449
		Length 20 m	240821
		Length 100 m	239954
		Special lengths in 5 m steps up to 100 m Special lengths in 10 m steps, from 100 m upwards, max. length: 800 m	
Combined fibre-optic cable with extended temperature range			
Including ST plugs, 2 optical fibres + 6 Cu leads for Pt 100 and pressure sensor, shielded, protected and flame-retardant according to IEC 332-3A, suitable for field application, temperature range from -55°C to 70°C			
	1631-113	Special lengths in steps of 5 m, up to 100 m Special lengths in steps of 10 m, from a length of 100 m (Max. length 200 m)	XXXXXX

Designation	Type	Specification		Order No.
Accessories				
Sampler (Swagelok-T)	5672-111	For analysis line with 6 mm		221715
	5672-112	For analysis line with 10 mm		221717
Sensor retraction tool	ZM-WA-025-040-EST	PB Compac flange PN 200, stainless steel		246703
Blind plug	ZM-BB-007-015-EST	For sensor retraction tool, stainless steel		246711
CF welding socket for sensor retraction tool	ZM-CF-037-025-EST	Stainless steel (NACE)		246706
	ZM-CF-037-025-ST	Steel (NACE)		246707
	ZM-CF-073-025-EST	Assembling small pipe diameters (DN50, DN65, DN80)	Stainless steel (NACE)	344861
	ZM-CF-073-025-ST		Steel (NACE)	344860
Compac blind flange	ZM-CF-357-025-EST	Stainless steel		246708
	ZM-CF-357-025-ST	Steel		246720
Mounting kit	ZM-WZ-003	1 hook wrench 4 screws for PB Compac PN 250 1 O-ring for PB Compac PN 250 Ø 41 x 3.5		246721
Sample system for natural gas applications	5985-13	316 SS/ up to 170 bar / ATEX, CENELEC EEx-d/e IIC T5 heated, with pressure reducer opt. self standing support frame, 316SS opt. roof, 316SS		247595 279426 274206
Sample cell „Gas-Liquid-separator"	5672-129			287907
Stainless steel case IP 65 (3-parts)	5673-112			283933
Test equipment				
Moisture generator	DPG-59	Approx. 20ppm / 50ppm / 100ppm		239 611

2   Safety precautions

The evaluation units are produced in line with the regulations currently in force and have left the factory in perfect condition after having undergone thorough safety tests.

- Installation and maintenance of the evaluation units to be carried out by qualified staff.

- Make sure that the data and operating conditions specified by BARTEC-BENKE are observed.

- Study the operating instructions before installing and starting up the system. If you have any questions concerning any particular aspects, contact our customer service for expert advice.

- **The HYGROPHIL® F 5673 is an optical precision instrument. It is essential therefore to protect it from knocks and jolts during transportation and to select a point of installation unaffected by vibrations.**

- Instruct your operating and maintenance personnel thoroughly and provide them with all essential information.

- The system's internal error messages are no replacement for safety devices in the larger facility in which the evaluation system is integrated.

- It is imperative to observe all the regulations which govern the operation of your facility.

- Before connecting the power supply, make sure that the evaluation unit's operating voltage (see the type plate) matches the actual supply voltage.

- In the event of trouble, make a note of all the error messages in the display and check whether they can be remedied. If local repair is not possible, send the unit for repair to BARTEC-BENKE and include full details of the fault.

- Take the unit out of operation immediately and secure it against being started up again accidentally if there is any reason for supposing that it can no longer be used safely (e.g. visible signs of damage).

Do not open the casing of the evaluation unit!
All works requiring the evaluation unit to be opened are reserved strictly for qualified technical staff.

- Keep the moisture-sensitive layer of the sensor free of contamination from oil and grease.

- **Use the supplied guard caps to protect the open light waveguide connectors on the evaluation unit and the sensor during transportation and storage.**

- Take care not to kink the light waveguides and not to bend them to a bending radius of less than 20 mm.

Instructions for the safe usage of the device

- The humidity measurement sensor is installed in the partition wall of the zone which in accordance to the definitions of device group II requires category 1 equipment (zone 0).

- For the application as category 1 equipment, the ambient conditions of the humidity measurement sensor have to comply with the atmospheric conditions in accordance with EN 50284 (temperature range from –20°C to +60°C, absolute pressure range from 0,8 bar to 1,1 bar).
  The humidity measurement sensor can also be applied as category 2 equipment in zone 1 at an ambient temperature Ta or a medium temperature TM ranging from –30°C to +60°C.

- If the device is installed in systems with the risk of overvoltage, carry out measures in accordance with EN 60079-14, para. 12.3 ! (also see DIN VDE 0185)

- Humidity measurement sensors of the types L166x involve the risk of an electromagnetic charging of the plastic casing! Only use a moistened cloth to clean the casing!

- The intrinsically safe circuits of the HYGROPHIL® F are galvanically separated up to Vm = AC 253 V (also see EN 60079-14, para. 12.3).

- If the device is installed in pressure lines or pressure vessels, make sure the appropriate specifications (pressure vessel regulation DruckbehV, TRG, GasHL-VO, TRGL, ...) are complied with!

- The humidity measurement sensor has to be included in the respective tightness and pressure tests.

- Usually an adapter with a screw thread is applied between the double-ferrule swage fitting of the humidity measurement sensor and the facility. On the facility side at least 5 threads of this adapter must be operative.

- Mounting the double-ferrule swage fitting:
  - First rotate the nut fingertight. If necessary tighten the nut by using a spanner until the measurement tube will not turn by hand.
  - Mark the nut in the 6 o´clock position.
  - While holding the fitting body steady with a spanner tighten the nut with a second spanner one and one-quarter turns to the 9 o´clock position (see also section 3.3.3).

- Only use BARTEC-fibre-optic cables.

- Make sure the cable of the intrinsically safe PT100 circuit and of the intrinsically safe pressure transmitter circuits are correctly laid. Do not lay the cables together with power supply cables in joint cable channels. Make sure there is a sufficient distance from electromagnetic interference fields! To prevent any potential equalisation currents, tie the port of the shielding to GND at only one place.

- In the construction of the humidity measurement sensor, epoxy resins are used. They are usually resistant to the mediums mentioned in the resistance list (see table p. 2-3). In case of application as category 1 equipment in other mediums, the resistance has to be checked separately.

List of resistance for application of category-1-equipment	
Alkohole	alcohols, generally
Ammoniak NH_3	ammonia
Argon	
Äthanol	ethyl alcohol
Chlor	chlorine
Distickstoff-Monoxid	
Druckluft	compressed air
Erdgas	natural Gas
Ester	ester
Flüssigkeiten	liquids, generally
Flußsäure H	hydrofluoric acid
Helium	
Hexan	hexane
Kerosin	kerosens
Kohlendioxid CO_2	carbondioxide
Kohlenmonoxid CO	carbonmon¬oxide
Kohlenwasserstoffe	hydro carbons, generally
Krypton	
Lachgas	Nitrous oxide
Methan	methane
Methanol	methyl alcohol
Methylenchlorid	
Naphtha	naphtha
Narkosegas	narcotic gas
Neon	
Propan	propane
Raffineriegas	refinery gas
Sauerstoff	oxygen
Schwefelhexafluorid SF_6	
Schwefelwasserstoff	hydrosulphide
SF_4	
Silikonöl Dämpfe	Silicon vapours
Stickoxid	nitric oxide
Stickstoff	nitrogen
Toluol	
Vinylacetat	
Wasserstoff	hydrogen
Xenon	
Xylol	

Exclusion of liability   BARTEC-BENKE GmbH and its agents shall be liable only for damage caused by gross negligence or intent. Said liability shall be limited to the value of the order in question issued to BARTEC-BENKE GmbH.
In particular, BARTEC-BENKE accepts no liability for damage resulting from non-observance of the safety information or from non-compliance with the operating instructions or operating conditions.
Liability for consequential damage is excluded.

3 Installation

3.1 General

- Before installing the evaluation unit, make sure that your supply voltage is the same as that set on the evaluation unit (AC 100…240 V or DC 10…36 V).

- If you want to use the output signals from the analog output and relay outputs to control any processes, signaling devices or the like, install the necessary wiring

- Remove the guard caps from the tip of the sensor, the light waveguide connectors and the ports on the back of the evaluation unit.

3.2 Arrangements for EMC

Ferrite noise filters must be fixed to the cables according to the specifications in the technical data of the plug in units.

After locking the plug contacts the filters may no more shift.

Ferrite noise filter
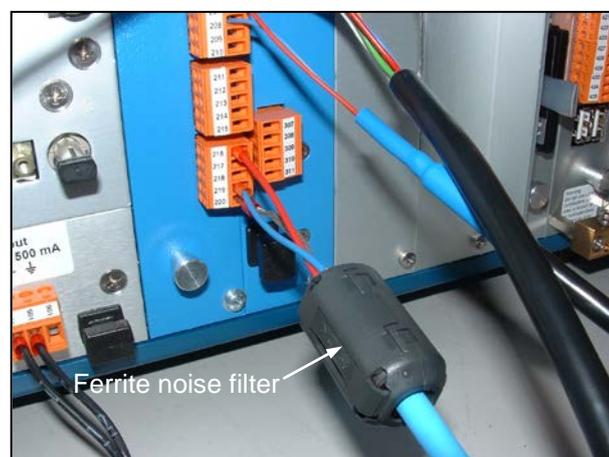
Included in delivery are 5 ferrite noise filters. If you need some more, you can order them (order no. 275368).
You can also order other types for different diameters of cables.

3.3 Sensor L166x

3.3.1 Wiring the sensor L166x

● Remove the 4 screws and open the casing.
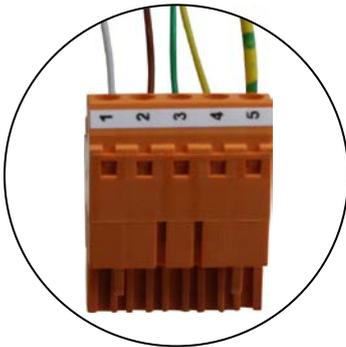
● Connect the Pt 100 cable <u>first</u>.
Connect the terminals 1 to 5 in the sensor casing to the terminals 201 to 205 at the back of the evaluation unit (see fig. at following page).
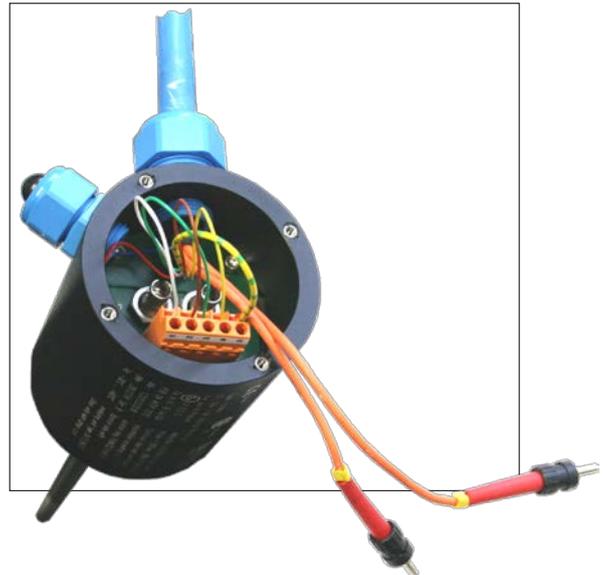
Plug Sensor FOC	Allocation	Colour	Plug (Ev. Unit)
1	Moist.sensor	OG	1
2	Moist.sensor	OG	2
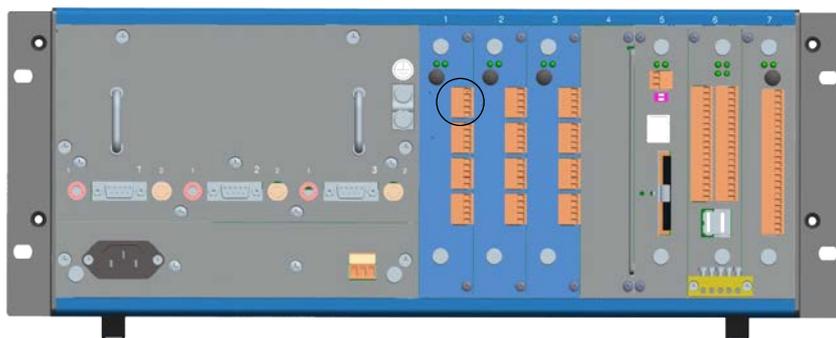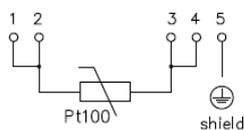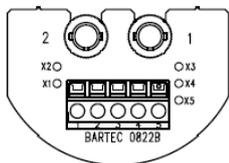
Clamp Sensor Pt100	Signal	Colour	Clamp Ev. Unit
1	I_Out_Pt100	WH	201
2	IN+_Pt100	OG o. BN	202
3	IN−_Pt100	GN	203
4	GND_Pt100	YE	204
5	Shield	GNYE	205
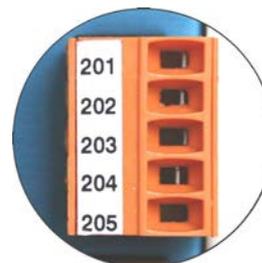
- Connect the fibre optic cable (bayonet connectors).
  The numbers 1 and 2 on the fibre optic cable have to tally with the numbers 1 and 2 at the connections in the casing. Let the cables make a bend from the entry to the ST coupling!
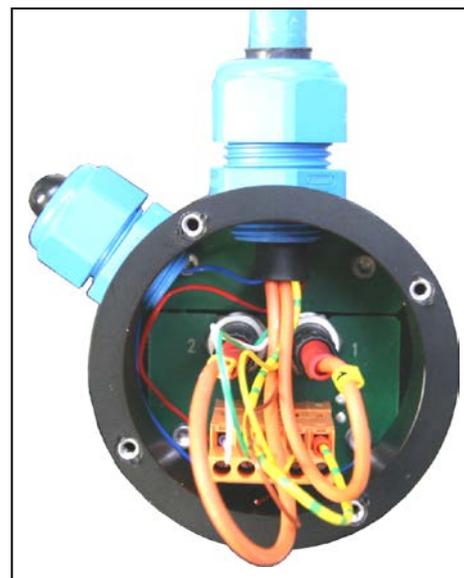
To protect the surface of the ST adapters remove the guard caps only directly before connecting!

- Tighten the union nuts. Pay attention to a good sealing by the rubber plugs.

- Close the casing and fix it by the 4 screws.

● Connect the two ST- connectors wich are at the other ends of the fibre optic cable to the connector plug at the back of the evaluation unit (bayonet connectors).

● Connect the connector plug of the humidity sensor in the corresponding port.

The "A" numbers of the sensors, the connector plugs, the fibre-optic wave-guide cables and the evaluation unit have to tally with the corresponding "A"-numbers on the system plate of the evaluation unit (see the illustration next page).

CE 0044

BARTEC
D-94239 Gotteszell

Typ: 5673-10
ANr: 13021605UE   Serie: A
BNr: 284492
Ta: +5 °C…+50 °C
Electrical rating see power supply module

Type plate (evaluation unit)

Typ: 5673-10
ANr: 13021605UE

Typ: L1661
ANr: 12092330UE

Typ: 1631-112
ANr: 11040002UE

System plate (evaluation unit)

ULTRAKUST

Typ: L1661
ANr: 12092330UE Ser: B
BNr: 281278

Typ: 1631-112   L = 5m
ANr: 11040002UE Ser:
BNr: 247283

geräteseite

CE 0044   CSA 226176
                    C   US

BARTEC
D 94239 Gotteszell

Type : L1661
Cl. I Div. 1 GP A,B,C,D T6 Ex ia
For use in HazLoc
Ex II 1/2 G
Ex ia IIC T6 Ga/Gb
PTB 04 ATEX 2075
ANr : 12092330UE
BNr : 281278 Ser: B
Ta : -30°C … +60°C

ANSI/ISA 12.27.01 – Single Seal
Pmax = 200 bar CRN: 0F10620.2C
Electrical data see certificate
Installation according to
control-dwg. Fs5672/Fs5673
Operate only with
analyzing unit type 5672/5673
Clean only with damp cloth

3.3.2 Installing the sensor L166x

3.3.2.1 Installing accessories

The following accessories are available for installing the sensor:

● Sampler type: 5672-111 (6 mm) (union-T) (SCS)

● Sampler type: 5672-112 (10 mm)

● Gas- / Liquid-separator (SCS) type: 5985-00-003

● Retraction tool type: 5672-115

3.3.2.2 Assembly examples

Installation in an analysis pipe via sampler
Type: 5672-111 (6 mm) (union-T), dimensions in mm
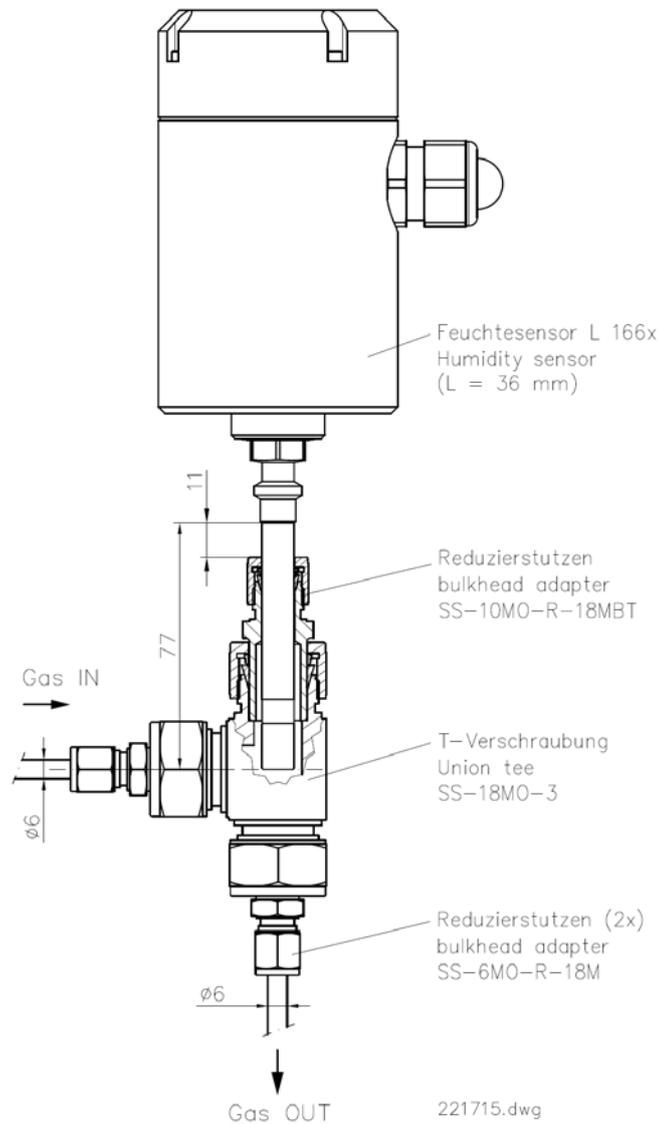
Installation in an analysis pipe via sampler
Type: 5672-112 (10 mm) , dimensions in mm

Feuchtesensor
L 166x
Humidity sensor
(36mm)

Reduzierstutzen (3x)
bulkhead adapter
SS-10MO-R-18MBT

T-Verschraubung
Union tee
SS-18MO-3

Gas IN

Gas OUT

11

77

∅10

∅10

221717.dwg
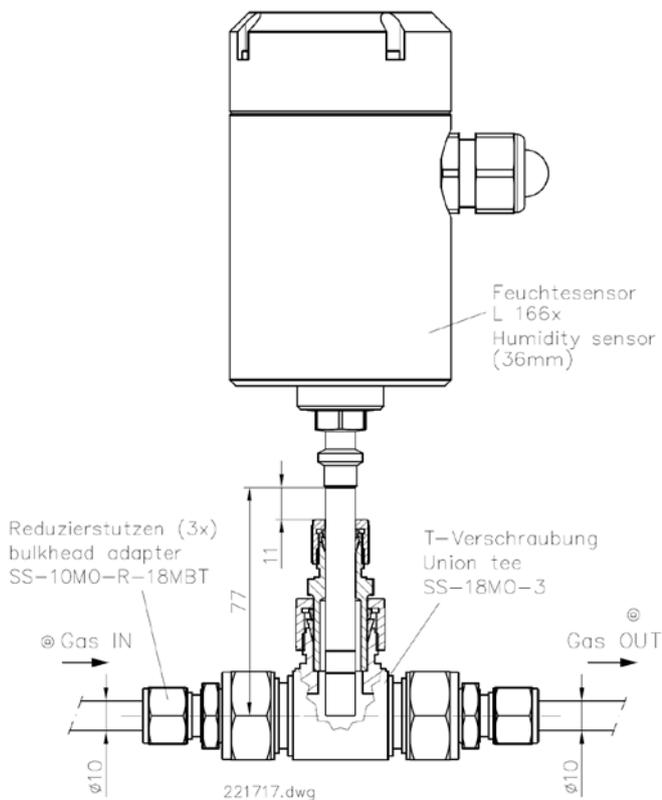
Installation in an analysis pipe via Sample cell „Gas- Liquid-separator"
Type: 5985-00-003 , dimensions in mm

Feuchtesensor L166x
Humidity sensor (36mm)

Einschraub—Verschraubung
Male Connector
SS—10M0—1—6BT

Einschraub—Verschraubung
Male Connector
SS—6M0—1—4

Probennehmer
"Gas—/Flüssigkeits—Separator"
Sample Cell
"Gas— / Liquid Separator"

Gas IN →

60.7

8

ø6

Einschraub—Verschraubung
Male Connector
SS—6M0—1—6

ø6

Gas OUT

246082.dwg
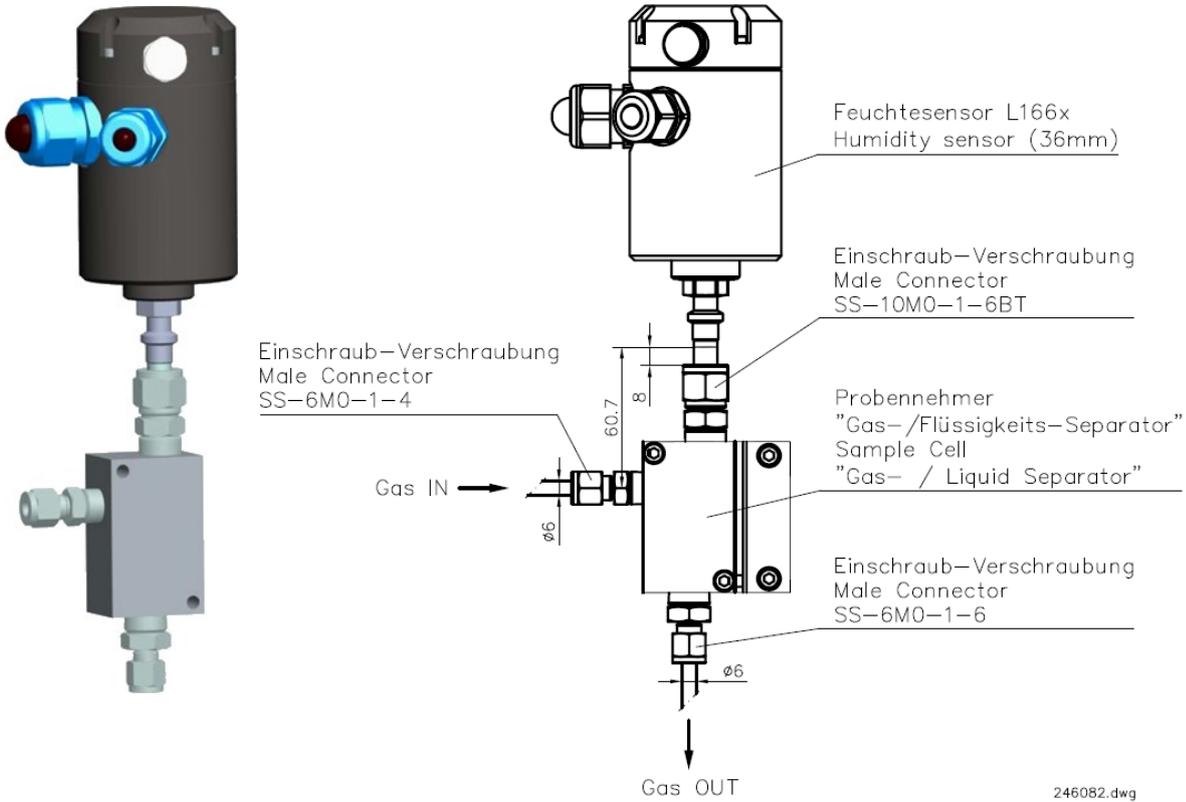
Installation in a mains pipe or bypass pipe via retraction tool
Type: ZM-WA-025-040, dimensions in mm

Schweißnaht
welded

Sensorende
Sensor end

48

8

214.3
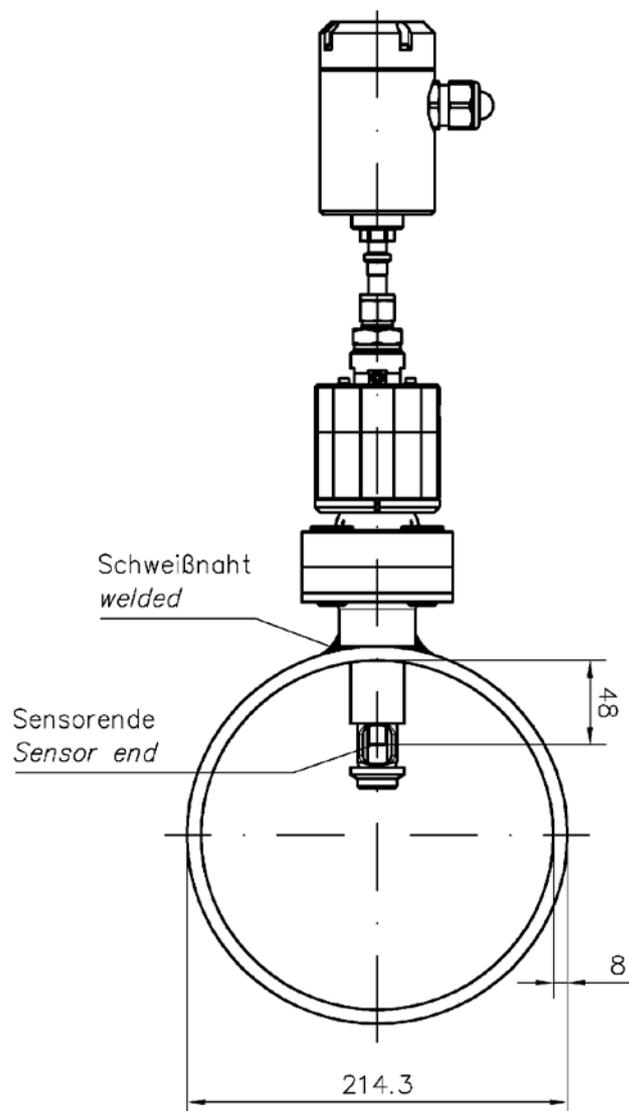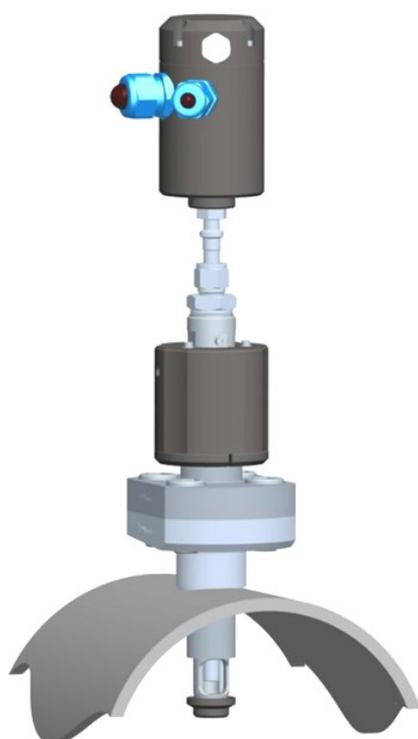
With the retraction tool will be delivered an instruction manual that includes all information of mounting, operation and service of the tool in combination with the sensor L 166x.

Integration in a sample system
Type 5985-13

To measure humidity in natural gas the sensor L 166x can be integrated in a sample system.

Hygrophil F, 5673

5673-104

zum Feuchtesensor
to Humidity Sensor

5673-101/102

220VAC
60Hz

Sample System, 5985-13

Feuchtesensor L1660
Humidity sensor (36mm)

Gehäuseheizung 500W
Enclosure Heater 500W

Medium Eingang
Sample Entry

Medium Ausgang
Sample Return

Raumtemperaturregler 40°C
Enclosure Thermostat 40°C

Durchflussmesser
Flowmeter

Druckreduzierung auf max. 2,5 bar
Pressure Reduzing to max. 2,5 bar

247595.dwg

600

300

600

50

113

763

Rear view,
Mounting holes:

560

M8

560
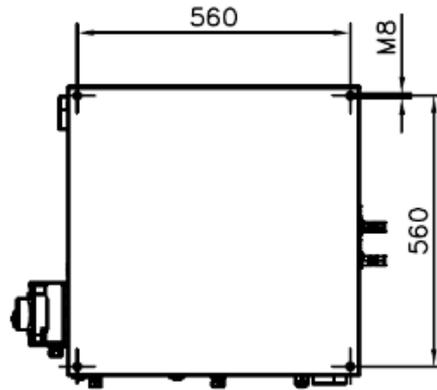
Dimensions in mm

3.3.3 Installation advice

Before installing the sensor make sure that the stainless steel protection cap is screwed tightly to the tip of the sensor.

The sensor L166x can be fitted with any suitable compression type fitting.

Never mount the ferrules within the distance of 50 mm, measured from the sensor tip (incl. protection cap) !

Dimensions in mm

Don´t clamp the sensor in this area!

50
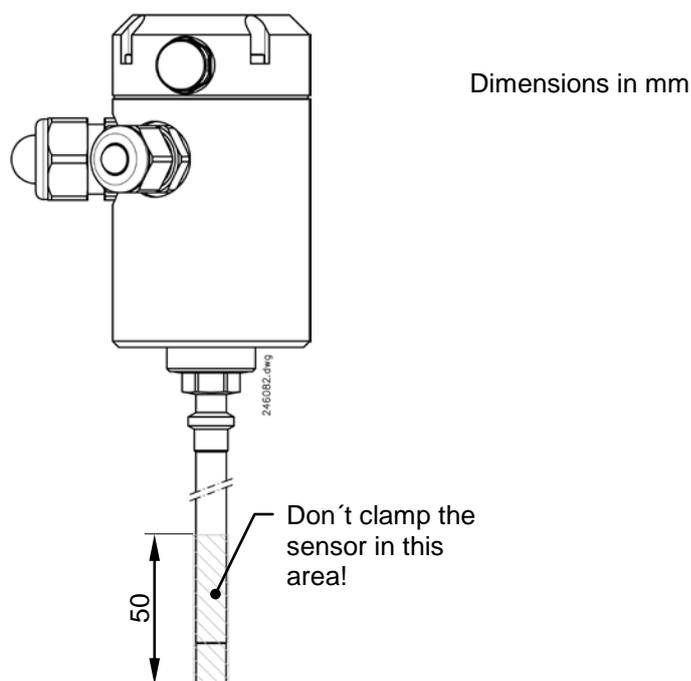
The following sequence describes the procedure to install the sensor in the gas-/ liquid-separator with Swagelok fittings.

This applies to union-T and slow down section likewise. At the retraction tool, the nut is already mounted on the sensor.

1. Assemble union nut with back and front ferrule on the connector. Make sure that both ferrules are fitted correctly.

2. Insert the sensor in the union nut until the tip of the sensor hits the bottom of the sample cell.

3. Mark the immersion depth with a pen approx. 1 mm above the union nut.

4. Lift the sensor appr. 8...10 mm.

Dimensions in mm

mark with a pen

marking

∞

246074.dwg
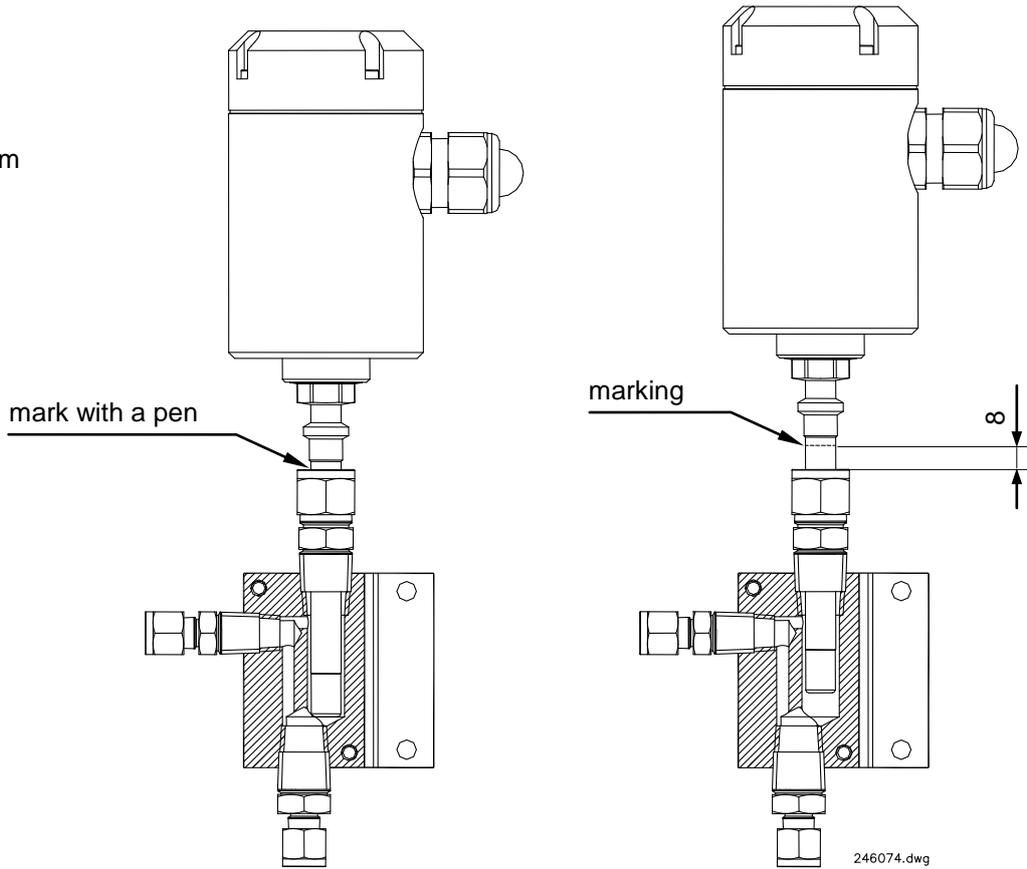
5. Tight the union nut according to the procedure of the compression type fitting manufacturer:

- First rotate the nut fingertight. If necessary tighten the nut by using a screw-wrench until the measurement tube will not turn by hand.

- Mark the nut in the 6 o´clock position.
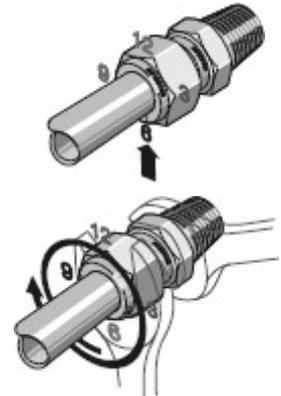
- While holding the fitting body steady with a screw-wrench tighten the nut with a second screw-wrench one and one-quarter turns to the 9 o´clock position.

4   Operation

4.1   Start up

The evaluation unit is not equipped with a switch. Connect the evaluation unit to the mains by the mains cable.
After the supply voltage has been applied, the software is initialised. Then the automatic sensor equalisation is carried out („Auto-Equalize").
This process takes about one minute.
Then the measuring variables are displayed.

4.2   Automatic sensor equalizing

The automatic sensor equalizing as it is executed when the system is started, will be repeated in an interval of 24 hours, when a measuring cycle is finished.
You can trigger the sensor equalizing any time during the measuring mode.
Touch F1 or F2 key. The current functions of theese keys are displayed. Then touch F1 key, („A. EQUAL.") to start the automatic sensor equalizing function.
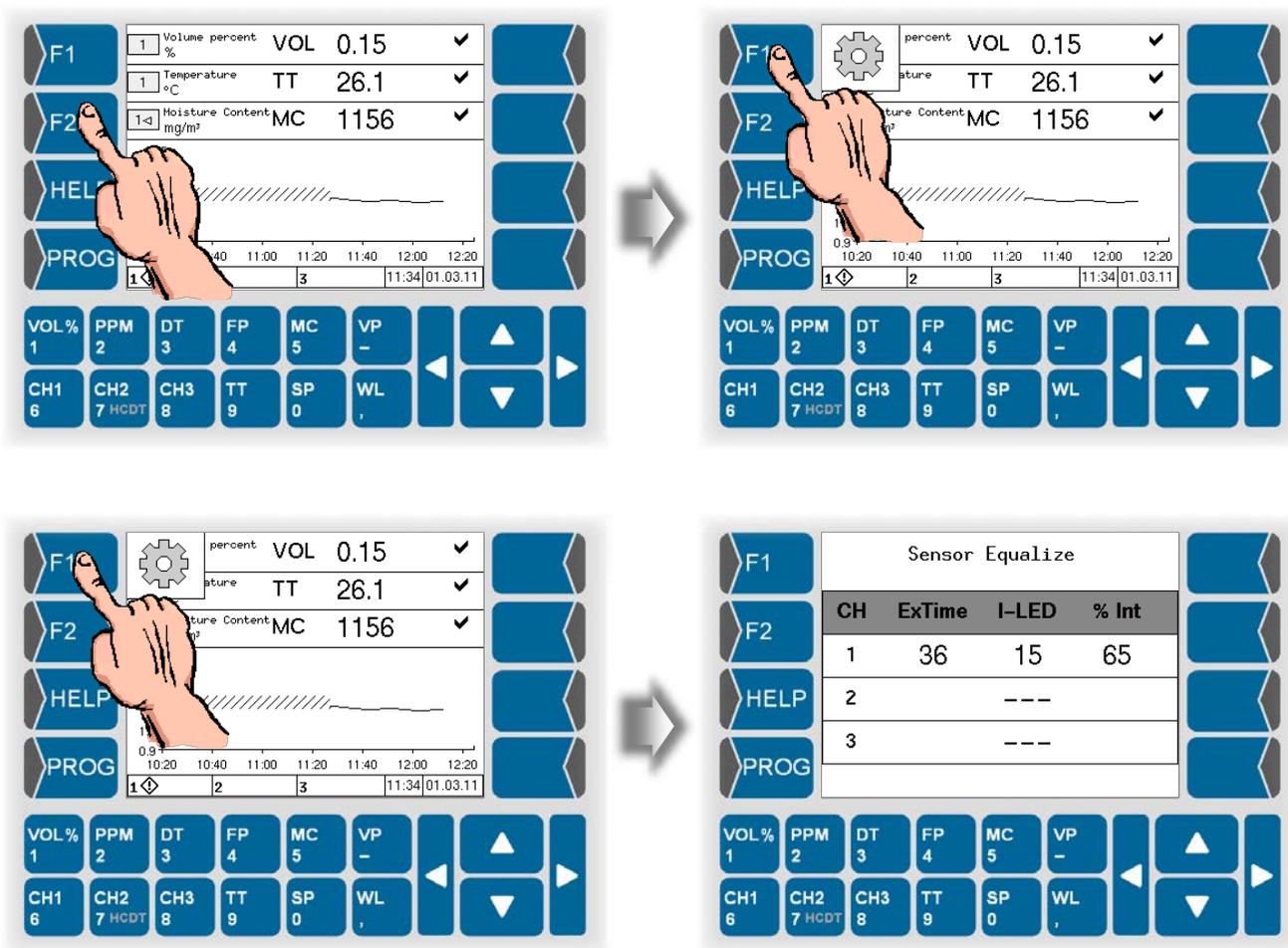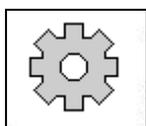
4.3 Display modes

After the automatic sensor adjustment has been completed, the unit is ready for operation.

The display can take place in three different online modes and one history graphic mode.

Use $\triangle$ and $\triangledown$ to switch between the three online display modes.

Use $\boxed{\text{F2}}$ to switch between the online graphic display and the history graphic display (see page 4-13).
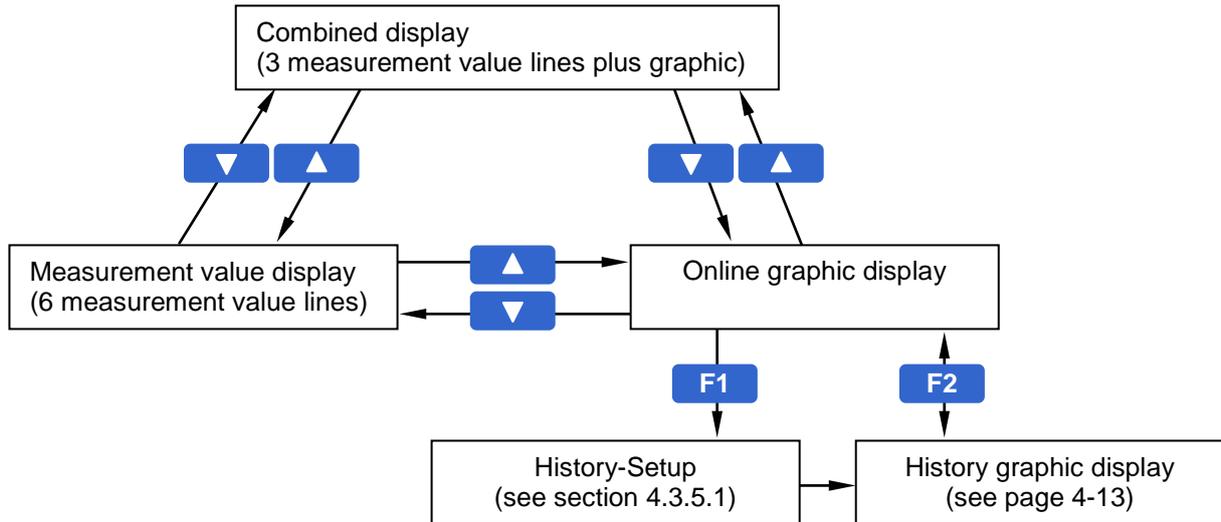
4.3.1 Combined display

The display shows three lines which can indicate different measurement variables at the same time.

Channel number

Dimension

Measurement variable

Measurement value

Status indication

Graphics

Info line
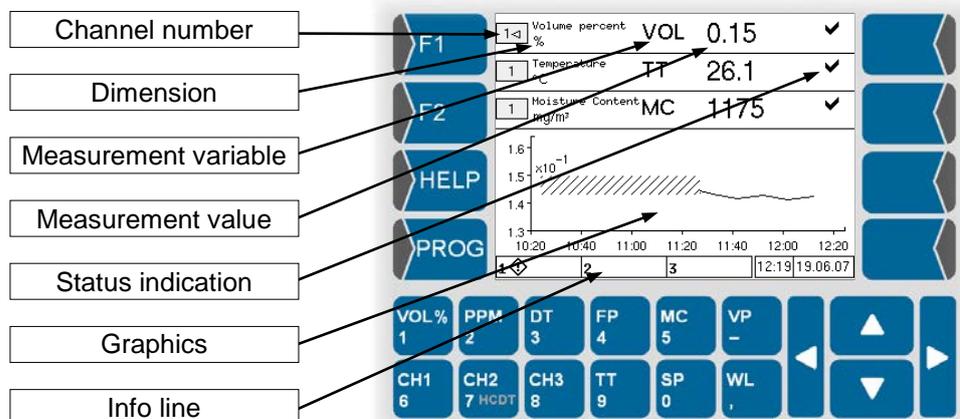
You can assign an available channel to each line and select a measurement variable to be displayed.

4.3.1.1 Selecting a line

Before you can set the indication of a line, you have to select this line. Touch the field which indicates the channel number.
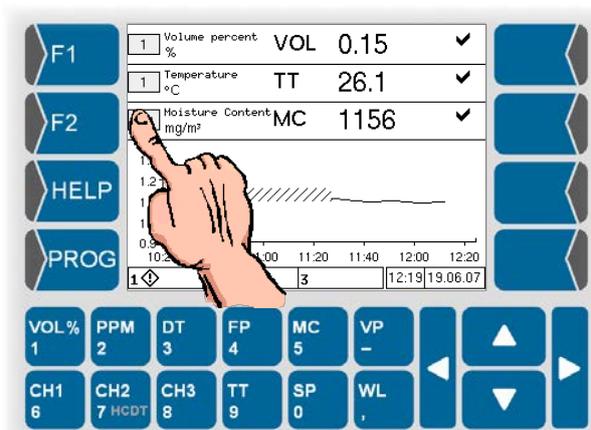
When the line has been selected, it is marked by an arrowhead after the channel number.

4.3.1.2 Assigning a channel

In order to assign a channel to the selected display line, touch the key with the appropriate channel designation (CH1, CH2 or CH3).
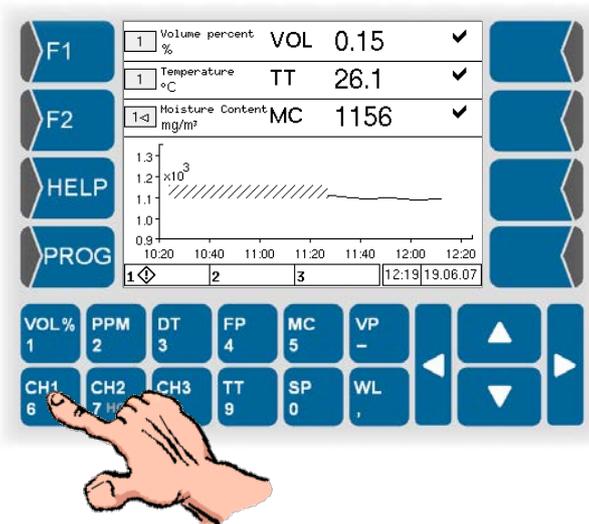
In the field for the channel number, the appropriate numeric character appears.

4.3.1.3 Assigning a measurement variable

In order to assign the measurement variable to be displayed to the selected line, touch the key with the appropriate measurement variable.
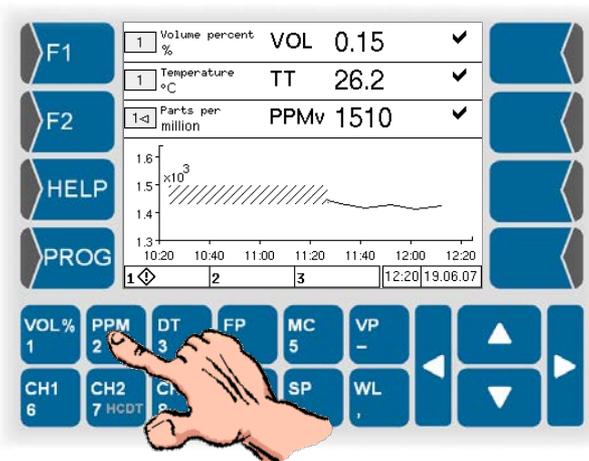
The selected measurement variable is indicated.

> With the key for vapour content [Vol%], you can toggle the display between vapour content and relative humidity.

4.3.1.4   Fixed values

If a primary measurement variable is not measured by a sensor, the fixed value configured for it is displayed (see section 5.6.3). In this case, an asterisk is displayed behind the dimension.

4.3.1.5   Status indication

In each line, the status of the measurement values is indicated by icons.

Icon	Meaning
✔	Measured values are ok
↑ VOL	Programmed limit (see section 5.6.4) has been exceeded. Below the icon there is the measurement variable whose limit has been exceeded (see also section 6.1).
↓ VOL	Programmed limit (see section 5.6.4) has been fallen below. Below the icon there is the measurement variable whose limit has been fallen below (see also section 6.1).
⊘	Error Indication of an error, measuring mode is not possible any more (see also section 6.3)

4.3.1.6   Graphic

Below the indication of the measurement variable there is a diagram presenting the measurement value curve of the measurement variable in the currently activated line for the last two hours.

If you activate another line, the graphic for the measurement values of this line is displayed. In intervals of 30 seconds, another measurement value is displayed. Every 10 minutes a measurement value is written into the data memory. If you switch to another display and then return to the graphic display, the recorded data is read from the data memory and is presented. Due to the data recording in intervals of 10 minutes, the curve is smoothed.

For periods during which no measurement values are available (e.g. device is turned off, no sensor is connected), the measurement value progress curve is hatched.

4.3.1.7   Info line

The info line below the graphic shows information on the operating status of the measuring channel, the current working temperature range and as well as the current date and time.

| Icon	Meaning
✔	Measured values are ok
↑ VOL	Programmed limit (see section 5.6.4) has been exceeded. Below the icon there is the measurement variable whose limit has been exceeded.
↓ VOL	Programmed limit (see section 5.6.4) has been fallen below. Below the icon there is the measurement variable whose limit has been fallen below.
◇	Warning Indication of missing measurement values, fixed value is used. The measuring operation is not interrupted (see also section 6.2)
⊘	Error Indication of an error, measuring mode is not possible any more (see also section 6.3)

4.3.2 Measurement value display with six lines

In this display mode, three further lines with measurement value indications are shown instead of the graphic.
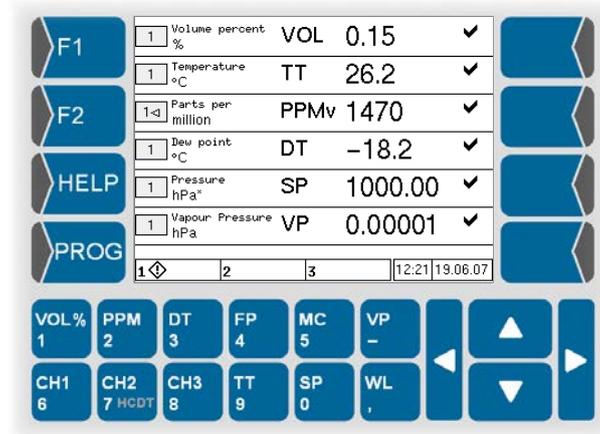
The setting of the display in the six measurement value lines is the same as in the combined display modes. Any changes of the settings in the first three lines are taken over into the mixed display mode after switching there.
The status display and the info line are the same as in the combined display mode.

4.3.3 Measuring the humidity in liquids

If the humidity in liquids is measured a double waved line is indicated before the channel number.
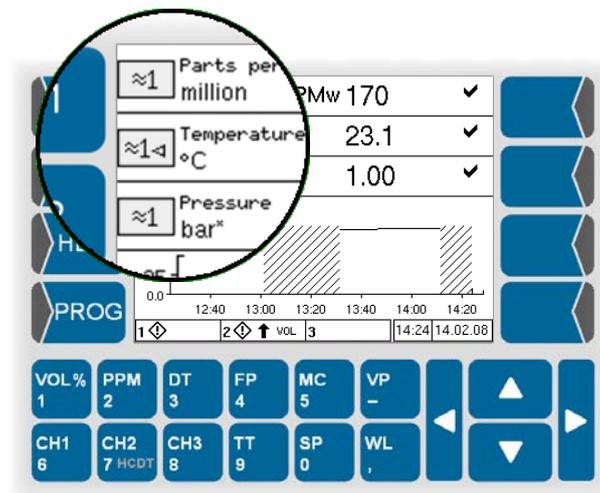
4.3.4   Online graphic display

In the online graphic display, the measurement value curve of the measurement variables of line 1, 2 and 3 for the last 2 hours is presented.
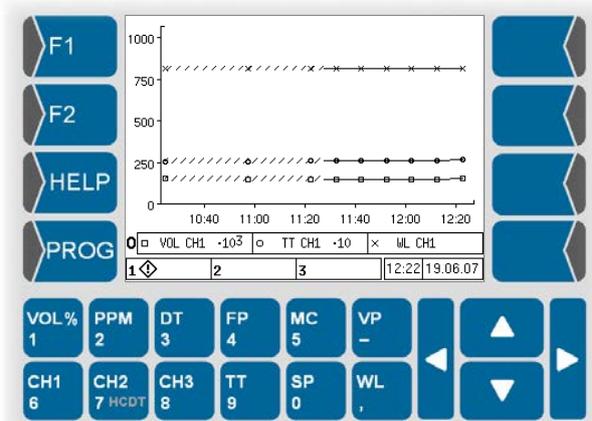
To distinguish the curves, they are marked with different symbols (x, □, ○).

As only one scaling is used for the measurement value axis, the measurement values are multiplied by powers of ten so that they can be presented within the value range of the measurement value scale.

In the line below the graphic, you find some information on the three measurement value curves presented. The "O" at the beginning of this line stands for "Online" und serves to distinguish this mode from the "History graphic mode" ("H").

Every 30 seconds a new measurement value is presented. Every 10 minutes, a measurement value is written into the data memory. If you switch to another display and then return to the graphic display, the recorded data is read from the data memory and is presented. Due to the data recording in intervals of 10 minutes, the curve is smoothed.

For periods during which no measurement values are available (e.g. device is turned off, no sensor is connected), the measurement value progress curve is hatched.

The info line is presented like in the two other online display modes.

4.3.5 History graphic display

The measurement values recorded in intervals of 10 minutes are written into a database with a memory capacity for 6 months.
You can define a period for which you want to present the stored measurement value progress curves for up to three measurement categories.

4.3.5.1 History Setup

● Switch to the online graphic mode.

● Touch [F1] or [F2] key. The current functions of theese keys are displayed.
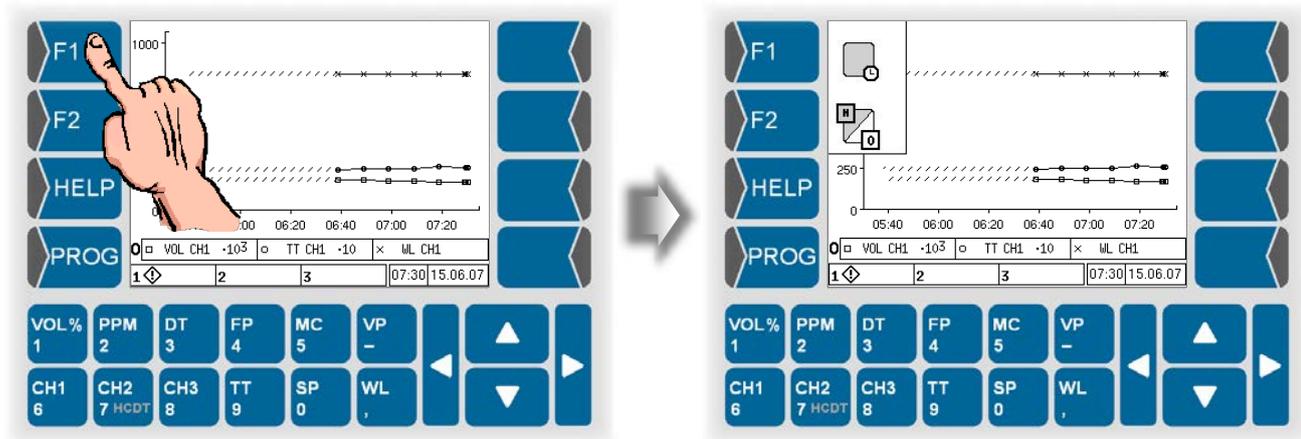
● Then touch the [F1] key to open the History Setup.
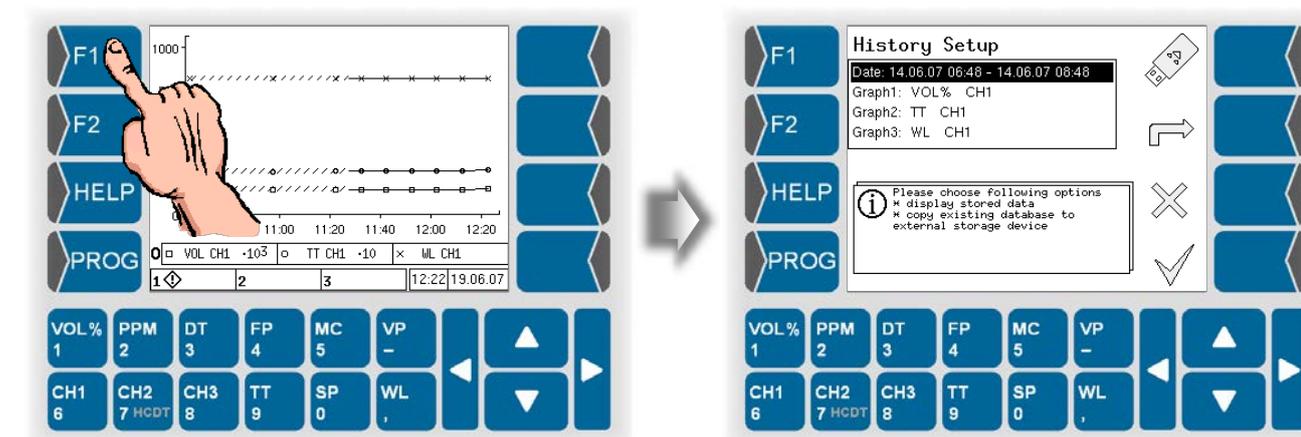
Defining the presentation period

● Open the dialog for editing the presentation period.

You can see the period containing data in the database in the display.
The point in time of the first and last value for the channel is displayed.
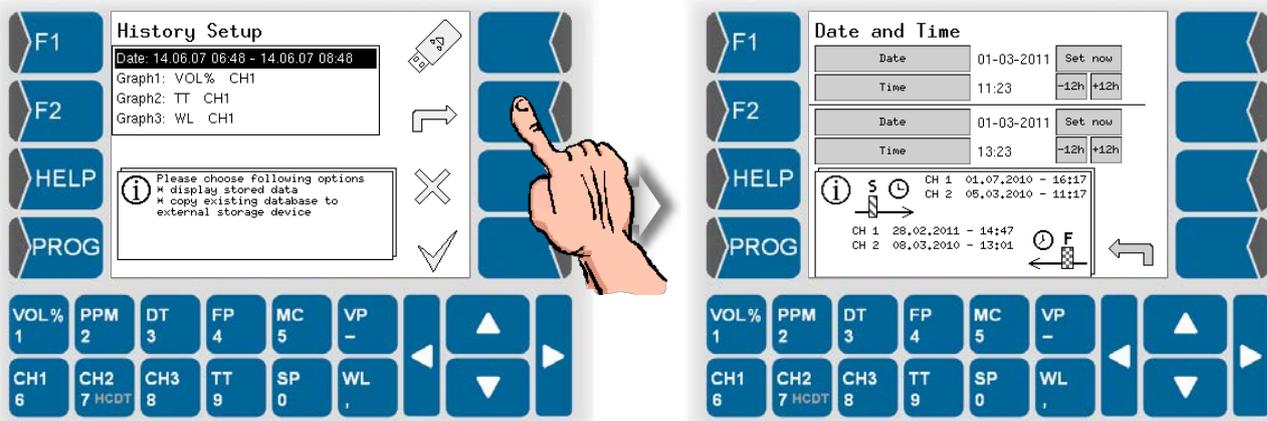
Now you can define the presentation period.

● Touch ⌐Date⌐ and ⌐Time⌐ for the start and the end of the presentation period and enter the required values.
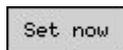
Set now   Use this button to set the current time and date.
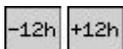
-12h +12h   Use this buttons to change the time in 12 hour steps.

You can enter each othe time and date into the according field.

The time between the start and the end of the presentation period has to be at least 2 hours.

● Touch ✓ to confirm the entries.
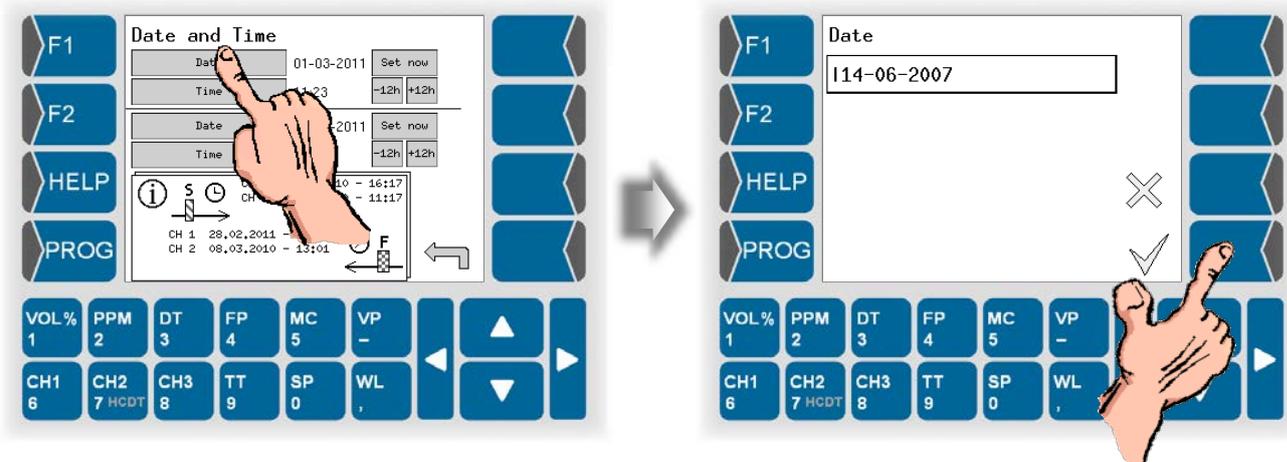
If the presentation period you have defined is too short, a message appears when you leave the history setup.

If you confirm the message by ing $\boxed{\checkmark}$, the period of 2 hours is automatically selected.
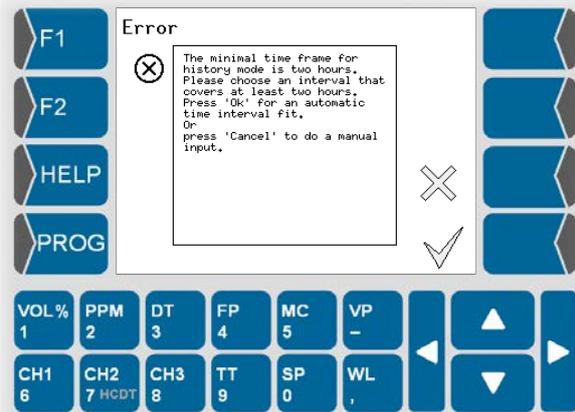
If the selected presentation period includes a period for which no data is available, the following message appears.

If you confirm the message by pressing $\boxed{\checkmark}$, the period is automatically corrected.
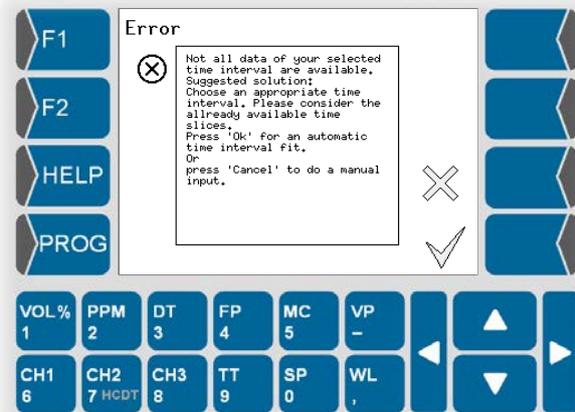
Defining the presentation of the graph

● Select a line for the graph (graph 1 in the example below) and open the dialog for editing the graph.
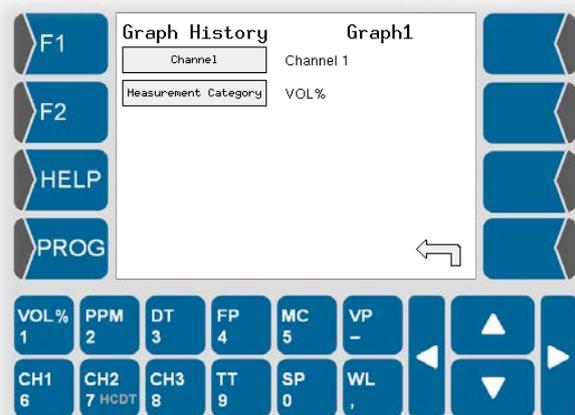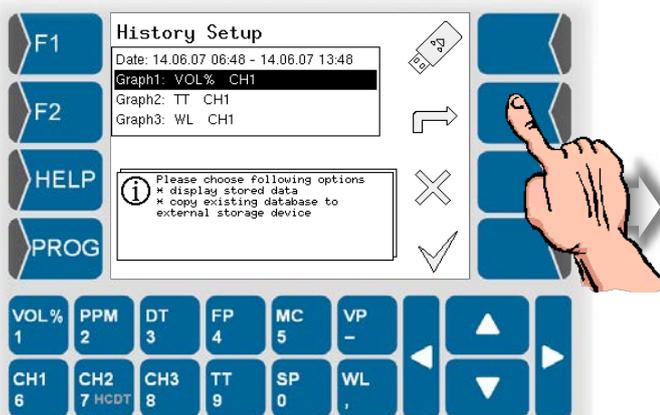
Now you can define the channel and the measurement variable for the selected graph.

● Use △ and ▽ to select the measurement channel whose stored measurement values shall be presented. Touch ✓ to confirm the selection.
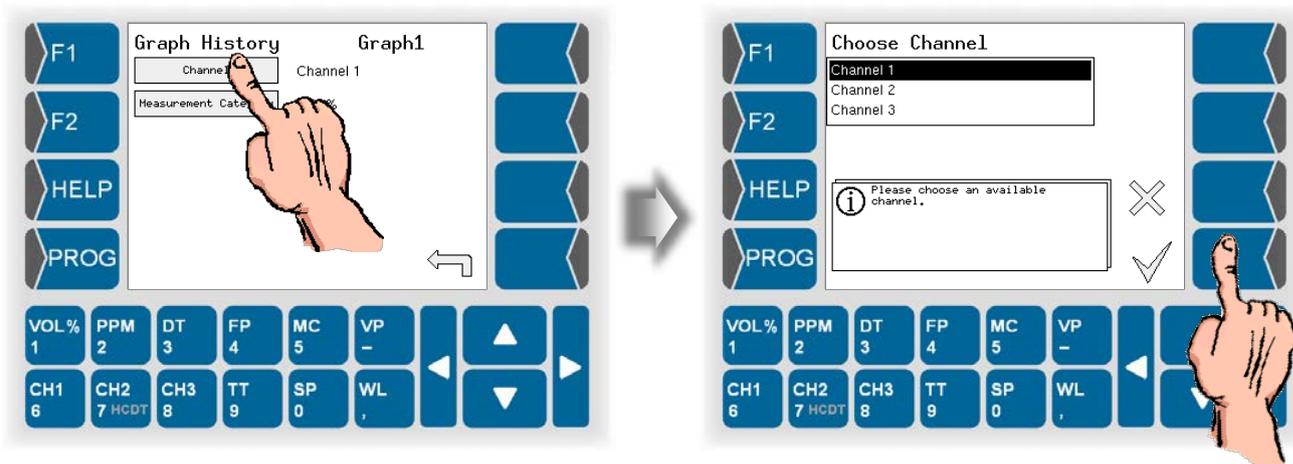
● Open the Measurement category selection.

● Use △ and ▽ to select the measurement variable whose measurement value curve shall be defined for the defined period. Use ✓ to confirm the selection.
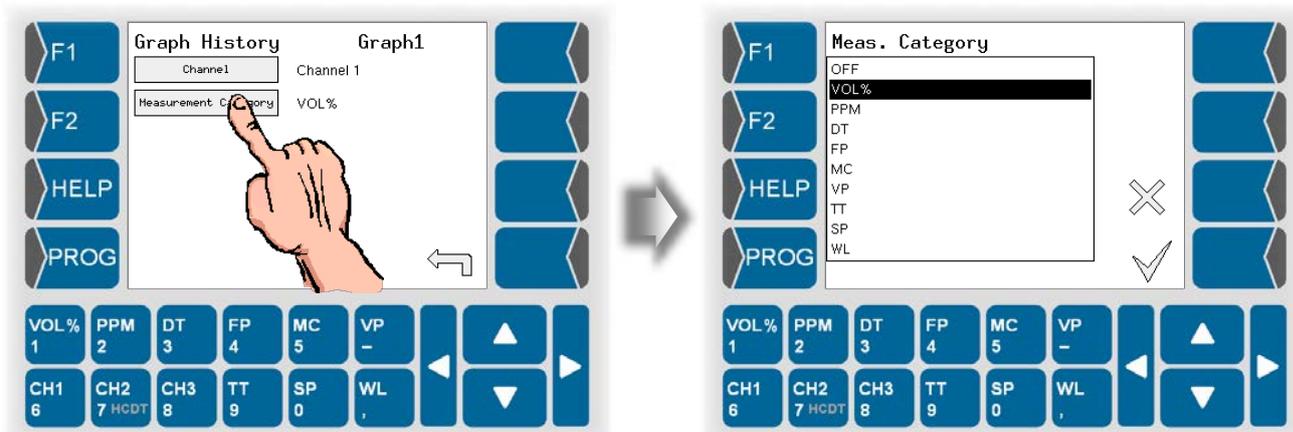

In the same way you can define two further measurement variables whose measurement curve shall be presented for the defined period (graph 2, graph 3).

4.3.5.2 Display the history graphic

● After carrying out all required settings for the graphic history mode, touch $\boxed{\checkmark}$.

If the settings are incorrect, a message will appear (see page 4-10).

If the settings are correct, the history graphic is displayed.
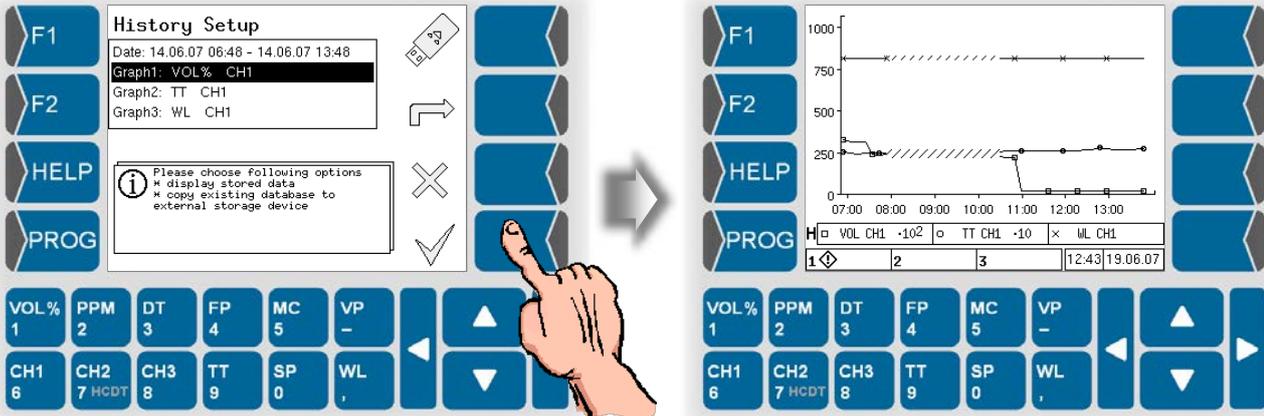
Like in the online graphic mode, the curves are marked with different symbols (x, □, ○). As only one scaling is used for the measurement value axis, the measurement values are multiplied by powers of ten so that they can be presented within the value range of the measurement value scale.

In the line below the graphic, there is information on the three measurement value curves presented. The letter "H" at the beginning of this line stands for „History" and serves to distinguish this mode from the "Online graphic mode" ("O").

Hide Graphs

By touching the three upper keys right of the display you can hide and recall each of the graphs.

● Touch one of the keys right of the display. The current functions of theese keys are displayed.

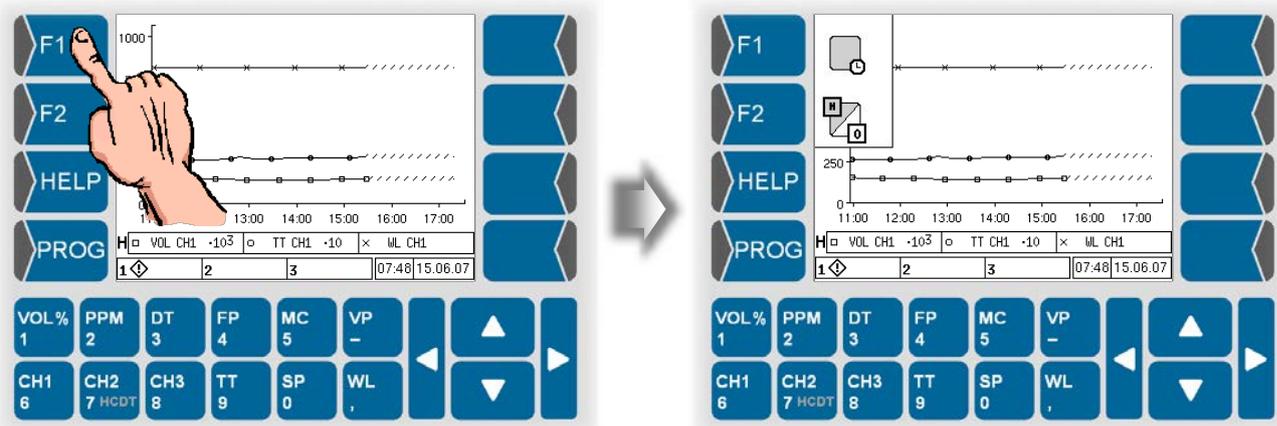● Touch the according key to hide or to display one of the graphs.
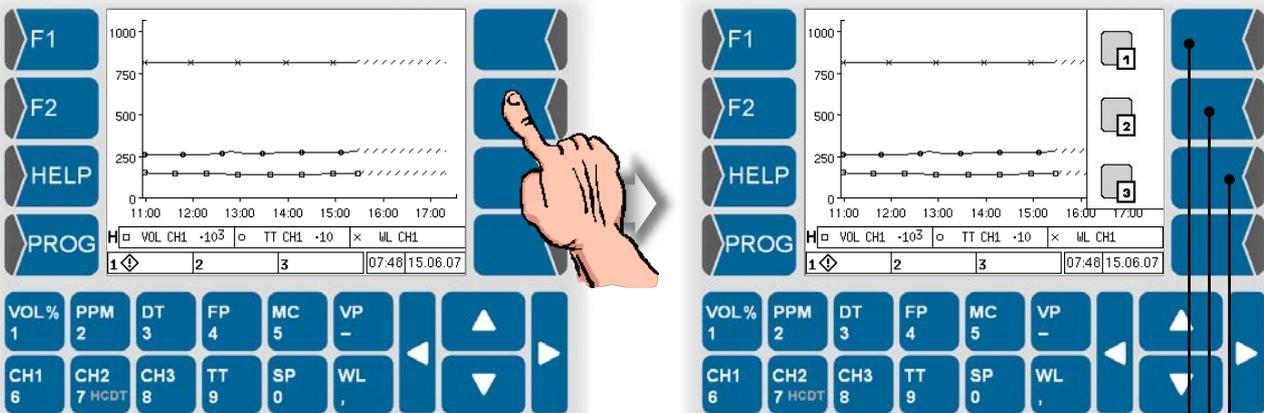
Hide / display graph 1

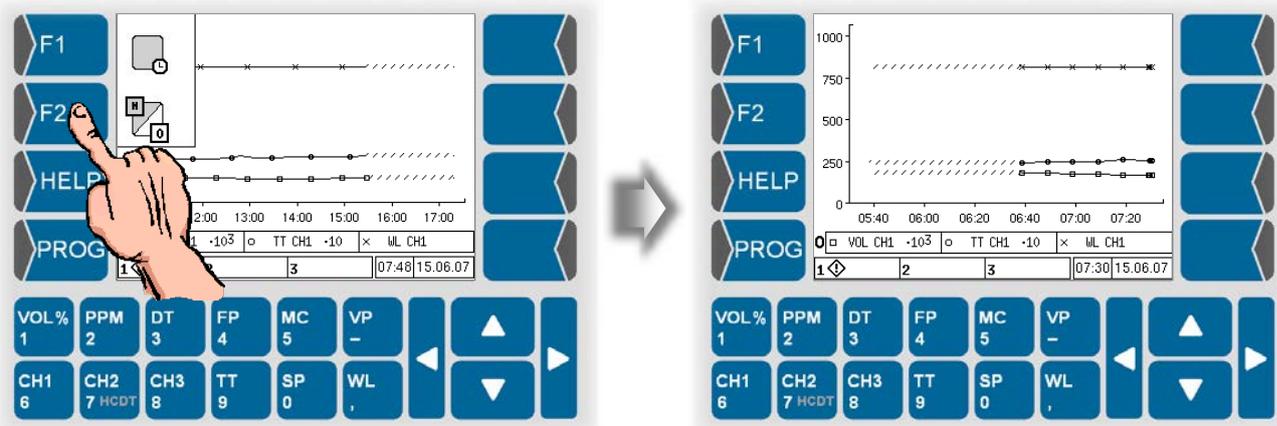Hide / display graph 2

Hide / display graph 3

Changing the display mode

Use $\boxed{F2}$ to switch between the history graphic mode and the online graphic mode.

● Touch $\boxed{F1}$ or $\boxed{F2}$ key. The current functions of theese keys are displayed.

● Then touch $\boxed{F2}$ key, to switch from online graphic mode to history graphic mode or reverse.

Use $\boxed{\triangle}$ and $\boxed{\triangledown}$ to leave the history graphic mode and switch to an online indication mode.
To call up the history graphic mode again, switch to the online graphic mode and then touch $\boxed{F2}$ twice.

4.4 Data export

HYGROPHIL® F 5673 safes the measuring data in a SQLite-database.
You can copy this database via USB-port to an external data medium and if required convert into a .csv file.

4.4.1 Copy data

● Connect the external medium (e.g. USB-stick) to the USB-port at the back of the evaluation unit.

> The data medium must be FAT 32 formatted!

● Call up Hisory-Setup (see section 4.3.5.1).

    ● Touch the key with the USB-stick icon.

Then you can choose to transfer a PC software (data converting program) additionally. For using the data converting program, you must only transfer it once.
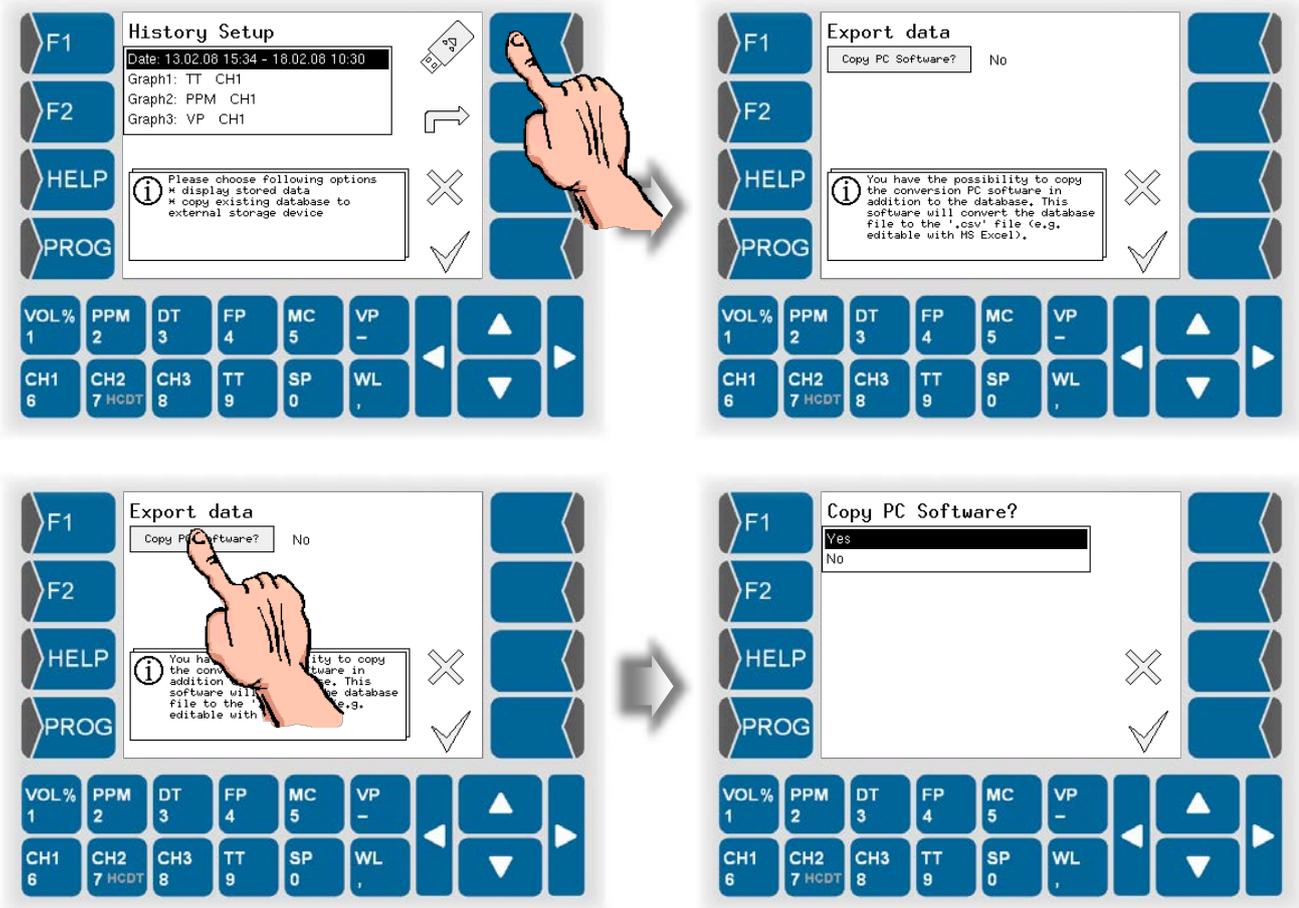
● Start data export with the ☑ key.
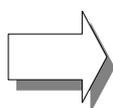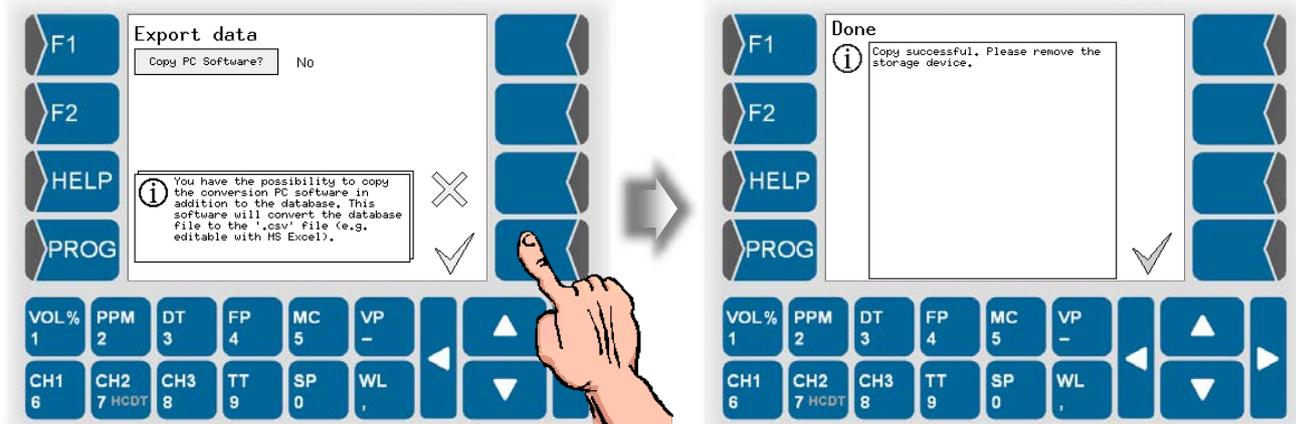
The database is always transferred completely. The defined presentation period for the history graphic display has no influence on the data export.

● For further processing the data connect the data medium to your PC via USB-Port.

4.4.2 Converting data

By using the PC-program that you can transfer additionally to the database you can convert the database to a .csv file. You can open and edit this file in Windows-applications, such as MS Excel, Open Office.

● First unpack the file *hygrodb2csv_win.zip*. It contains the converting program.

● The folder *hygrodb2csv_win* contains the program file *hygrodb2csv_win.exe*. Start this program.

● Choose in the line below „Input Path" the file that is to convert.

● Choose in the line below „Output Path" the folder in which the converted data shall be saved. Instead of the file name „output" you can enter a desired file name.

● Under „Units" select the output format of the measuring values.

● Under „Decimals format" select the kind of decimal separator.

● Start converting with the Convert button.
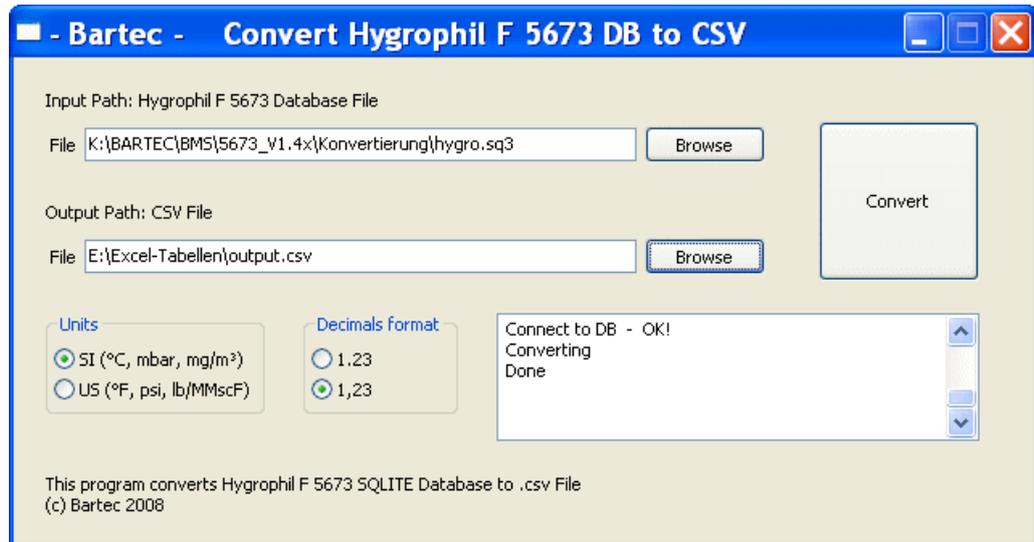
4.4.3 Export service information to an external data medium

For an analysis by your service staff you can export service information to an external data medium. Databases, log files and configuring information will be copied to the data medium. For this purpose open the menu „System Information" (see section 5.6.15).

5 Programming

Various operating parameters and functions can be programmed in order to operate the HYGROPHIL® F 5673 humidity measurement system. You can adjust the measurement system to the given operating requirements and the system environment.

An overview of the menu structure in the programming mode can be found in section 5.5.

5.1 General instructions

In the programming mode, the humidity measurement goes on in the background.
After the return to the display mode, the indication is updated in accordance with the new programming.

The following sections describe the principles of working with the different menus and the parameter settings.

The keys can be assigned different functions whose current meaning is marked by icons.

All keys are touch-sensitive, i.e. you need not press them but only touch them.

| Icon	Meaning	Effect
	Open	The marked menu is opened, for a marked parameter, an entry dialog or a selection dialog is opened.
	Quit menu	You quit the menu that is open at present and change over to the super ordinate menu.
	Abort	You quit the menu that is open at present and change over to the super ordinate menu. Settings/entries already carried out are rejected.
	Correct	In an entry dialog the character left to the cursor is deleted.
	Take over, store	The selected setting of a parameter is confirmed. You quit the menu that is open at present. All settings/entries (also of the subordinate menus) are taken over and stored. **All changes will only be stored if you quit the menu by means of this key!**

5.2 Calling up programming mode

● Touch the $\boxed{\text{PROG}}$ key to call up the programming mode.

Then you must enter the password. The default password is 5673. You can change the password (see section 5.6.16).
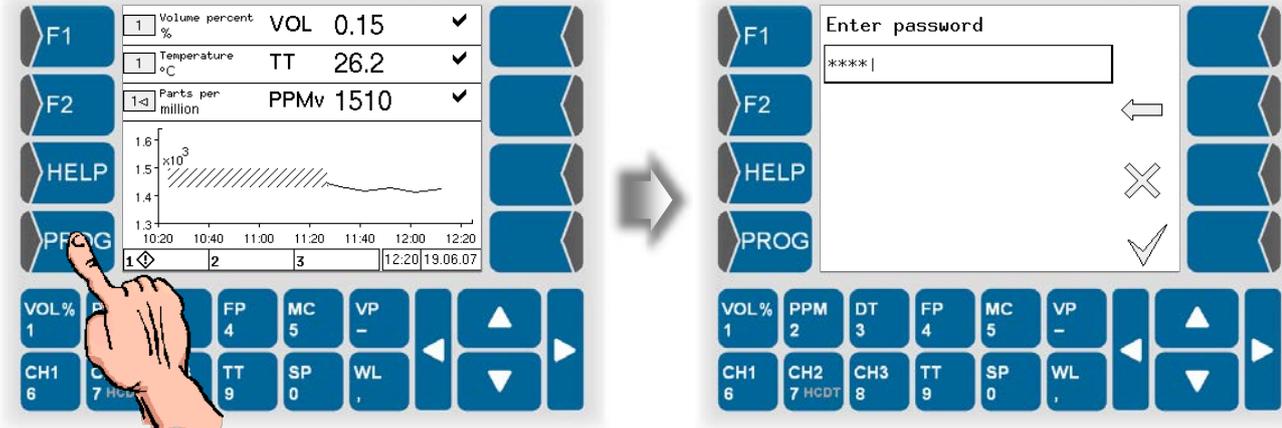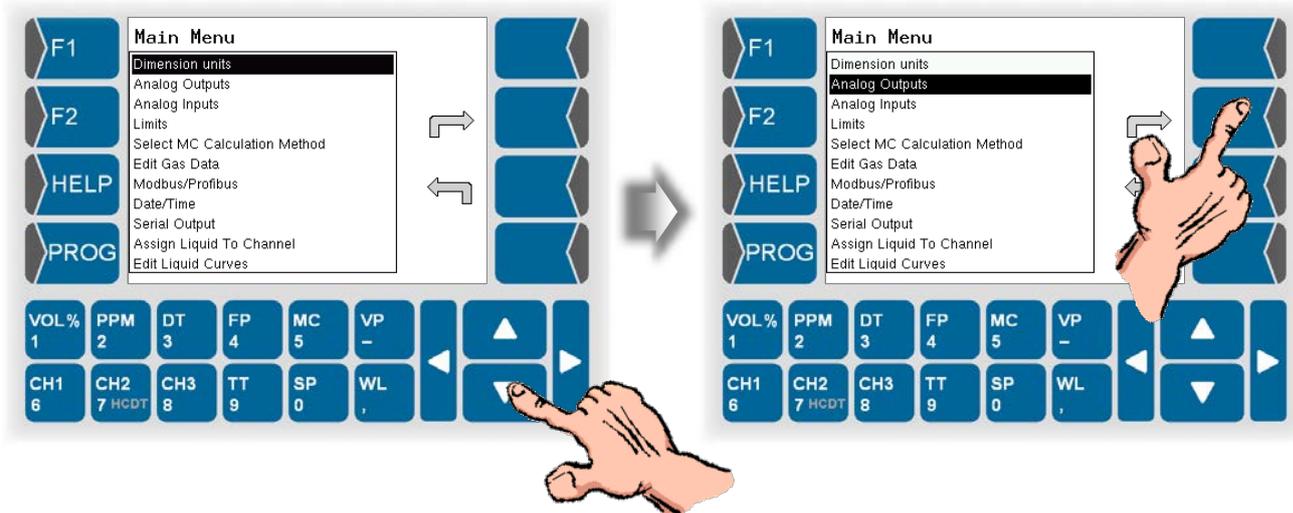

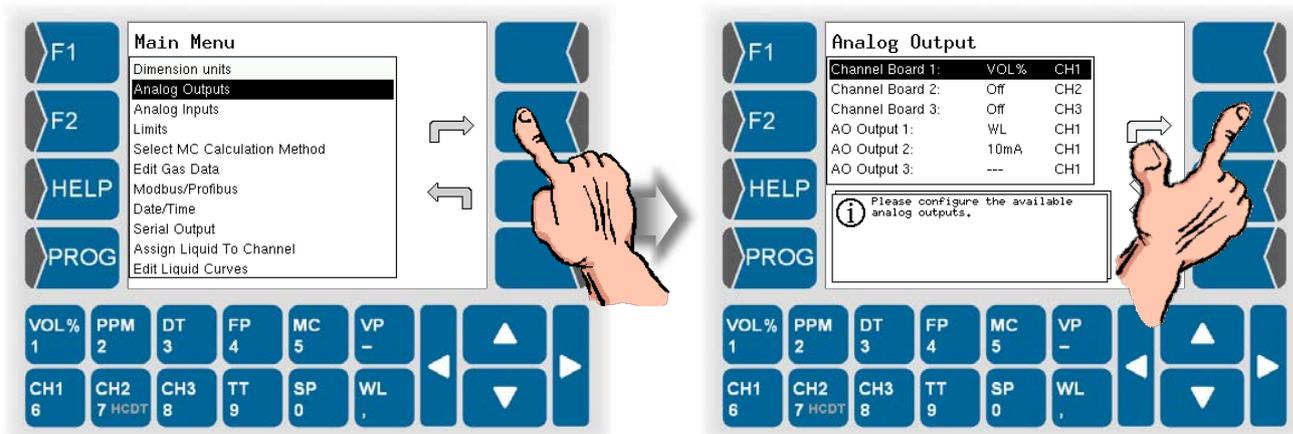● Enter the valid password and confirm it. The main menu will be opened.
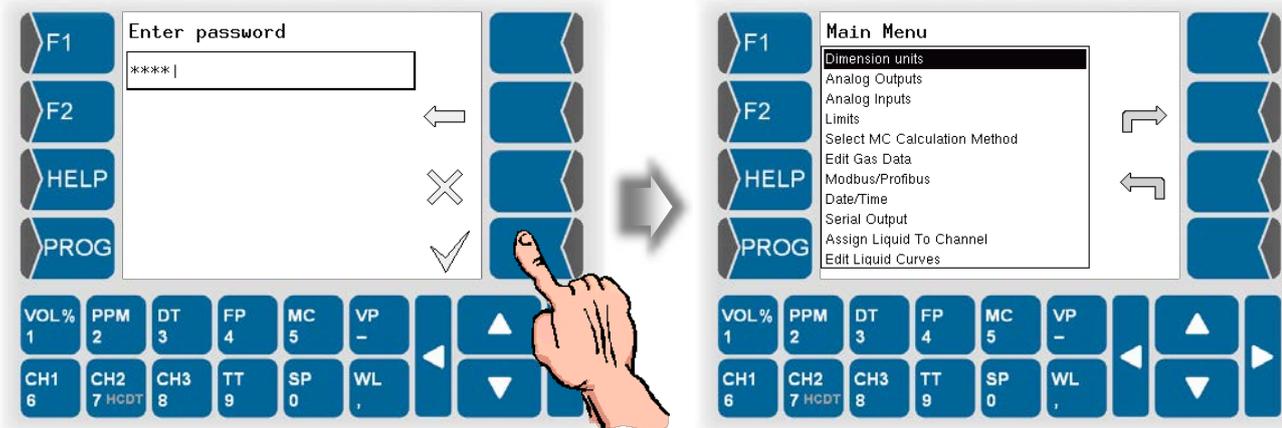
5.3 Selecting and opening the menu

Use △ and ▽ to select the menu to be opened. Then touch the open-key ↵ .

You can open some menus only after having selected a system component (channel board, analogue output).

Touch △ and ▽ to select a system component and then touch ↵ to open the menu.

5.4 Editing parameters

● On the display, touch the field whose parameters you want to edit.
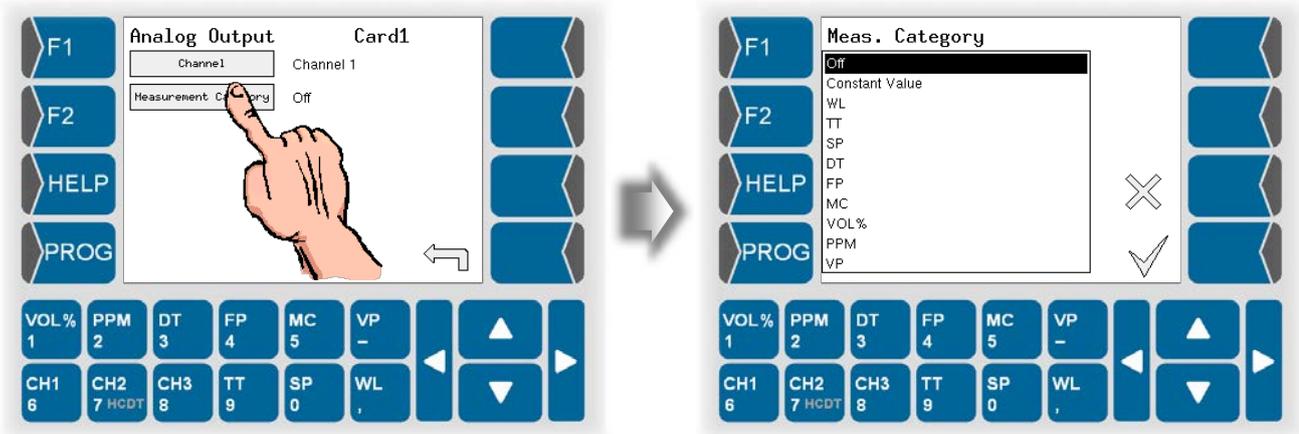
5.4.1 Selecting the parameter setting

● Use △ and ▽ to select the required setting, then confirm the selection.

The change is not saved in the program memory until you also leave the super ordinate menu by using ✓.

5.4.2   Selecting the parameters for editing
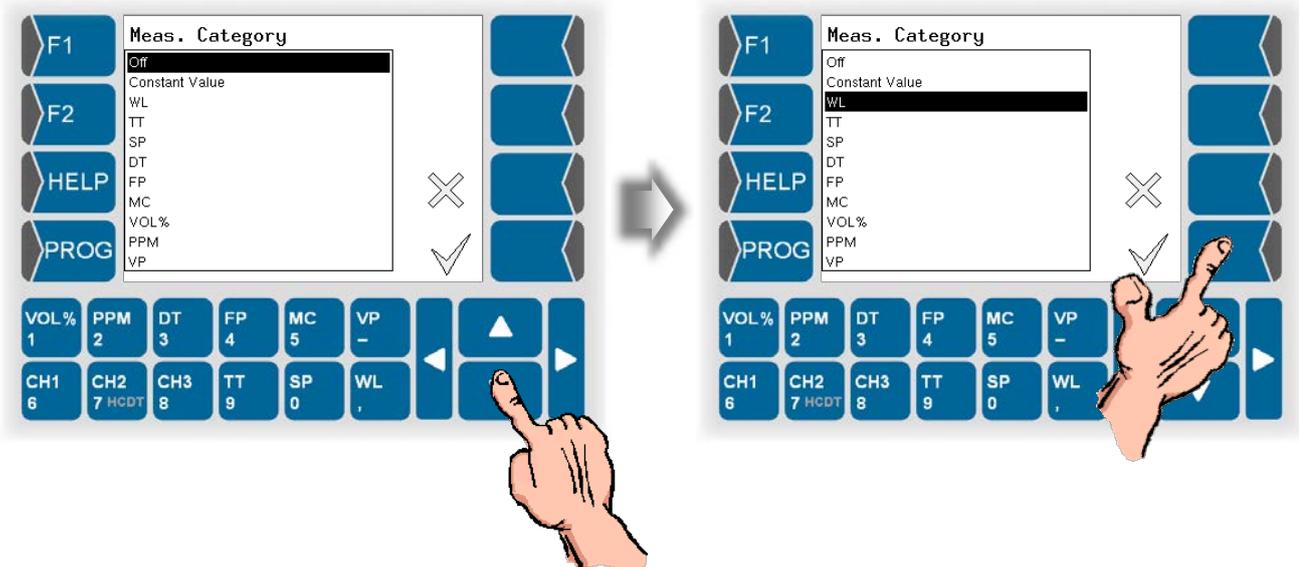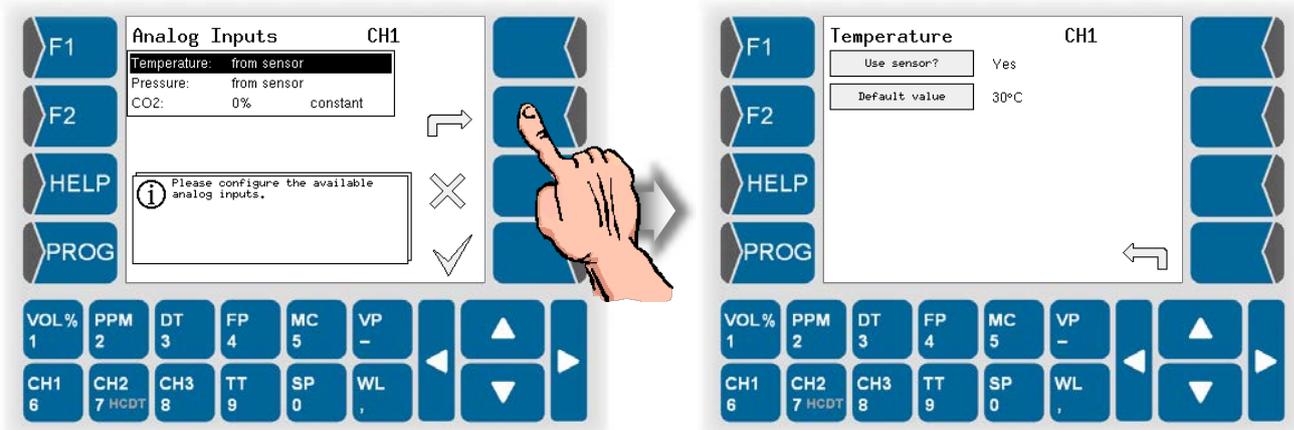
If the menu contains several parameters which can be edited individually, first select the parameter and then touch ⟶ to open the appropriate editing dialog.

Now you can edit the settings of this parameter.
Either a selection dialog (see section 5.4.1) or an entry dialog for the entry of numerical values (see section 5.4.3) is opened.

5.4.3   Numerical entries

You can enter numerical values by means of the keys below the display.
The value that was set up to now is displayed after opening the dialog.

Use ◁ and ▷ to change the position of the cursor.
The delete key (arrow pointing to the left) is available for carrying out corrections. If you touch this key, the character left to the cursor is deleted.

Touch the OK key to confirm the entry.

5.5   Structure of the programming menu

```
PROG
 │
 ├──── Dimension units ─────┬──── Temperature TT / DT / FP ──── ° Celsius
 │                          │                                   ° Fahrenheit
 │                          │                                   Kelvin
 │                          │
 │                          ├──── Pressure SP / VP ──────────── Pa
 │                          │                                   hPa
 │                          │                                   kPa
 │                          │                                   bar
 │                          │                                   mbar
 │                          │                                   psi
 │                          │
 │                          └──── Moisture MC ───────────────── mg/m³
 │                                                              lb/MMscF
 │
 │
 ├──── Analog outputs
 │         │
 │      Channel Board 1 ────┬──── Channel ──────────────────── Channel 1
 │      Channel Board 2     │                                   Channel 2
 │      Channel Board 3     │                                   Channel 3
 │                          │
 │                          ├──── Measurement Category ──────── Off
 │                          │                                   Constant Value
 │                          │                                   WL
 │                          │                                   TT
 │                          │                                   SP
 │                          │                                   DT
 │                          │                                   FP
 │                          │                                   MC
 │                          │                                   VOL%
 │                          │                                   PPM
 │                          │                                   VP
 │                          │
 │                          ├──── Minimum
 │                          │
 │                          ├──── Maximum
 │                          │
 │                          ├──── 0/4...20 mA ───────────────── 0...20 mA
 │                          │                                   4...20 mA
 │                          │
 │                          ├──── invers ────────────────────── Yes
 │                          │                                   No
 │                          │
 │                          └──── source/sink ───────────────── source
 │                                                              sink
 ┆
```
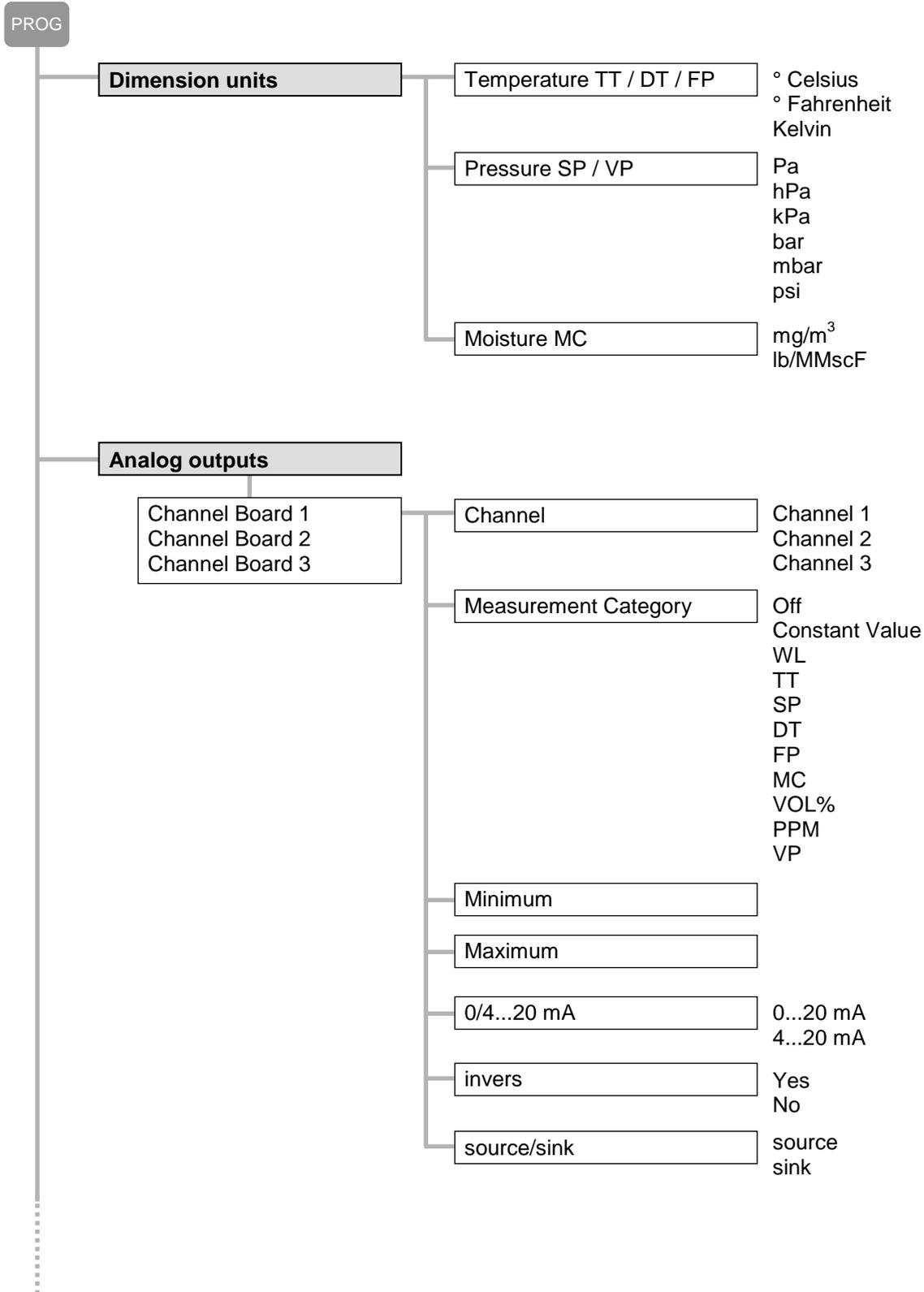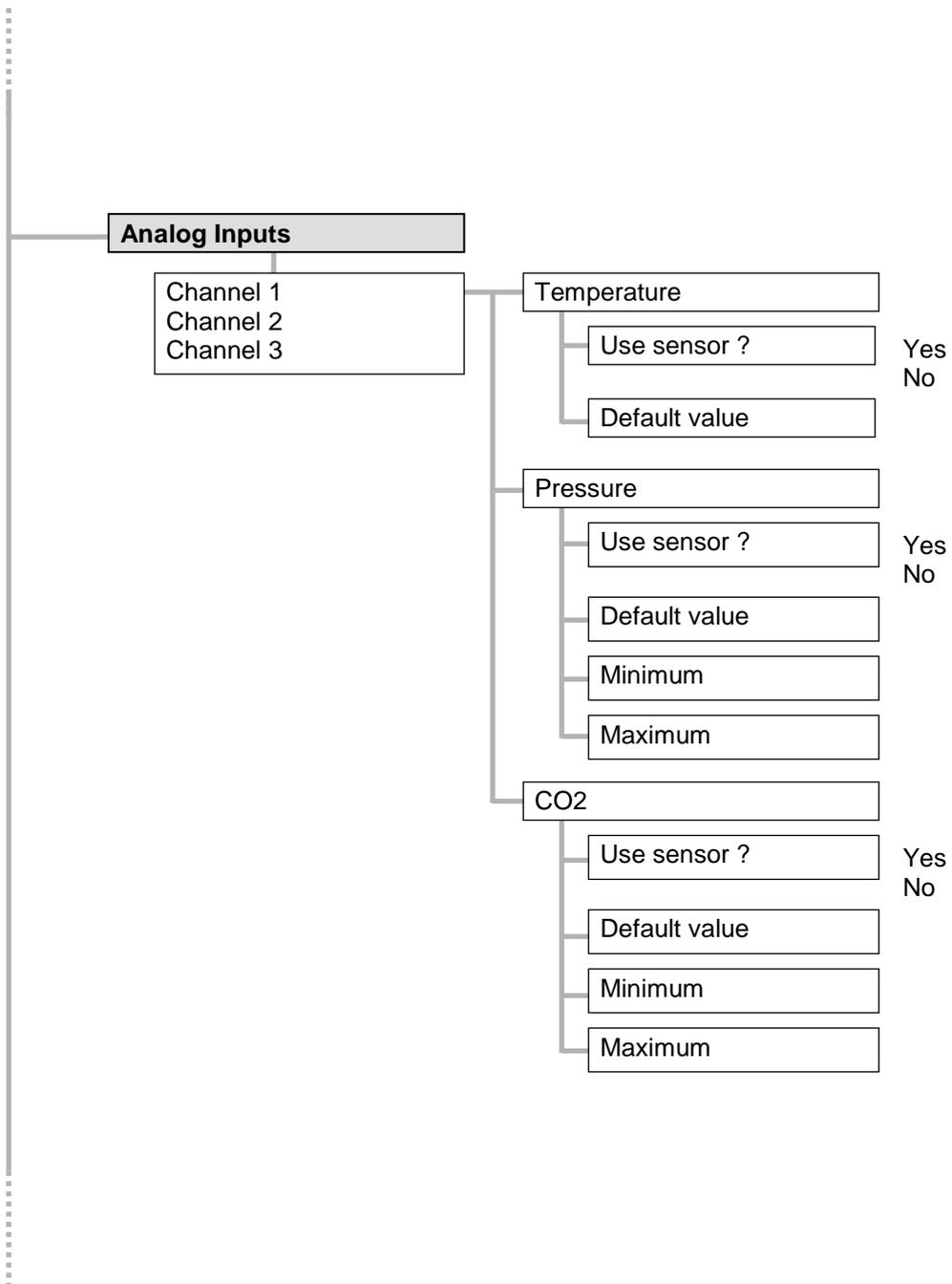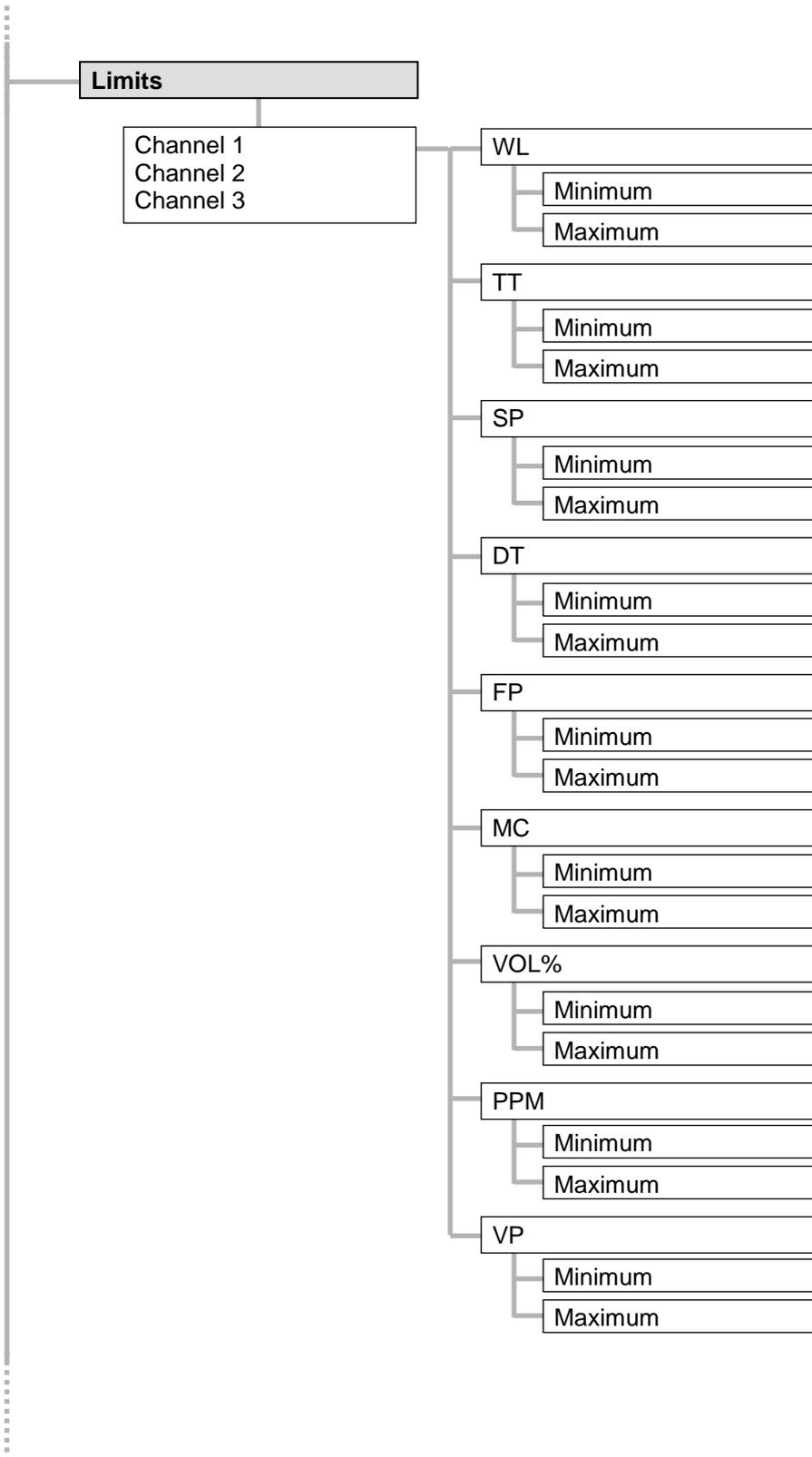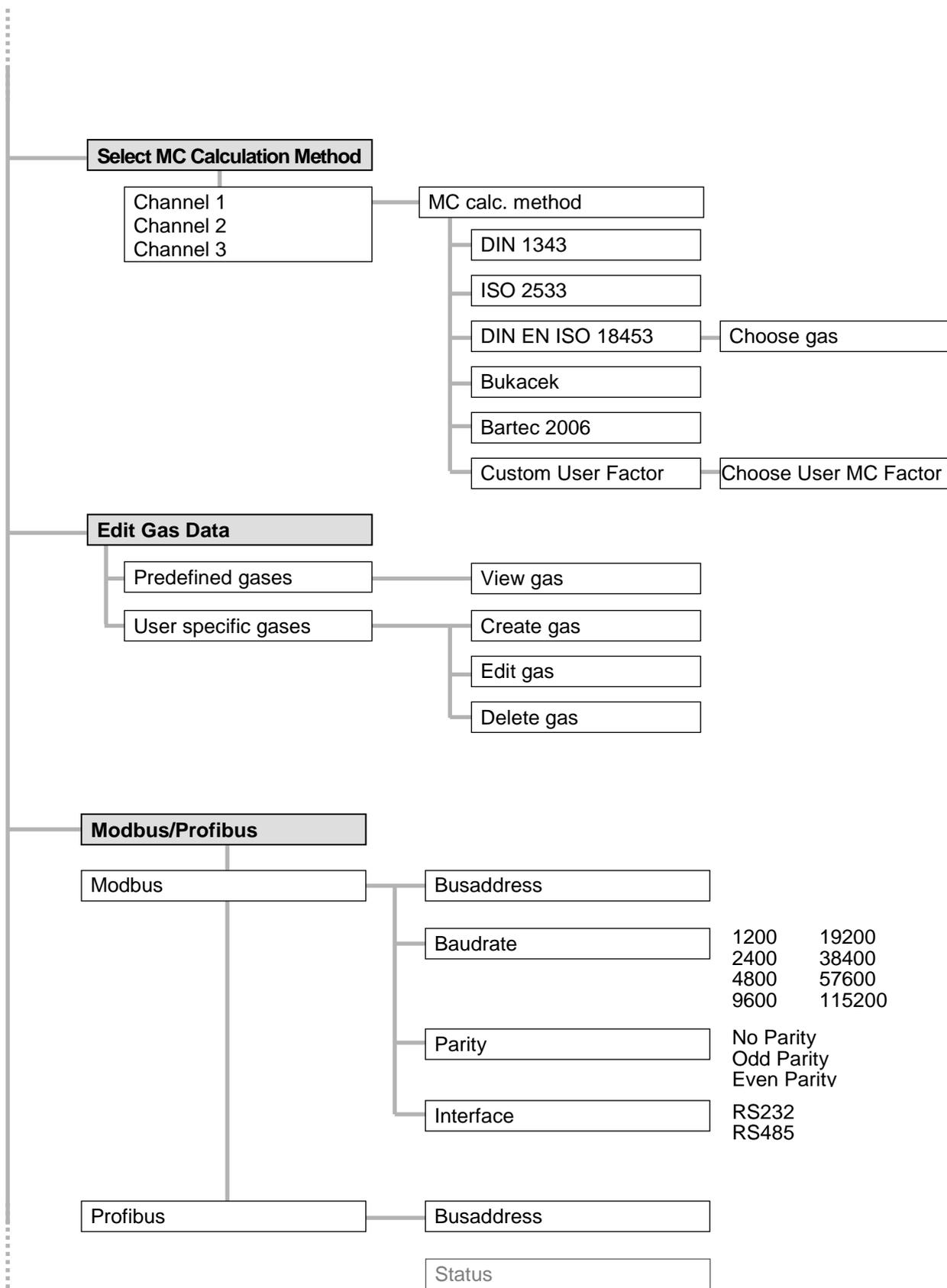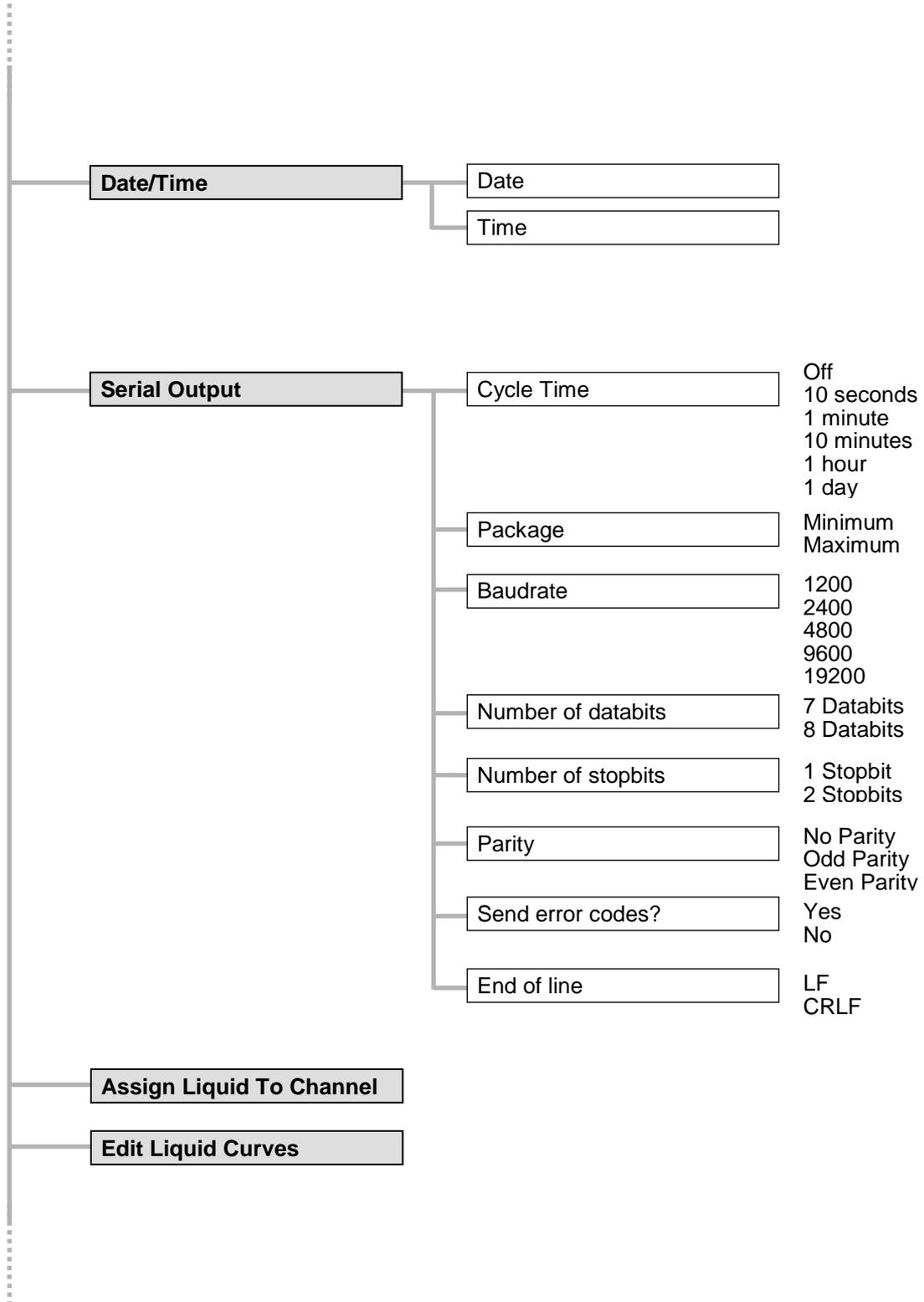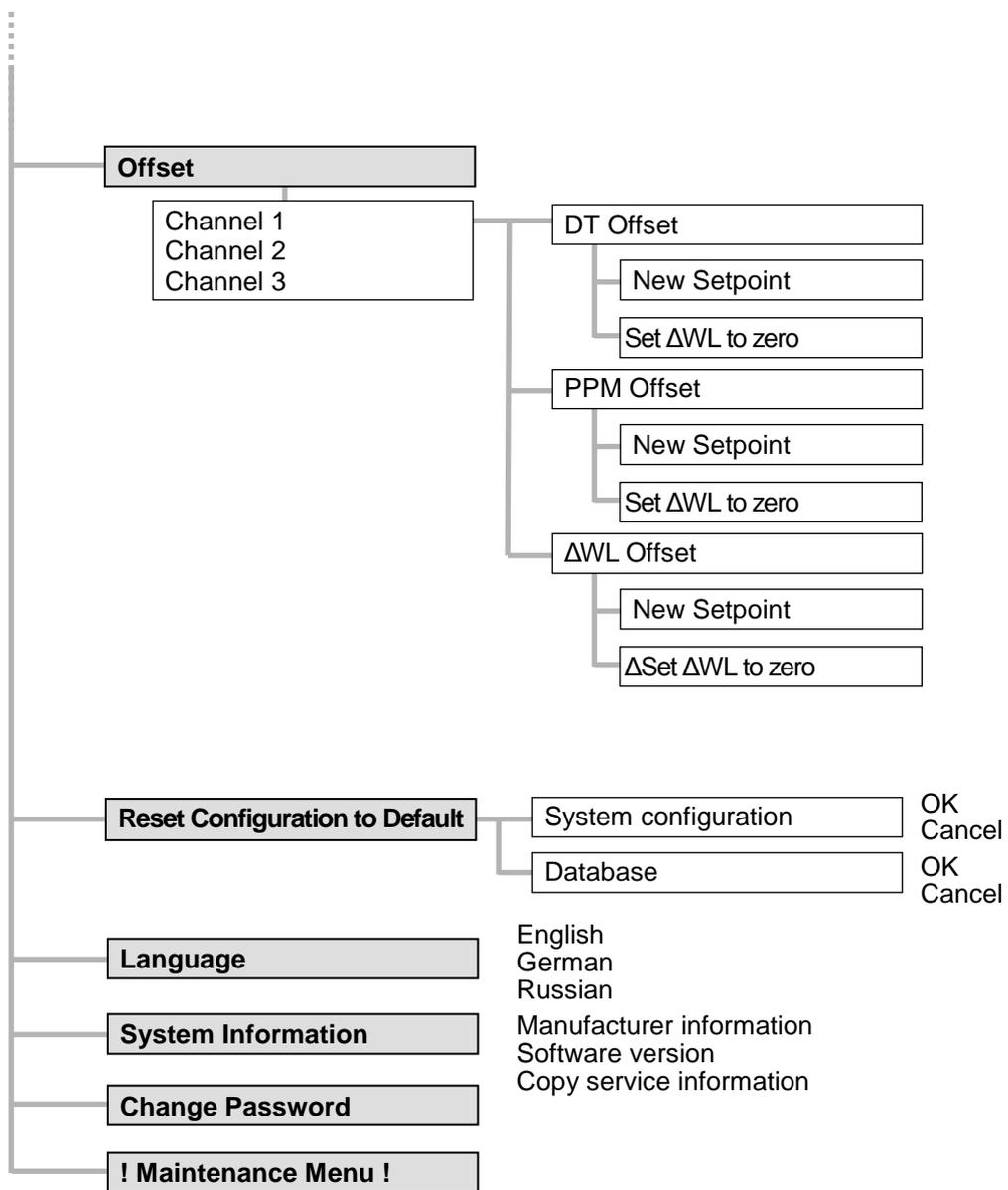
Temperature TT / DT / FP — ° Celsius, ° Fahrenheit, Kelvin

Pressure SP / VP — Pa, hPa, kPa, bar, mbar, psi

Moisture MC — mg/m^3, lb/MMscF

Channel — Channel 1, Channel 2, Channel 3

Measurement Category — Off, Constant Value, WL, TT, SP, DT, FP, MC, VOL%, PPM, VP

0/4...20 mA — 0...20 mA, 4...20 mA

invers — Yes, No

source/sink — source, sink

Analog Inputs

Channel 1
Channel 2
Channel 3

Temperature

Use sensor ? Yes
No

Default value

Pressure

Use sensor ? Yes
No

Default value

Minimum

Maximum

CO2

Use sensor ? Yes
No

Default value

Minimum

Maximum

```
Limits
     │
     ├── Channel 1        ┌── WL
     │   Channel 2        │      ├── Minimum
     │   Channel 3        │      └── Maximum
     │                    │
     │                    ├── TT
     │                    │      ├── Minimum
     │                    │      └── Maximum
     │                    │
     │                    ├── SP
     │                    │      ├── Minimum
     │                    │      └── Maximum
     │                    │
     │                    ├── DT
     │                    │      ├── Minimum
     │                    │      └── Maximum
     │                    │
     │                    ├── FP
     │                    │      ├── Minimum
     │                    │      └── Maximum
     │                    │
     │                    ├── MC
     │                    │      ├── Minimum
     │                    │      └── Maximum
     │                    │
     │                    ├── VOL%
     │                    │      ├── Minimum
     │                    │      └── Maximum
     │                    │
     │                    ├── PPM
     │                    │      ├── Minimum
     │                    │      └── Maximum
     │                    │
     │                    └── VP
     │                           ├── Minimum
     │                           └── Maximum
```

Select MC Calculation Method

Channel 1
Channel 2
Channel 3

MC calc. method

DIN 1343

ISO 2533

DIN EN ISO 18453 → Choose gas

Bukacek

Bartec 2006

Custom User Factor → Choose User MC Factor

Edit Gas Data

Predefined gases → View gas

User specific gases → Create gas

Edit gas

Delete gas

Modbus/Profibus

Modbus → Busaddress

Baudrate

1200	19200
2400	38400
4800	57600
9600	115200

Parity
No Parity
Odd Parity
Even Parity

Interface
RS232
RS485

Profibus → Busaddress

Status

Date/Time
- Date
- Time

Serial Output
- Cycle Time
  - Off
  - 10 seconds
  - 1 minute
  - 10 minutes
  - 1 hour
  - 1 day
- Package
  - Minimum
  - Maximum
- Baudrate
  - 1200
  - 2400
  - 4800
  - 9600
  - 19200
- Number of databits
  - 7 Databits
  - 8 Databits
- Number of stopbits
  - 1 Stopbit
  - 2 Stopbits
- Parity
  - No Parity
  - Odd Parity
  - Even Parity
- Send error codes?
  - Yes
  - No
- End of line
  - LF
  - CRLF

Assign Liquid To Channel

Edit Liquid Curves

Offset

Channel 1
Channel 2
Channel 3

DT Offset

New Setpoint

Set ΔWL to zero

PPM Offset

New Setpoint

Set ΔWL to zero

ΔWL Offset

New Setpoint

ΔSet ΔWL to zero

Reset Configuration to Default

System configuration

OK
Cancel

Database

OK
Cancel

Language

English
German
Russian

System Information

Manufacturer information
Software version
Copy service information

Change Password

! Maintenance Menu !

5.6   Program parameters

In this section the meaning of the individual parameters of all menus is explained.

5.6.1   Dimension units

In this menu you can define the dimensions units for temperature, pressure and moisture content.

Measurement variable	Dimension
Temperature TT / DT / FP	°Celsius °Fahrenheit Kelvin
Pressure SP / VP	Pa hPa kPa bar mbar psi
Moisture Content MC	mg/m^3 lb/MMscF

5.6.2   Analog outputs

● Open the menu „Analog outputs".First select an analog output of a channel board or an analog output of the COM-board to be programmed.
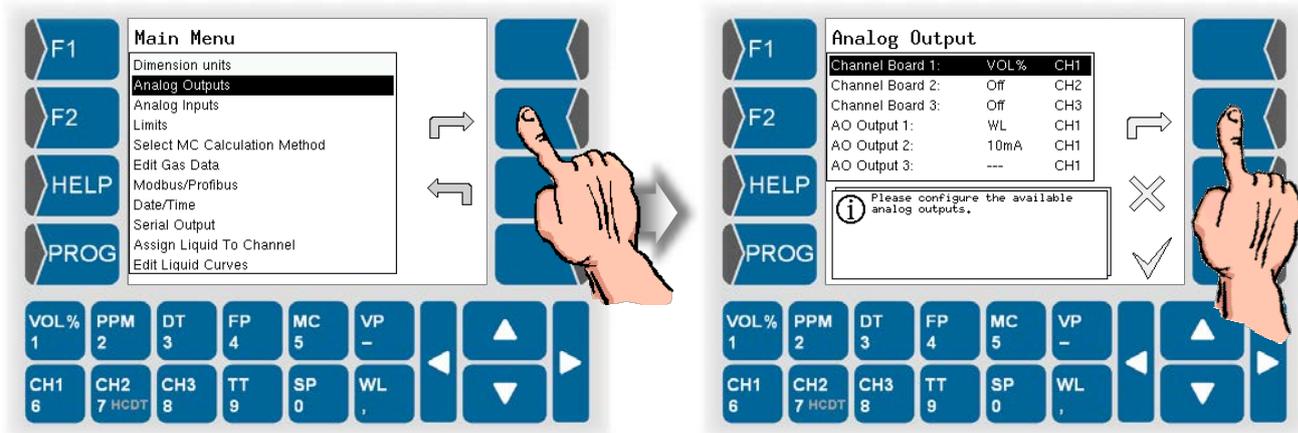
Then the programming of the selected analog output takes place.
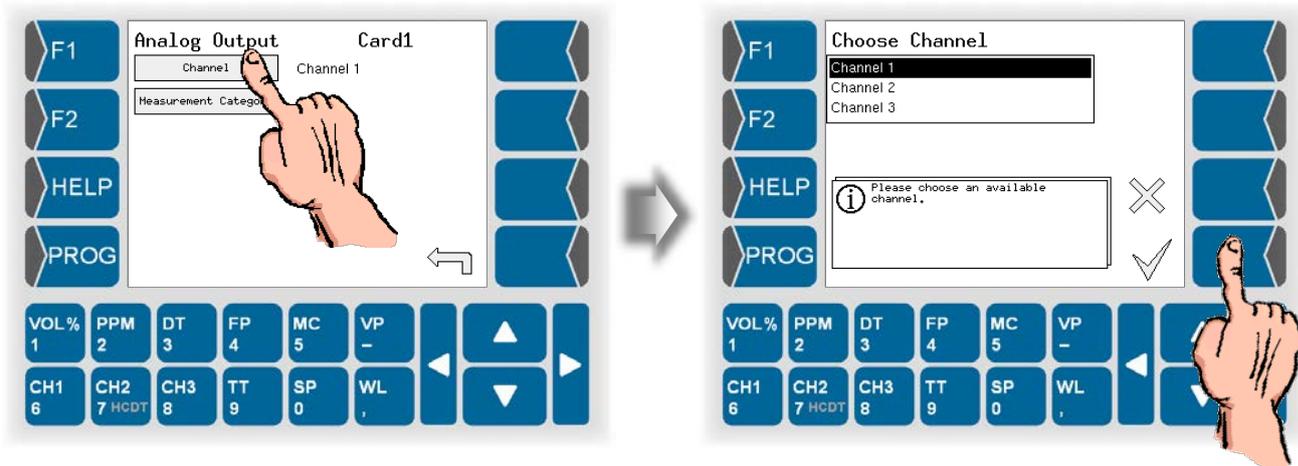
Channel   Select one of the three possible measurement channels for the analog output.
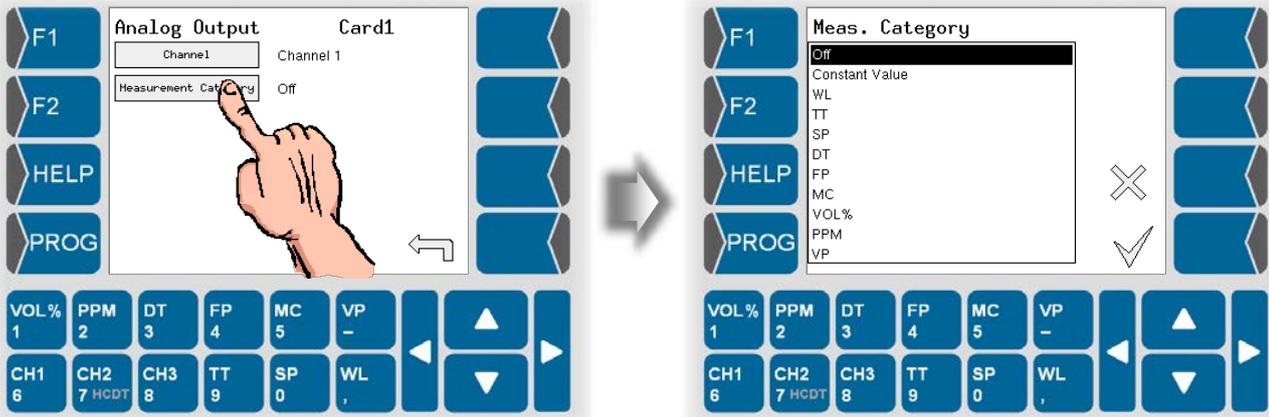
Measurement Category | Select the measurement variable to be issued at the selected analog output.

With the "**Off**" setting happens no current output at the selected analog output. In this case are no further parameter settings available (see fig. above).

You can define a **constant value** to be output continual instead of a measuring variable. In this case you must just define the value in the range of 0...20 mA.
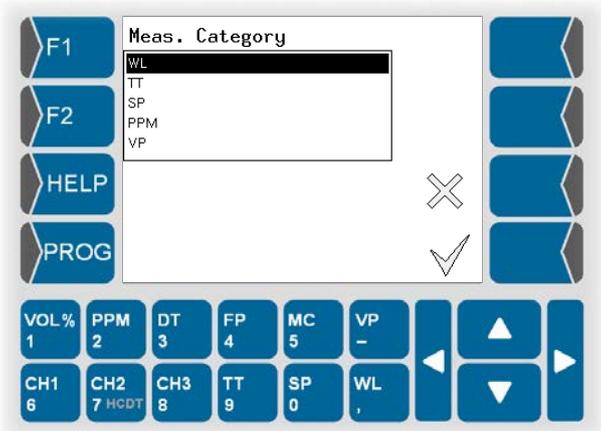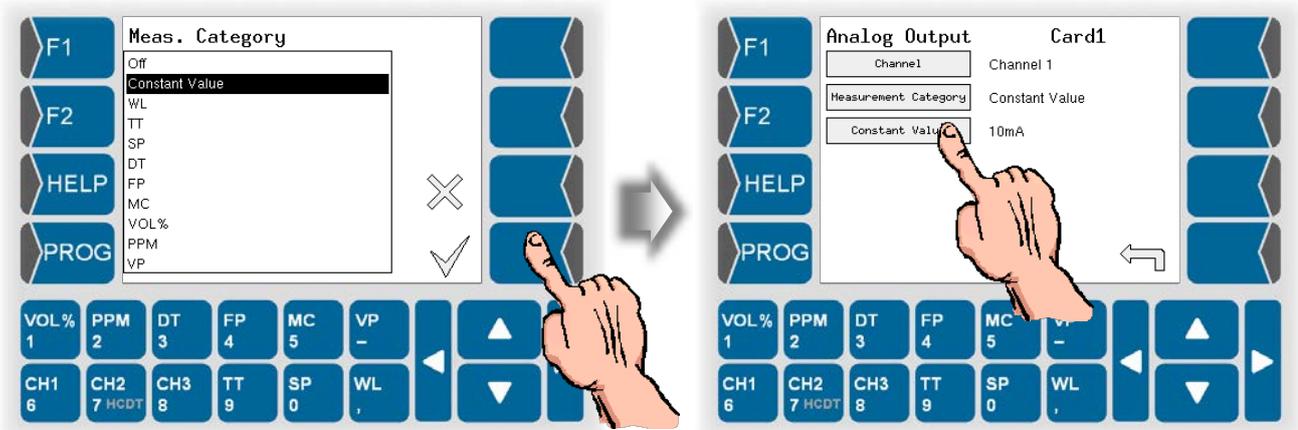
When measuring in liquids are only this measuring categories available.

If you have selected a **measuring variable** to be output at the selected analog output, you must configure further parameters.
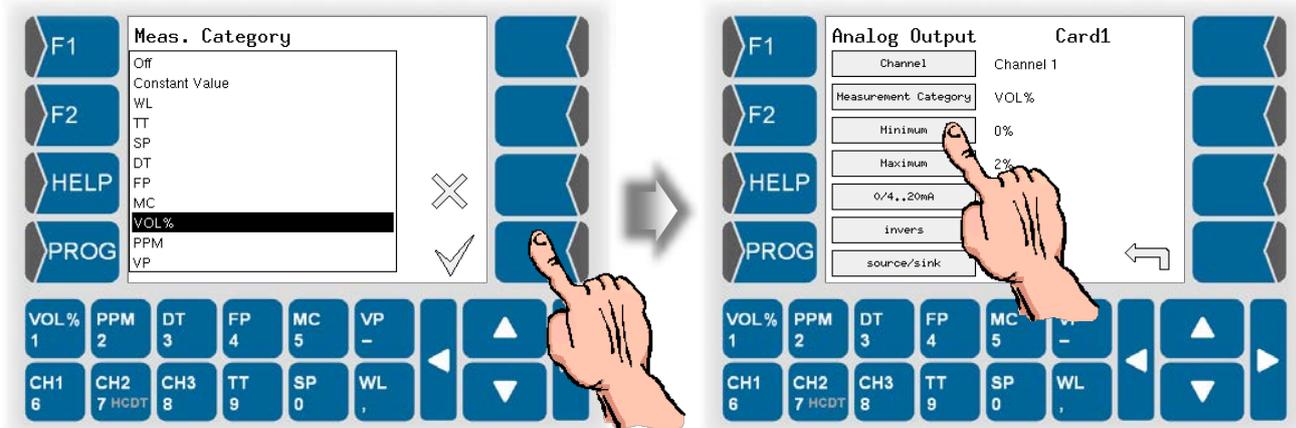
For each measurement variable you can define a measurement value range to be evaluated This range has to be within the possible total measurement range. You can define the measurement value range with the parameters „Minimum" and „Maximum".

Minimum	Setting of the minimum value for the measurement variable displayed at the analog output. This value corresponds to 0 and 4 mA respectively.
Maximum	Setting of the maximum value for the measurement variable displayed at the analog output. This value corresponds to 20 mA.
0/4...20	Select the output current range for the analog output (0...20 mA or 4...20 mA).
invers	If you invert the analog output, the output current is issued inversely proportional to the measured value.
source / sink	The current signal can function as a source (current is issued) or as sink (current is consumed). *This parameter is available for the analog outputs of the three channel boards. With the analog outputs of the COM board („AO output 1...3") is the output signal always „source".*

5.6.3 Analog inputs

- Open the menu „Analog Inputs".

- Choose which one of the three measurement channels you want to program.
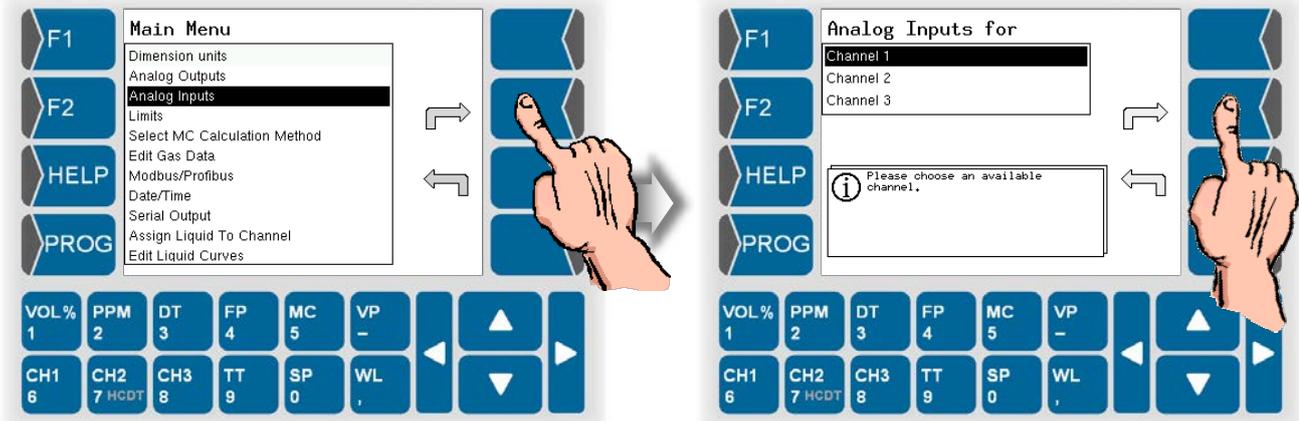
- Then select the measurement variable to be measured via the selected measurement channel.

5.6.3.1 Temperature

- Define whether to use a temperature sensor or not.

- Under Default value, enter a fixed value. This fixed value will be applied if no sensor is used.
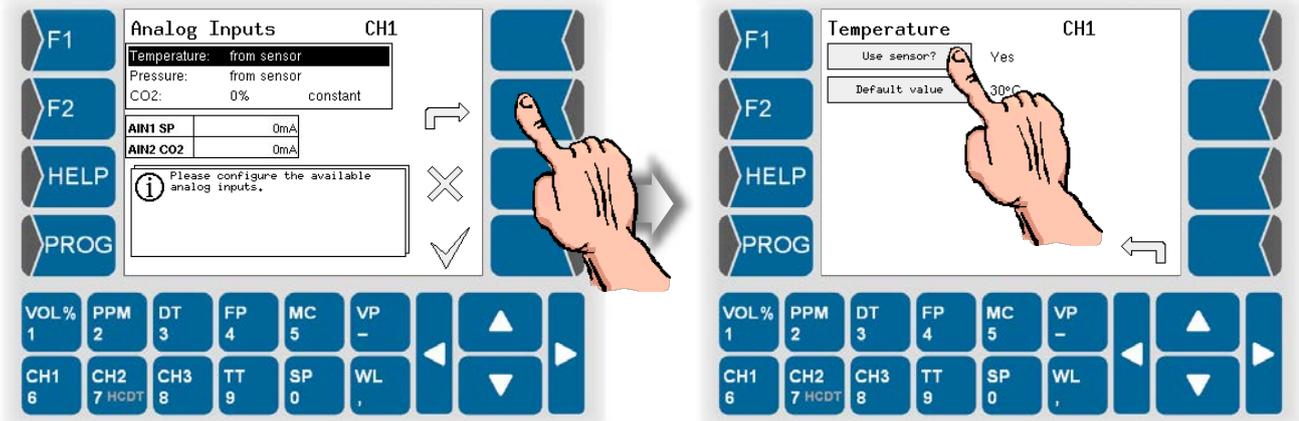
5.6.3.2 Pressure
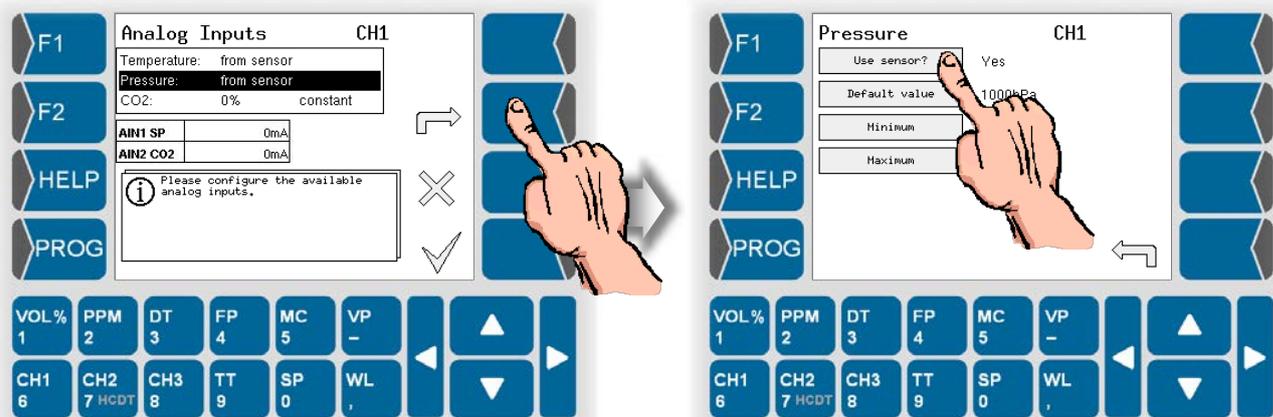
- Define whether to use a pressure sensor or not.

- Under Default value, enter a fixed value. This fixed value will be applied if no sensor is used.

- Define the measurement range for the current input of pressure.
  The minimum value corresponds to an input current of 0 and 4 mA respectively, the maximum value corresponds to 20 mA.

5.6.3.3 CO₂ content
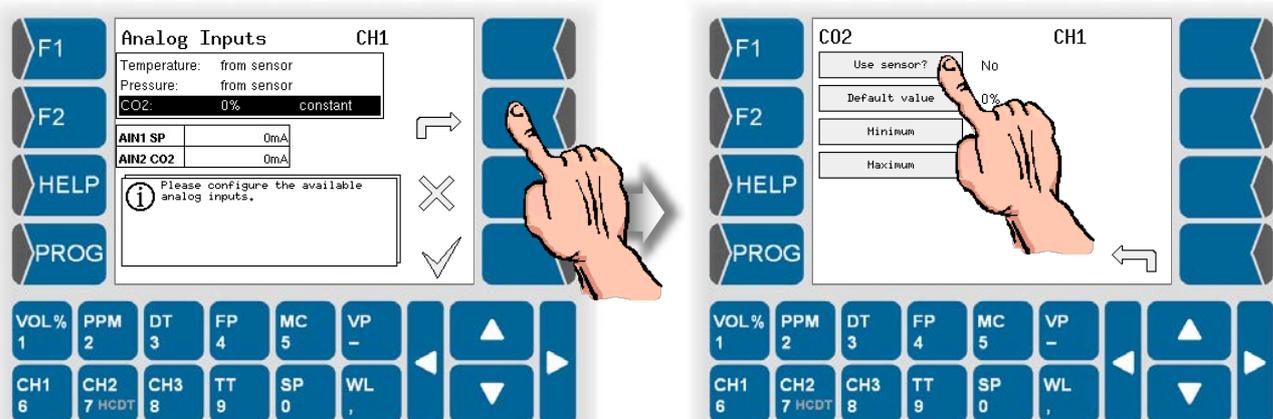
- Define whether to use a CO_2 sensor or not.

- Under Default value, enter a fixed value. This fixed value will be applied if no sensor is used.

- Define the measurement range for the current input of CO_2 content. The minimum value corresponds to an input current of 0 and 4 mA respectively, the maximum value corresponds to 20 mA.

Default values

The fixed value that is entered for a measuring variable will be applied if no sensor is used.
If a sensor should be used but is not connected or if a connected sensor is defective, the fixed value will automatically be used. If a fixed value is used, an asterisk appears behind the measured value in the display
(see section 4.3.1.4).

5.6.4 Limits

It can be checked whether the values that have been measured or calculated do not infringe the limit values.

● Open the menu „Limits".

● Choose which one of the three measurement channels you want to program.
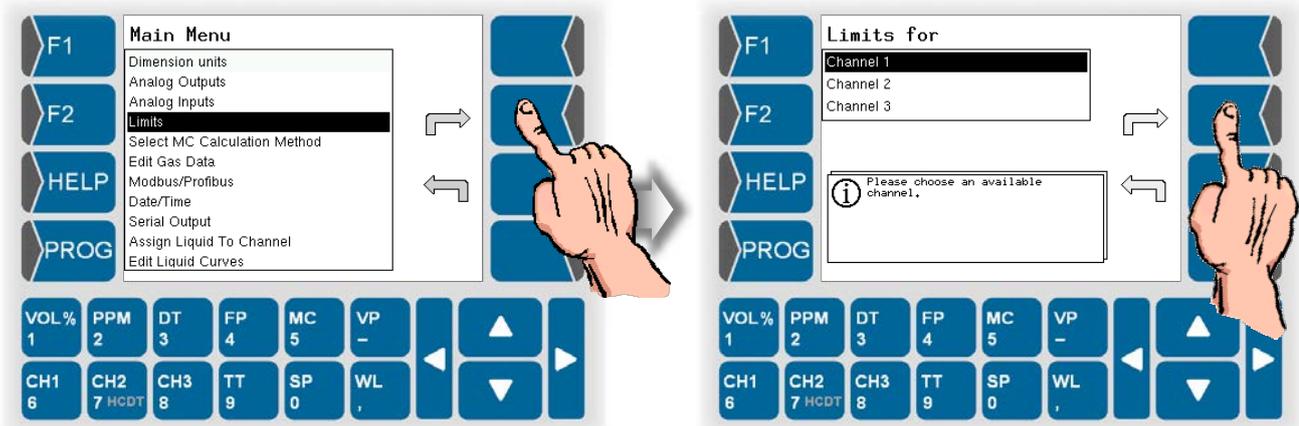
● Select the measurement variable. The currently valid limits are displayed.

● Enter the required minimum and maximum values.
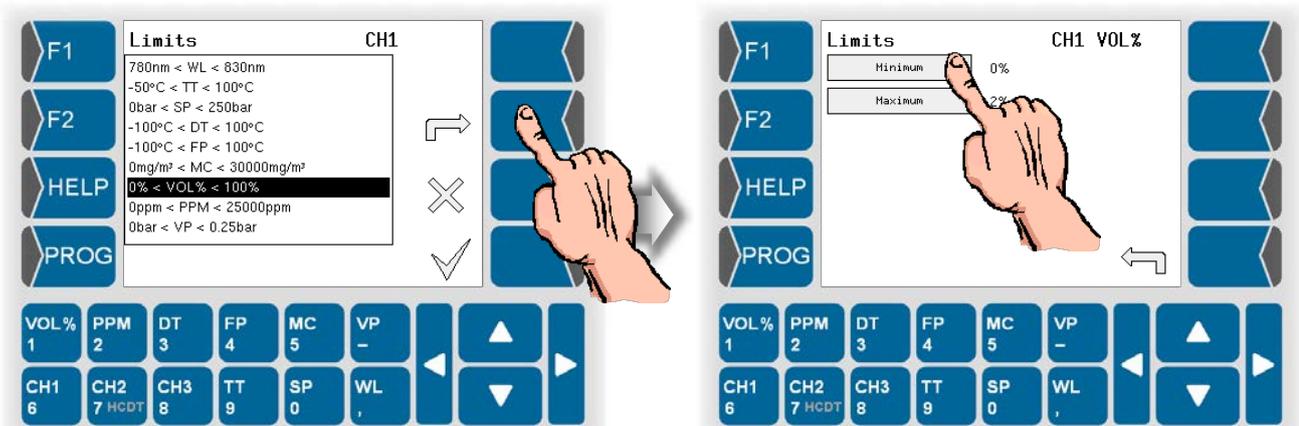
If a value either exceeds or falls below any limits, a signal is issued via an optocoupler.
Icons in the display show that a limit has been exceeded or fallen below (see section 4.3.1.5 and 4.3.1.7).

5.6.5 Selecting the MC Calculation Method

When using HYGROPHIL® F 5673 you can select different methods for calculating the moisture content MC [mg/m³, lb/MMscf].

● Open the menu „Select MC Calculation Method".

● Choose one of the available channels for the MC-calculation.
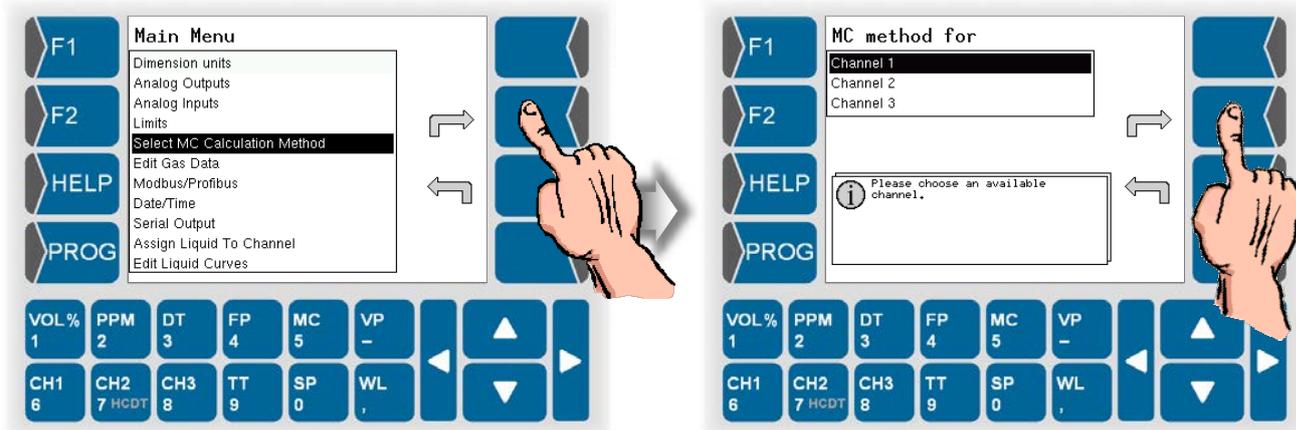
● Select the method for calculation MC.
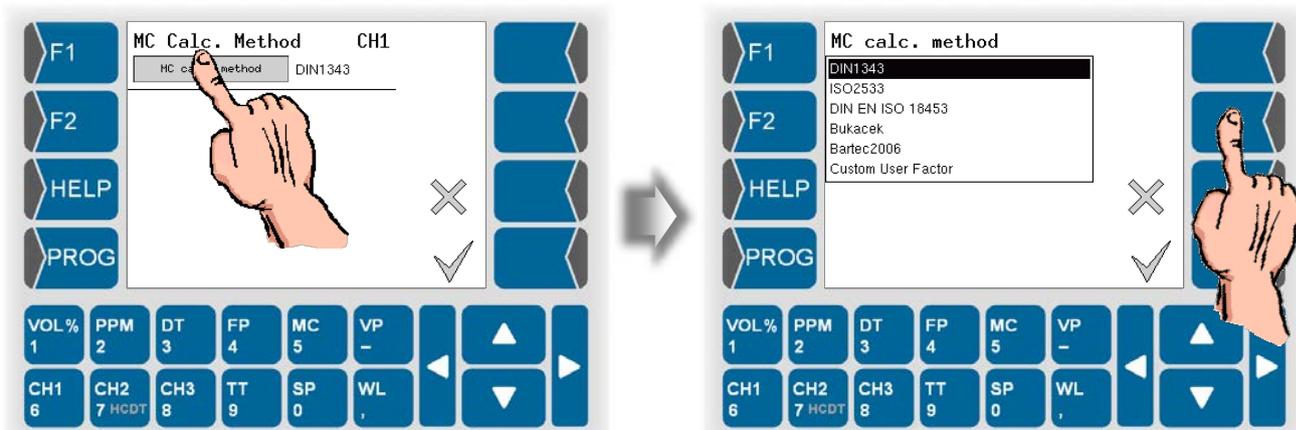
DIN 1343
ISO 2533
DIN EN ISO 18453
Bukacek
Bartec 2006
Custom User Factor

You must do further settings when using the calculation method DIN ISO 18453 or Custom User Factor (see below).

DIN EN ISO 18453

DIN EN ISO 18453 „Erdgas – Beziehung zwischen Wassergehalt und Tau-punkt" defines a method for calculation of water content from the dewpoint under conditions which are typical for natural gas.

The calculating tolerances defined in this standard apply for the pressure range from 0.5 MPa to 10 MPa and a water dewpoint in the range of -15 °C to +5 °C. The expanded working range includes pressure from 0.1 MPa to 30 MPa.

● Select the calculation method DIN EN ISO 18453.
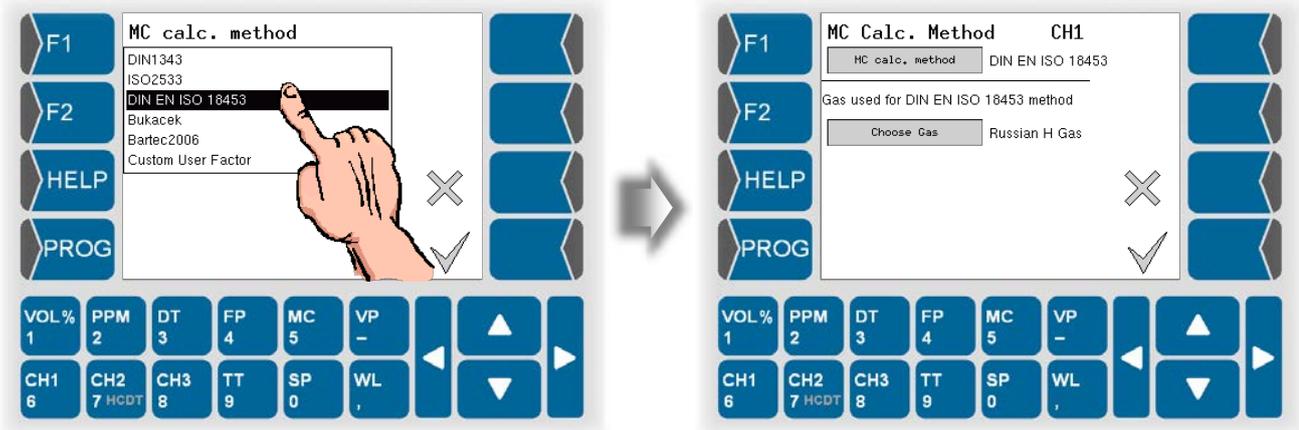
● Select the gas for which the calculation is to apply.
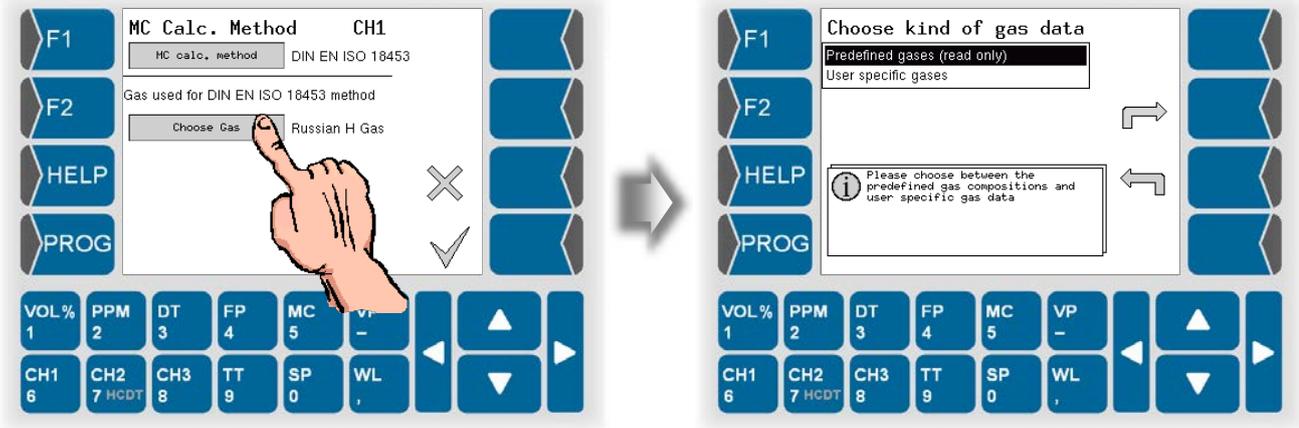
You can choose the gas from a list of predefined gases (see section 5.6.6.1) or from a list of user specific gases (see section 5.6.6.2).
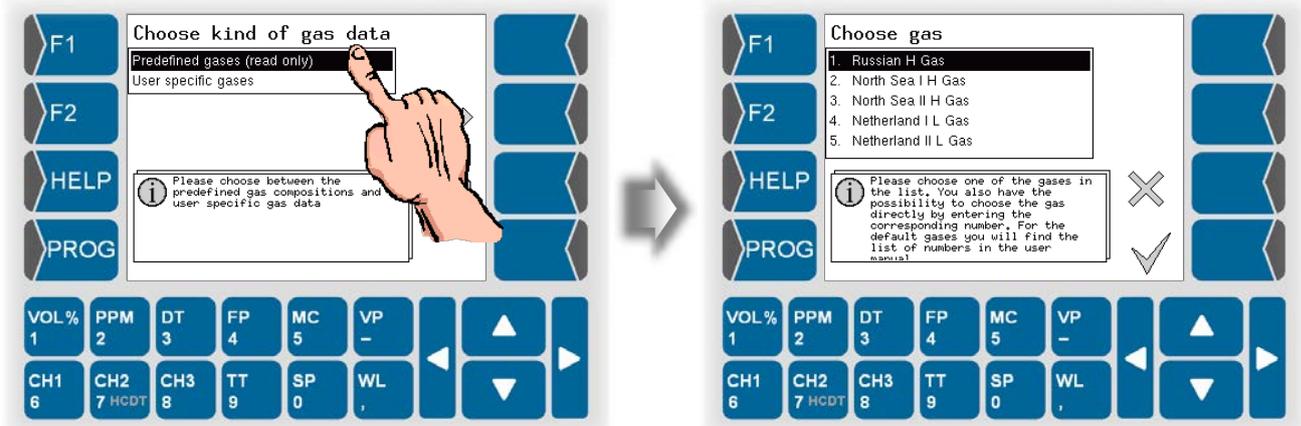
Custom User Factor

For special needs you can define a factor for the conversion ratio of ppmV to MC.
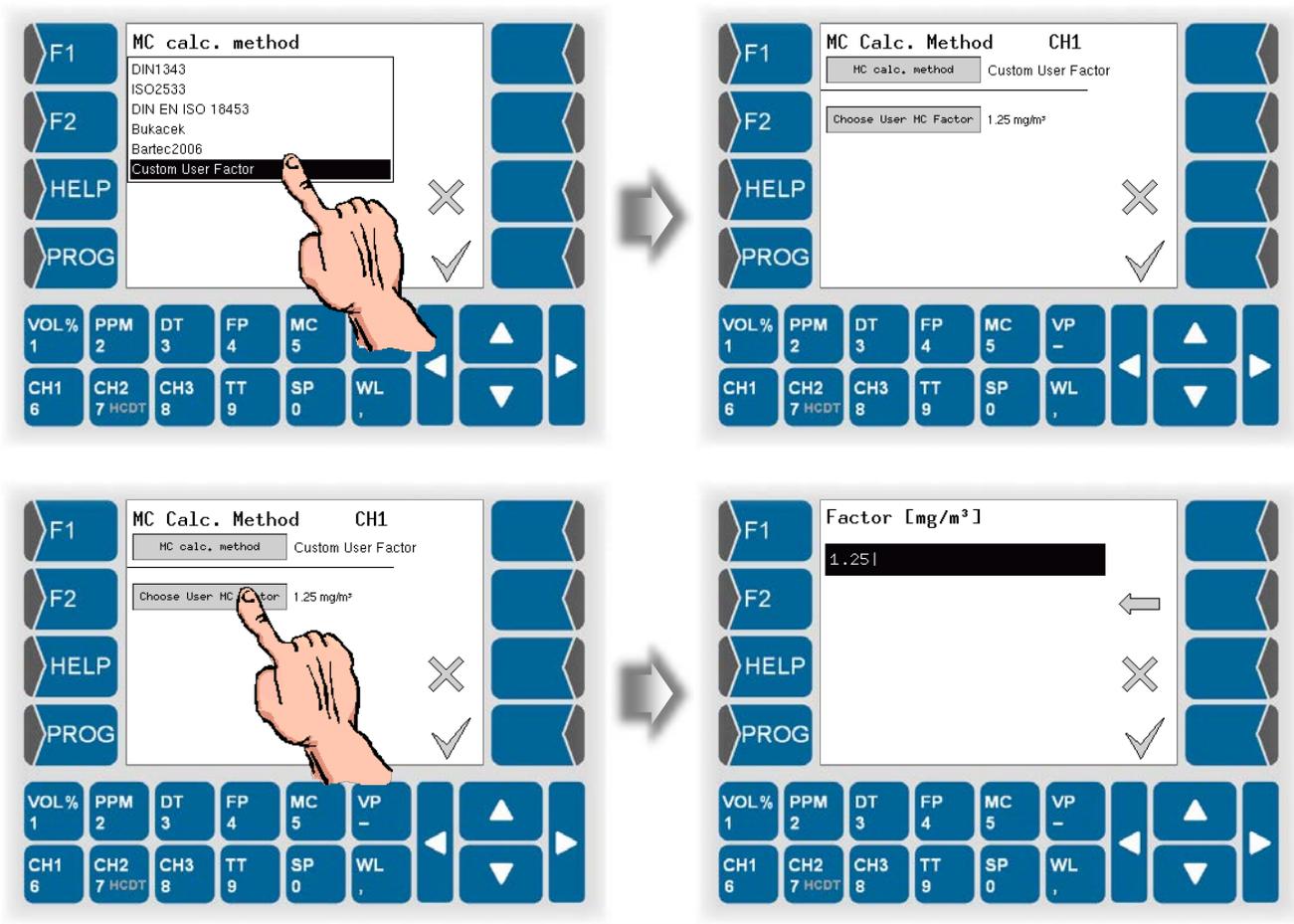
5.6.6   Edit Gas Data

The menu is used to view and edit the composition of user specific gases as well as to view the composition of predefined gases.

- Open the „Edit Gas Data" Menu. Then choose, if you want to view the predefined gases or the user specific gases which can also be edited.
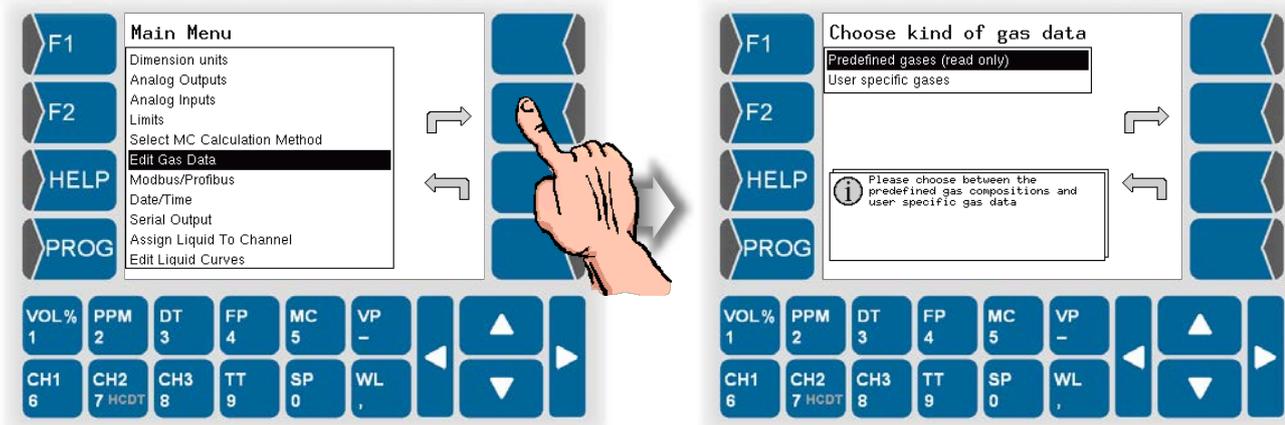
5.6.6.1 Predefined gases

A list of predefined gases exists already when the measuring system is delivered. You cannot modify the content of this list but you can view the definition of the composition of all gases.
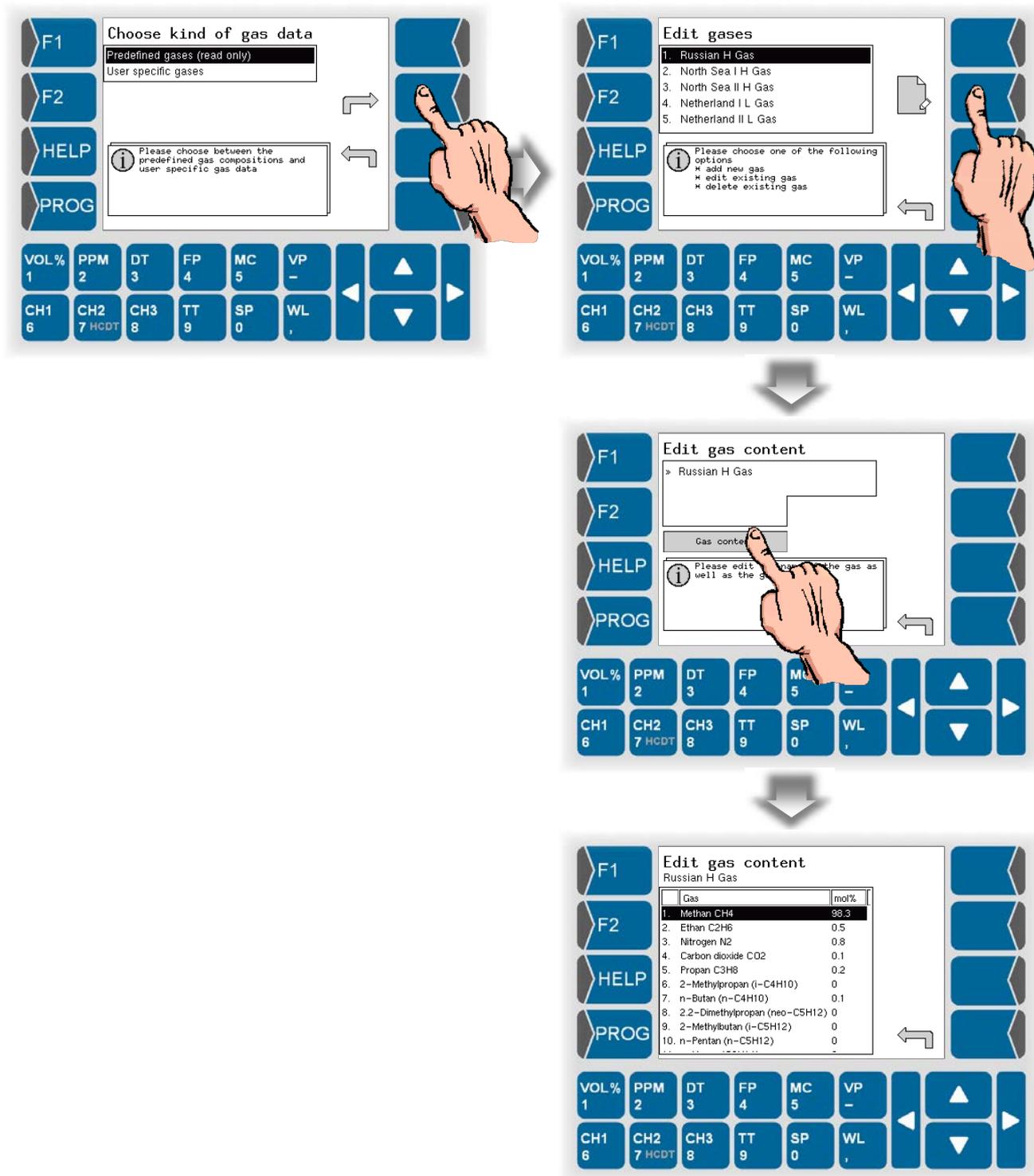
There is a table showing the composition of the predefined gases at page 9-5.
Source for the list of predefined gases is the worksheet G 260 of DVGW (Deutsche Vereinigung des Gas- und Wasserfaches e.V.).

5.6.6.2   User specific gases

There are no user specific gases entered when the measuring system is delivered. You can define gases of any composition according to the special requirements of the measuring task.

● Open the „User specific gases" menu.
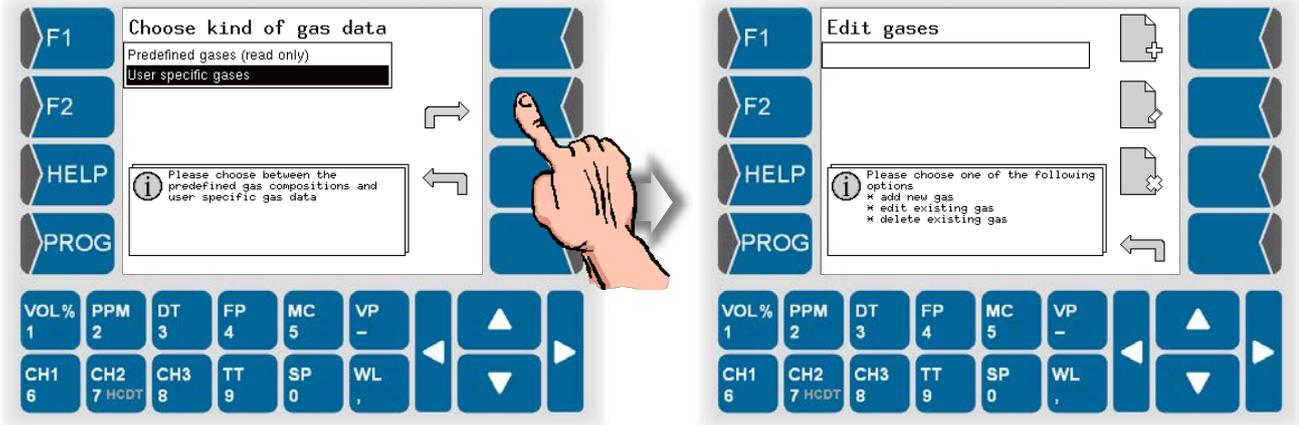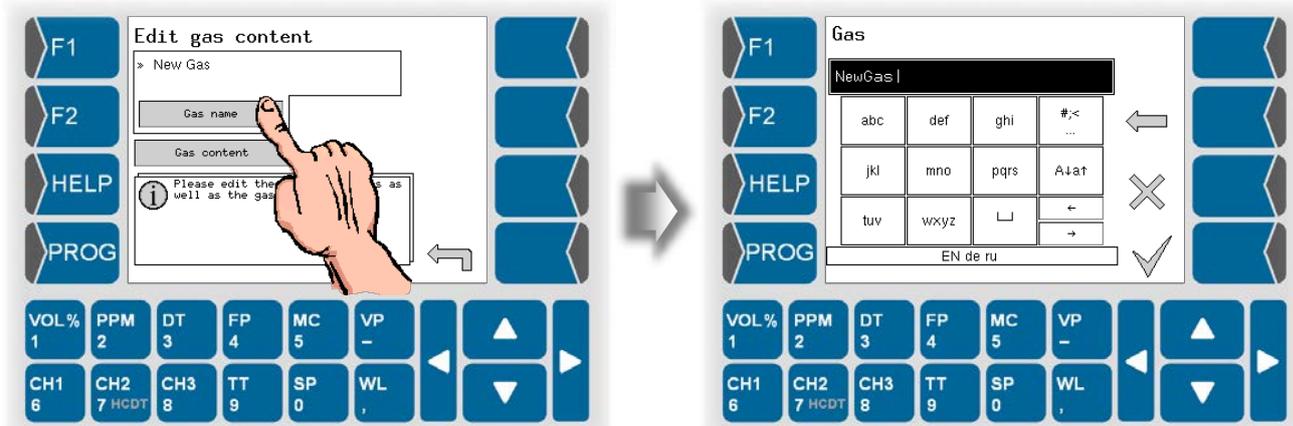

Then the following options are available:

 create a user specific gas

 edit a user specific gas

 delete a user specific gas
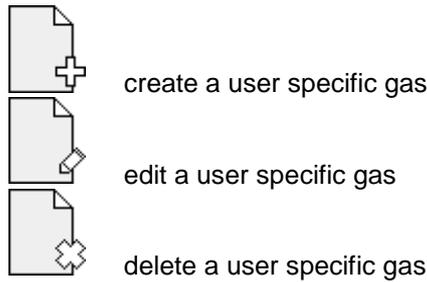
Create a user specific gas

● Touch the „create a user specific gas" softkey.
A gas named „New Gas" is created.
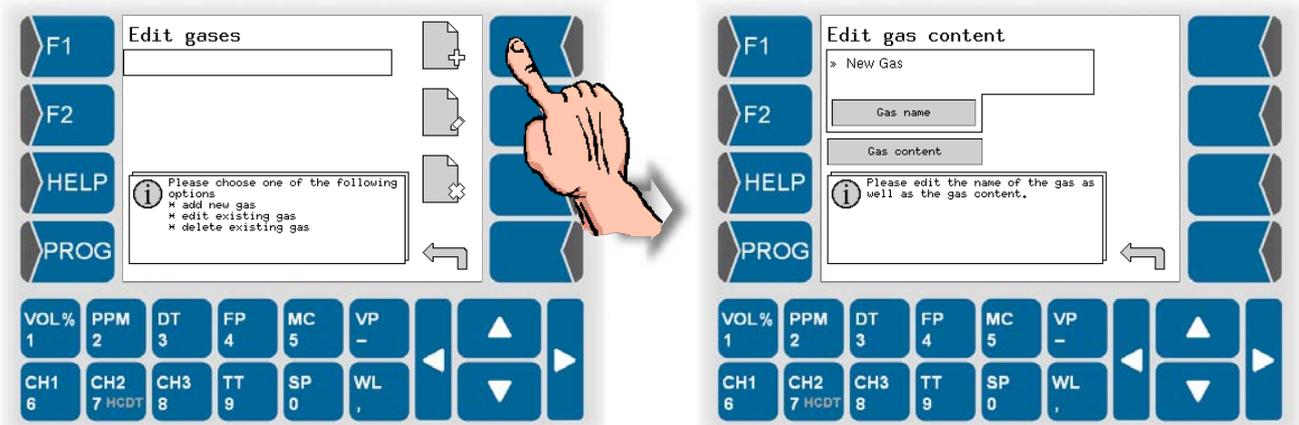
● Touch the ⌑Gas name⌑ button. Use the following dialog to change the name of the gas.

Letters are entered using the keys that are shown on the display. To enter a letter, simply touch the corresponding key. The keys are assigned up to four characters. You determine which character appears in the input line by pressing the key the appropriate number of times in quick succession.
You can enter a blank with the ⌑⊔⌑ key.

You can use the ⌑A↓a↑⌑ key to switch from upper case to lower case letters and vice versa.

If special characters need to be entered, you can use the ⌑#;<⌑ key to switch the key assignment to the special character level. You can switch back to letters using the same key, which is now labelled ⌑abcä⌑ .
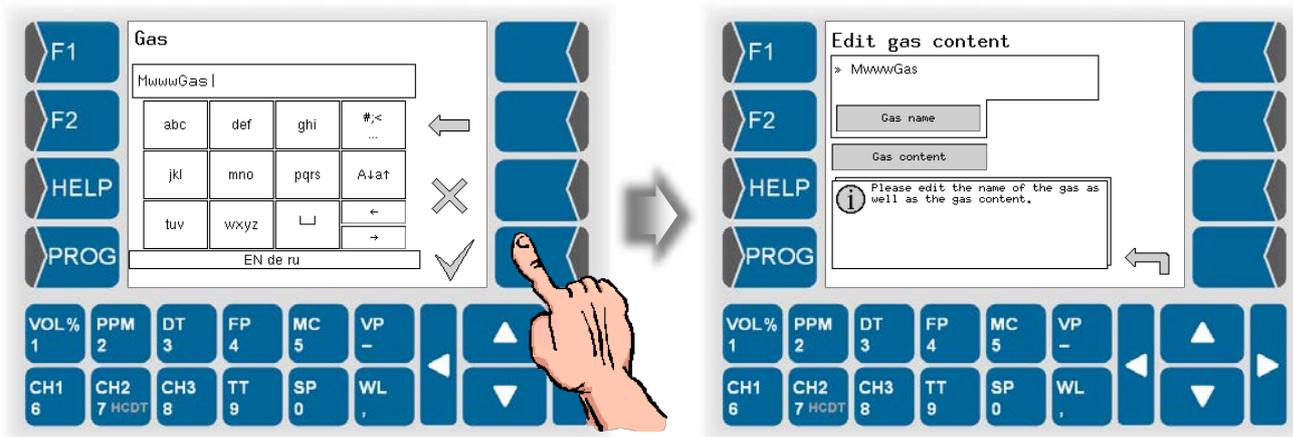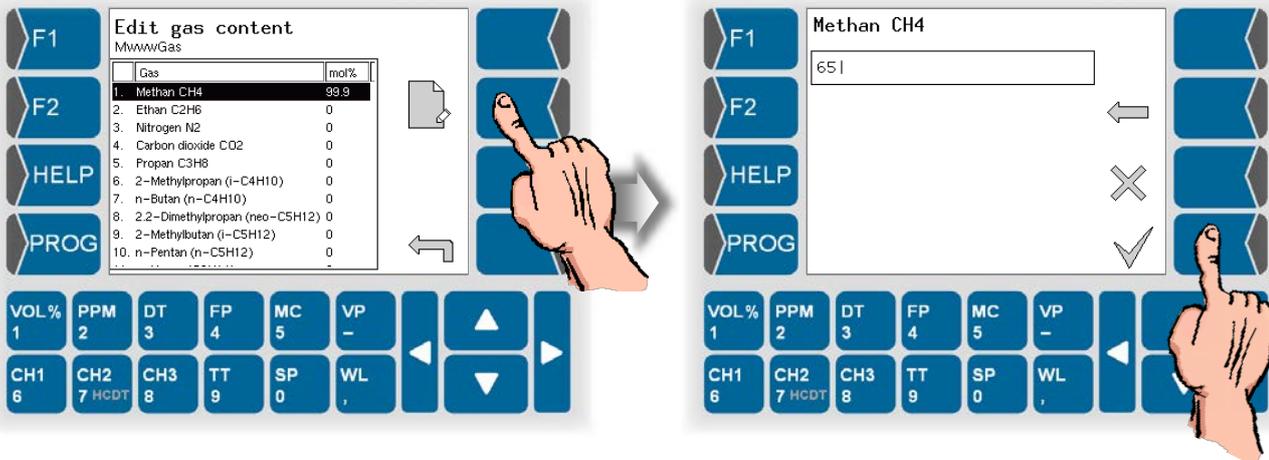
With the next step you must enter the composition of the gas.

● Touch the ⎡Gas content⎤ button.
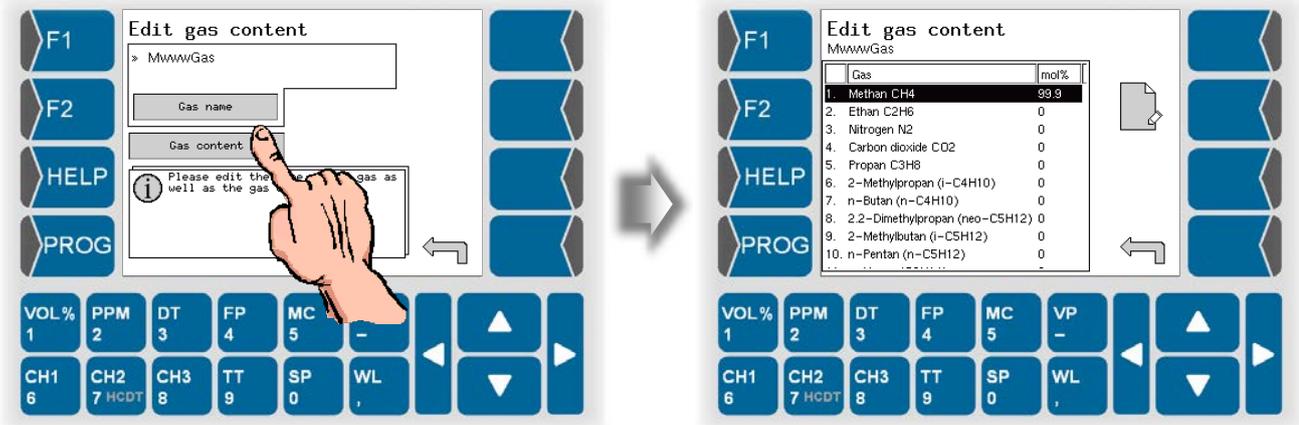
● Select one of the components of the mixture by using the arrow keys or touching the corresponding numeric key.

● In the following dialog enter the percentage of the selected substance.
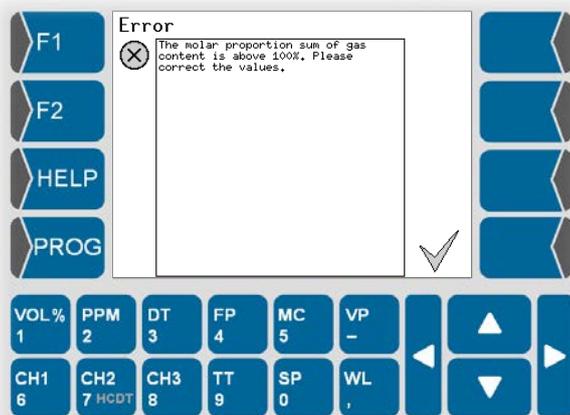
● Confirm the entry by ✓.

● Repeat the entry of the percentages for all other substances in the gas mixture.

When entering the gas content, the software checks the validity of the entries. If entries are outside of the measuring range or if the sum would exceed 100% is an accordingly message displayed.
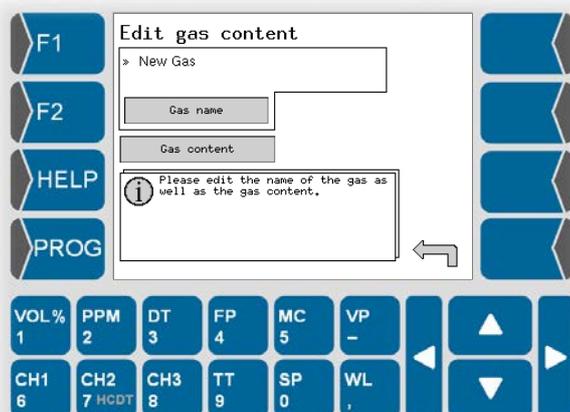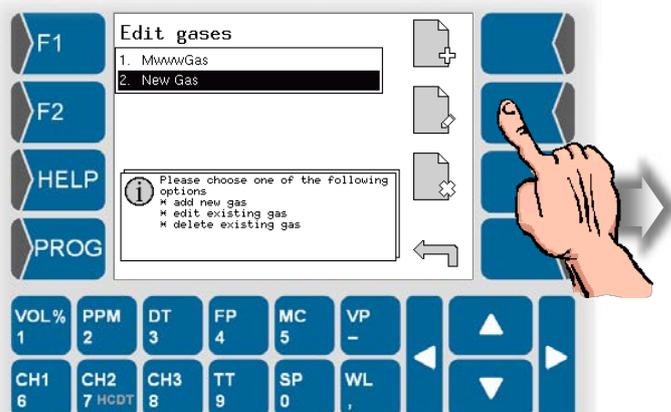
Example
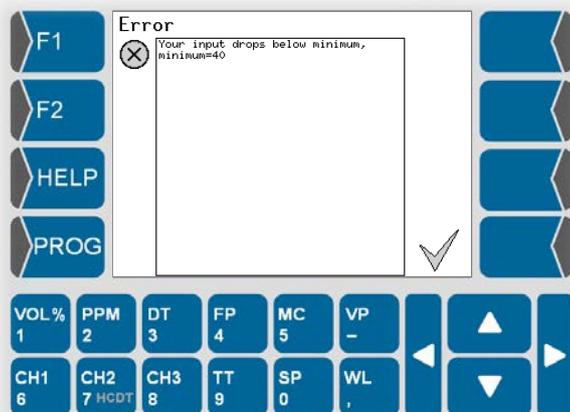
Example

Edit a user specific gas

Select the gas, whose data you want to edit. Touch the „Edit" softkey.
Then you can edit the name and the composition of the gas as described above.

Delete a user specific gas

Select the gas that you want to delete from the list. Touch the „Delete" soft-key.
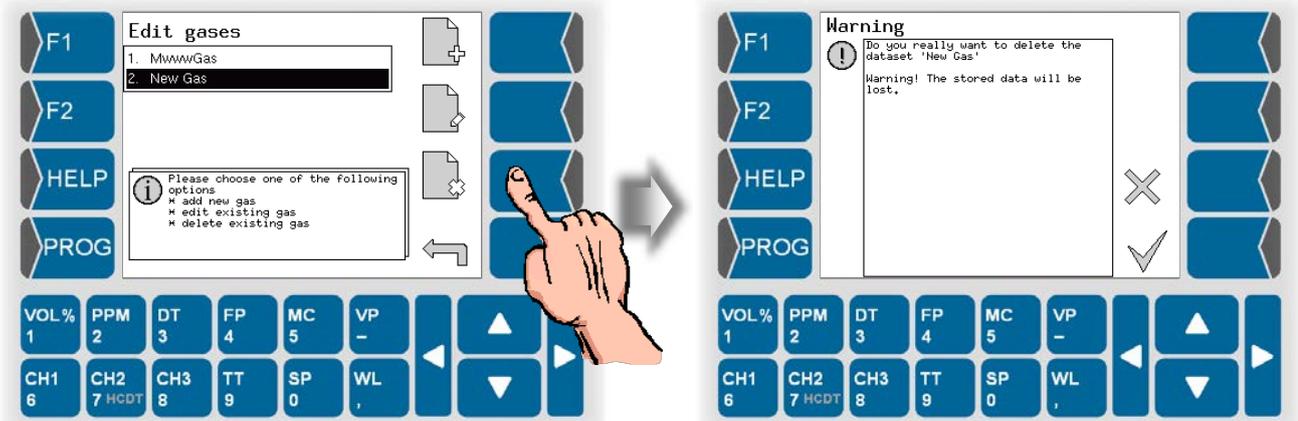
After confirming the warning is the selected gas deleted from the list.

The gas can also be deleted if it is already assigned to the measuring channel.
In this case you must update the configuration of the MC calculation.

5.6.7 Modbus/Profibus

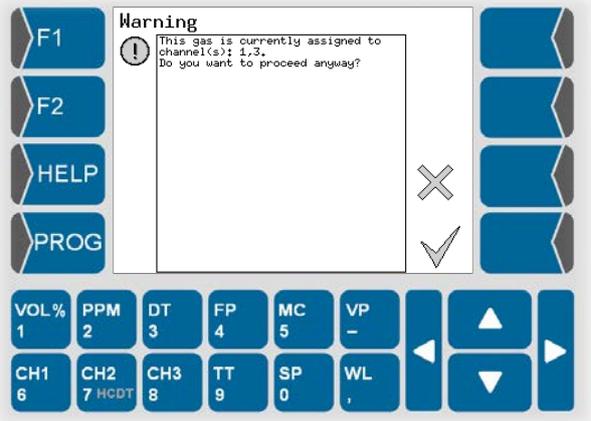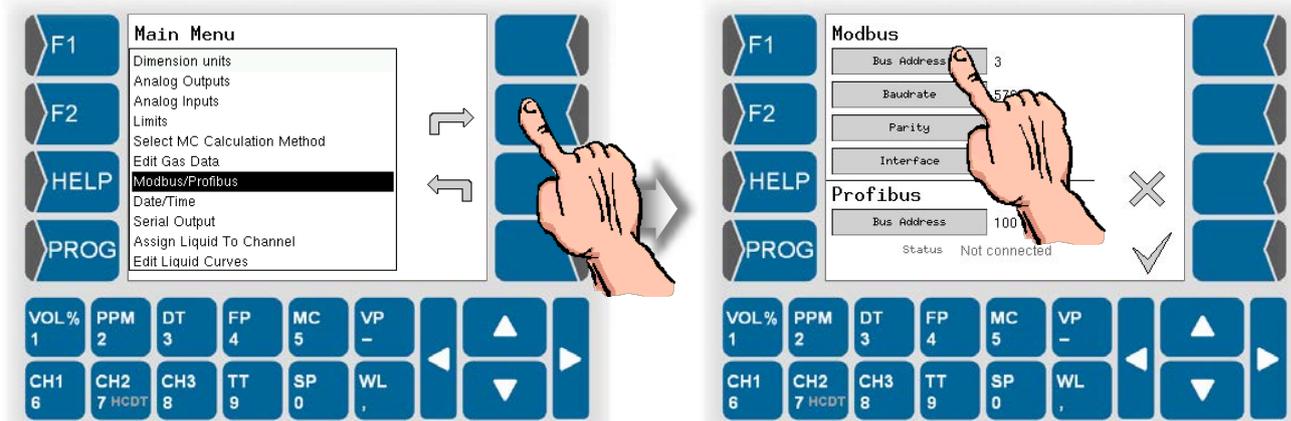Use this menu to configure the measuring system for operating in a bus system (modbus or profibus).

● Open the menu „Modbus/Profibus".

● Set the parameters according to the applied bus system.

Parameter	Possible settings	Comments
Modbus		
Bus Address		Address of the measuring device
Baudrate	1200 2400 4800 9600 19200 38400 57600 115200	
Parity	No Parity Odd Parity Even Parity	
Interface	RS232 RS485	choosing the type of interface to be used
Profibus		
Bus Address		Address of the measuring device
Status		Display of status information

Detailed information to the bus systems see section 8.

5.6.8   Date and time

- Open the menu „Date/Time".

- Set the current date and time.
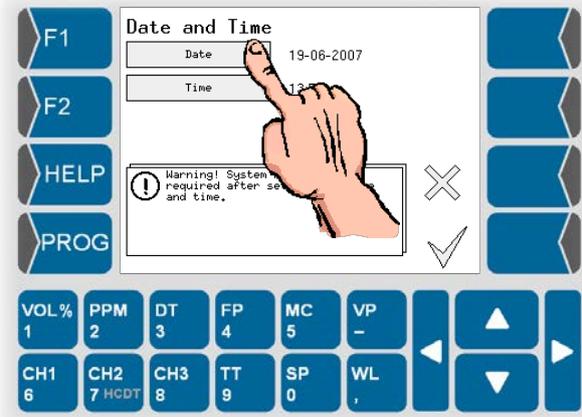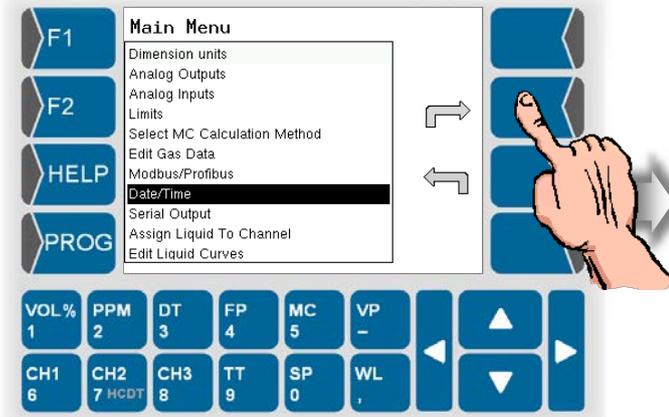
Please mind that the device will be rebooted if you save these settings.
Do not implement these settings if the ongoing measurement process must not be interrupted!
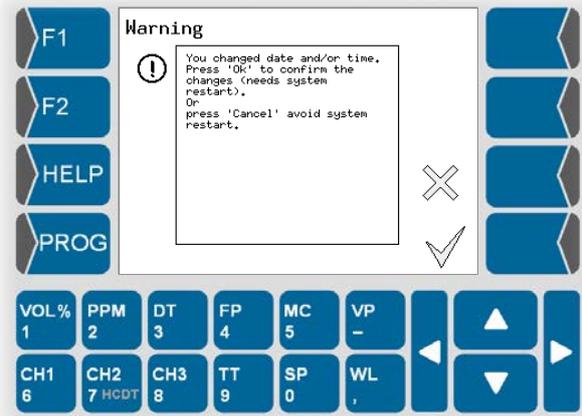
If you change the date or the time, the operating voltage has to be applied until the device is back in the measuring operation mode. Disconnection of the voltage will cause a data loss.

This message appears during the restarting process:

5.6.9 Serial output

- Open the menu „Serial output".
- Set the parameters of the serial output as required.

Use the arrow keys to scroll the window.

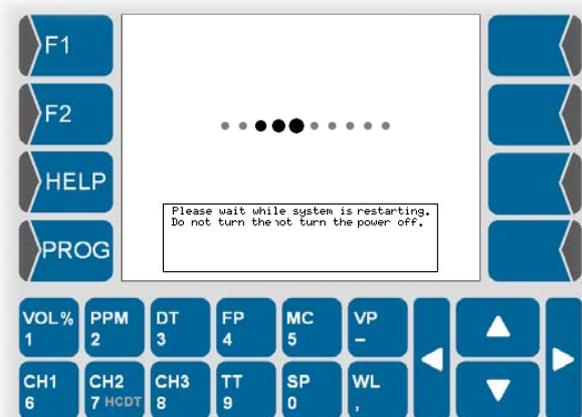| Parameter	Possible settings	Comments
Cycle Time	Off 10 seconds 1 minute 10 minutes 1 hour 1 day	Time interval after which there is an output to the serial interface.
Package	Minimum Maximum	Number of measurement variables issued per record. (Min: Date, Time, Channel, TT, SP, HCDT, DT, state of ERROR-relay, state of Limit-relay) Max: Date, Time, Channel, TT, SP, WL, VOL%, PPM, DT, HCDT,FP, MC, VP, state of ERROR-relay, state of Limit-relay)
Baudrate	1200 2400 4800 9600 19200	
Number of databits	7 Databits 8 Databits	
Number of stopbits	1 Stopbit 2 Stopbits	
Parity	No Parity Odd Parity Even Parity	
Send error codes?	Yes No	You can choose output the error codes or not.
End of line	LF CRLF	Code to be used for end of line (depending on operating system)

5.6.10 Assigning a liquid to a channel

To measure the moisture in liquids you must assign a characteristic curve of a liquid to a channel.

● Open the menu "Assign Liquid To Channel".

● Then select the channel to be used for measuring in a liquid.
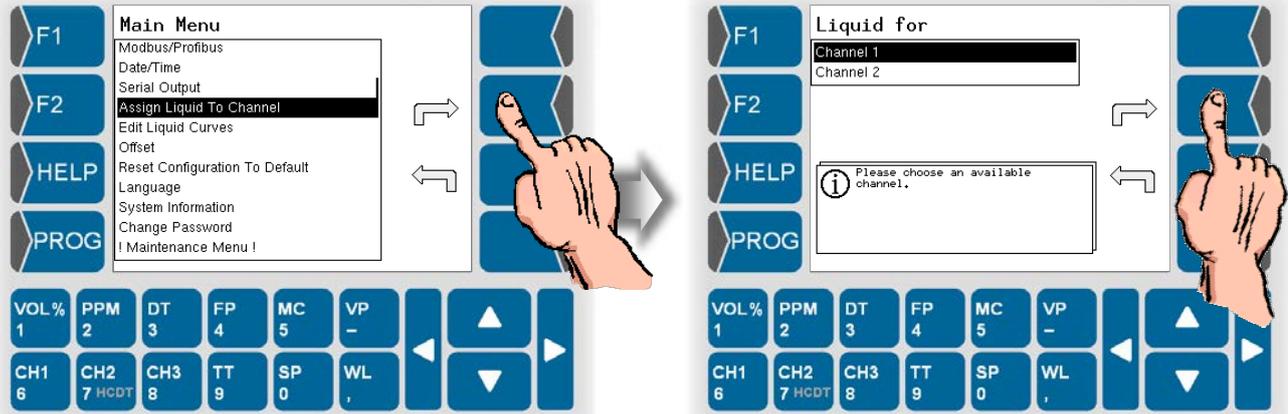
When opening this menu for the first time there is not yet a curve assigned to the channel.

● Touch the Choose Liquid button.

● Then you can decide to use one of the default curves or a user specific one.
The device is delivered just with default curves.
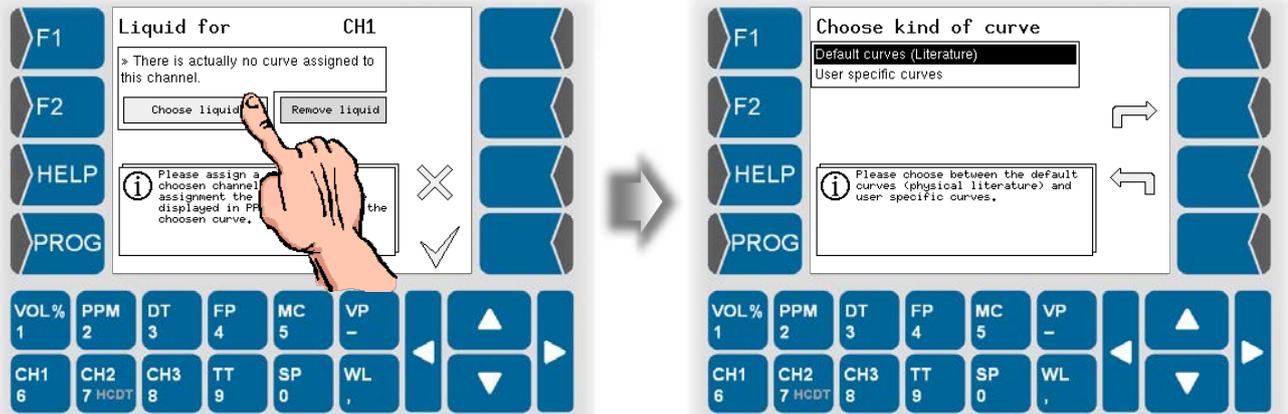
5.6.10.1 Default curves

The default curves („Literature") which are delivered with the device cannot be edited.

You find an overview of the available default curves in the appendix at page 9-3.

● Choose the liquid that is matching to your measuring task. Use the selection keys or just the corresponding numeric key for choosing.
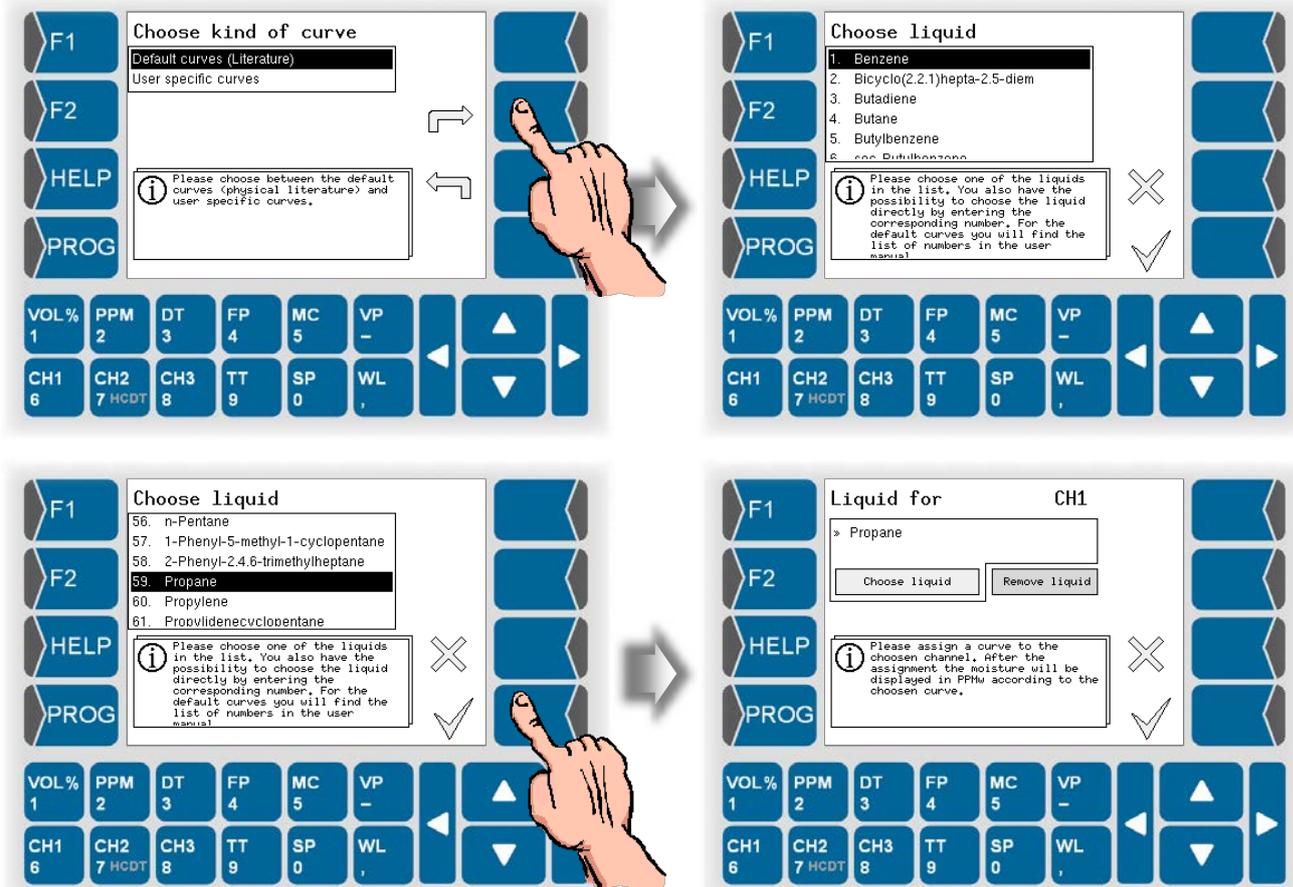
As soon as you confirm the selected liquid curve is HYGROPHIL® F in the selected channel ready for moisture measurement in liquids.

To return to moisture measurement in gases, you must remove the assigned curve.
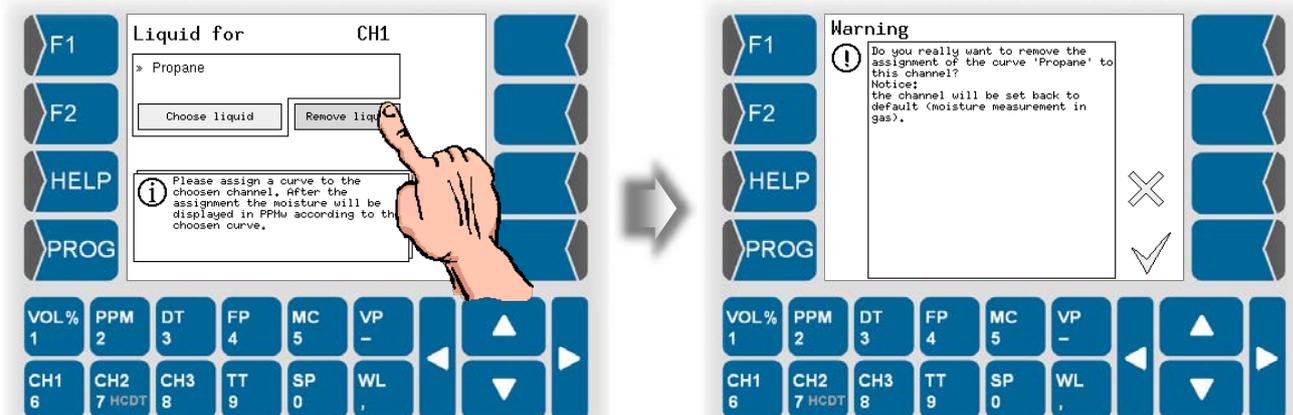
5.6.10.2 User specific curves

User specific curves are not present when delivering the device.
To use such a curve you must create at least one curve (see page 5-35).
Assigning of a user specific curve is to do in the same way as assigning a default curve.

5.6.11 Edit Liqiuid Curves

This menu is used to edit resp. to view liquid curves.

● Open the menu „Edit Liqiuid Curves".

● Then choose if you want to view the default curves or edit user specific curves.
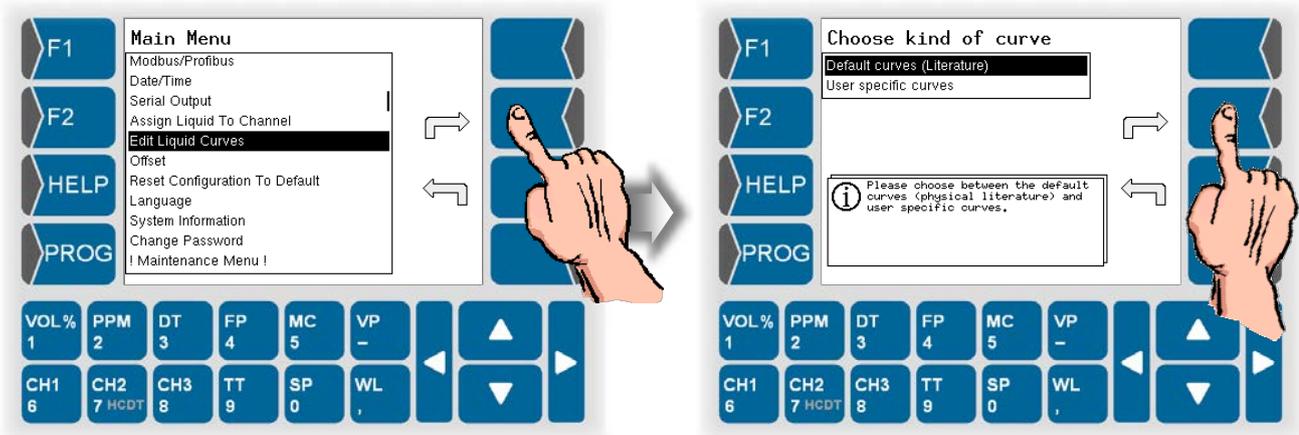
5.6.11.1 Default curves

With the menu „Default curves" you can only view data of the default curves.
Data of that curves cannot be changed.

5.6.11.2   User specific curves

You can create curves which are specifically designed for your measuring task.

Open the menu for editing of user specific curves.
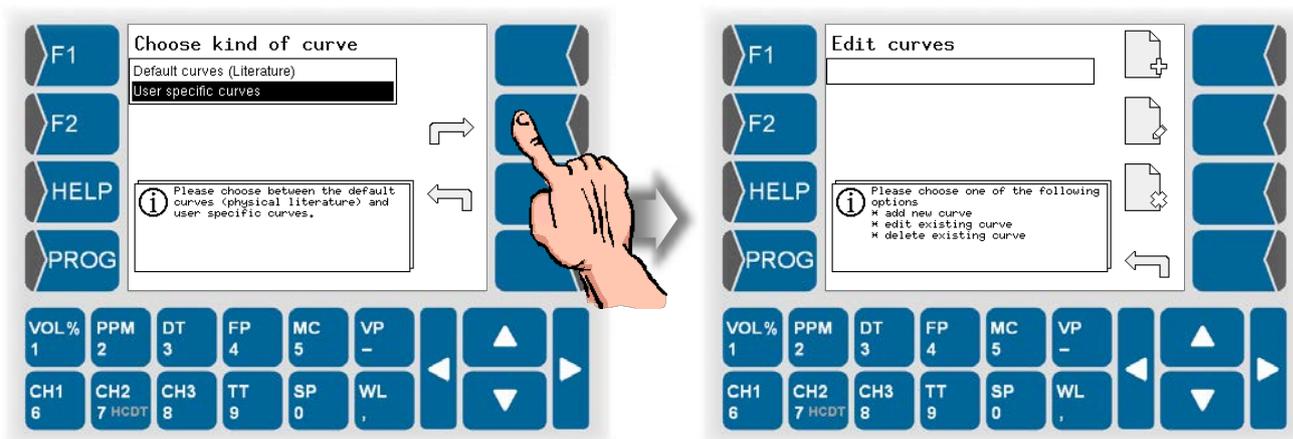
Choose from the following options:

Create a new curve

Edit a curve

Delete a curve
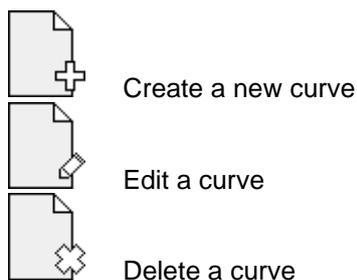
Create a new curve

User specific curves are not present when delivering the device.
To use such a curve you must create at least one curve.

● Touch the „Create curve" key.
  A new curve with the name „New Curve" and the point 0/0 is created.
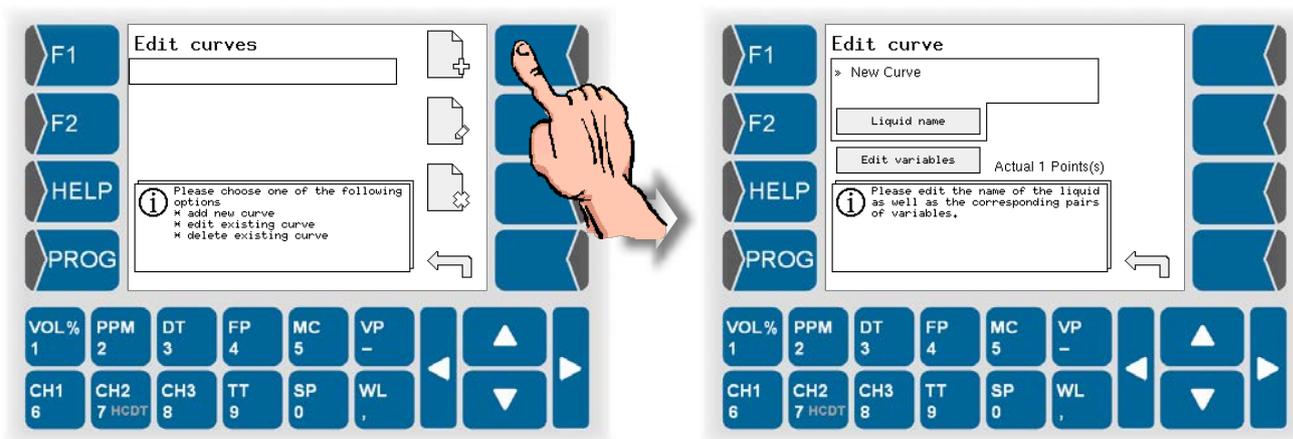
● Touch the $\boxed{\text{Liquid name}}$ button.
In the following dialog you can create resp. edit the name of that curve.
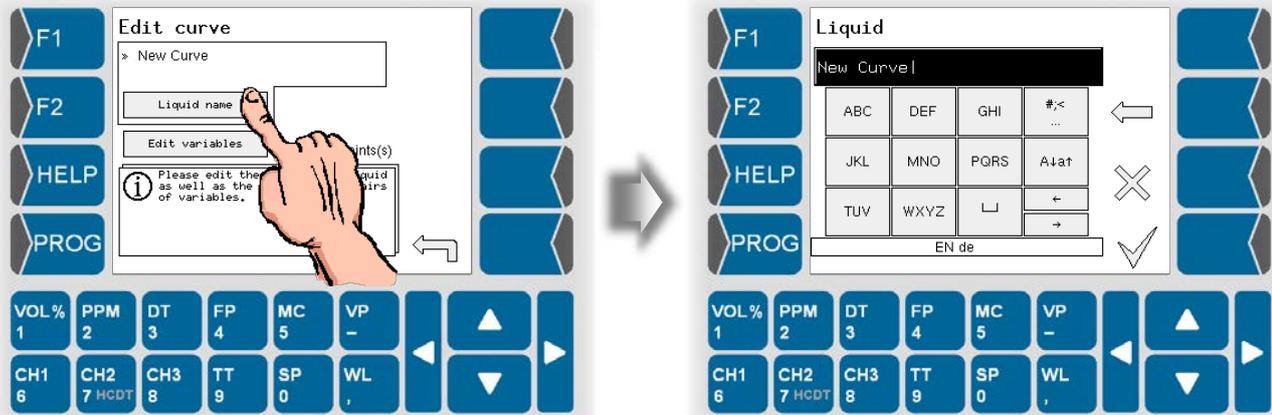
To enter letters use the keys displayed on the screen. A key can be used to type up to four characters.
The number of keystrokes specifies the character that appears in the input line.

The $\boxed{\sqcup}$ key generates a space.

Use the $\boxed{\text{A↓a↑}}$ key to switch from capital letters to small letters and back.

To enter special characters, you can switch to the special character keyboard layout with the $\boxed{\#;<}$ key. Use the same key (designed with $\boxed{\text{abc}}$) to switch back to the standard keyboard layout.
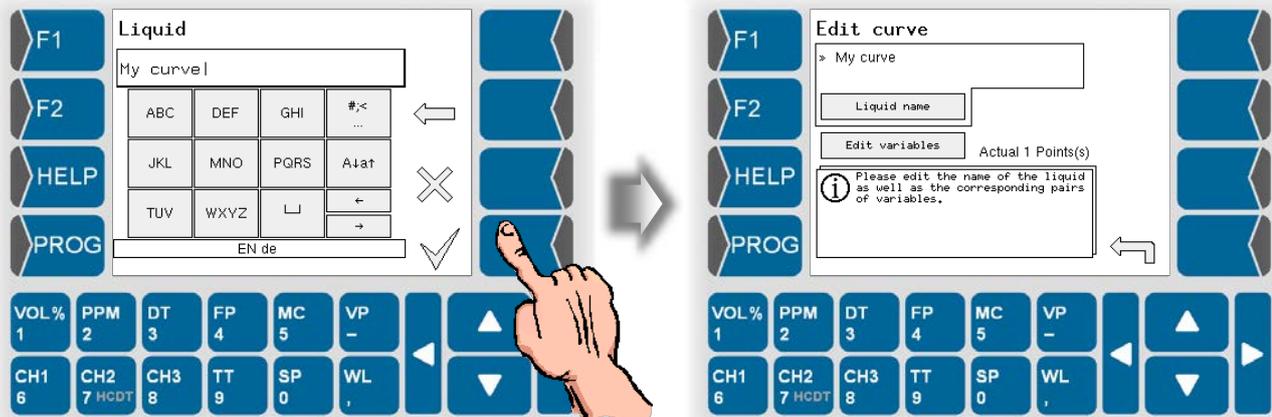
To specify the points of the curve you must execute a reference measurement that determines the pairs of variates for T and PPMw.

Next step is to transfer the found pairs of variates into the curve.

● Touch the Edit variables button.
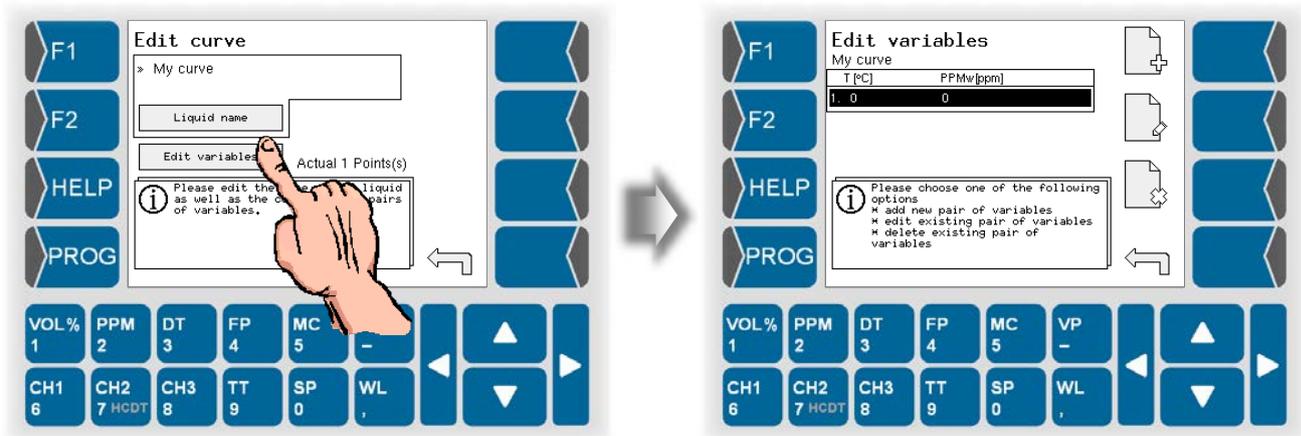
Then you can choose from the following options:

Add a new point

Edit variates of the point

Delete a point
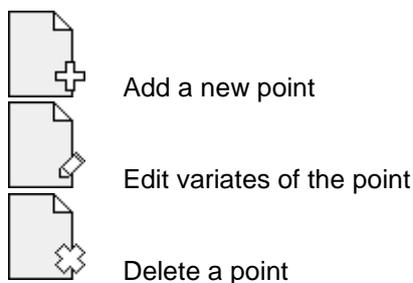
● Touch the „Edit" key to enter the pair of variates for the first point.
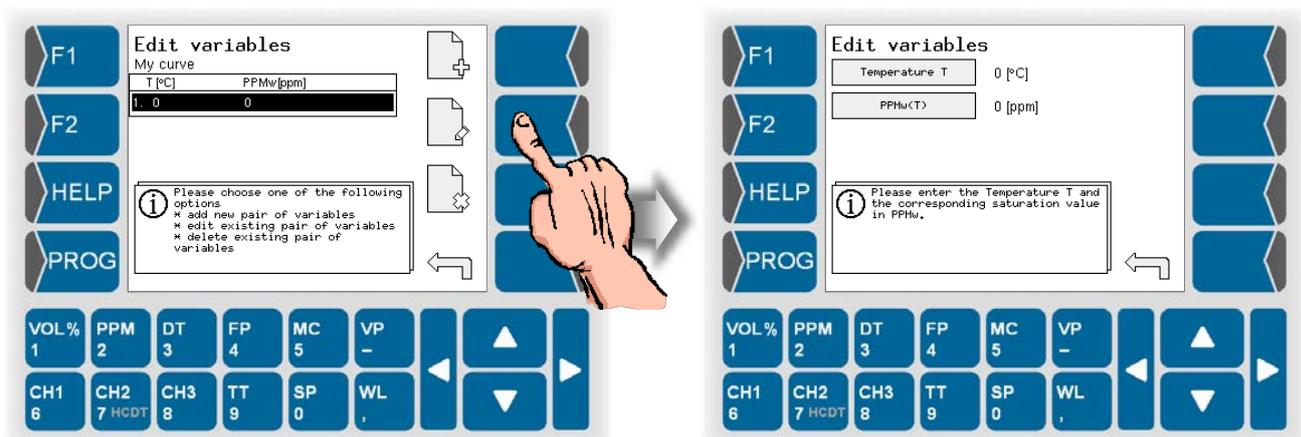
● Then enter the measured values for temperature and PPMw.
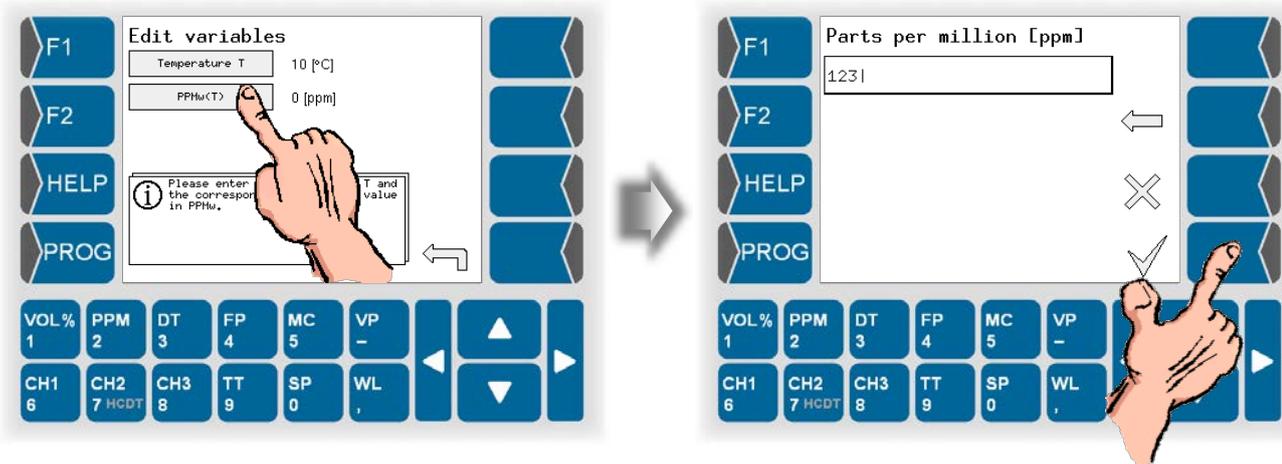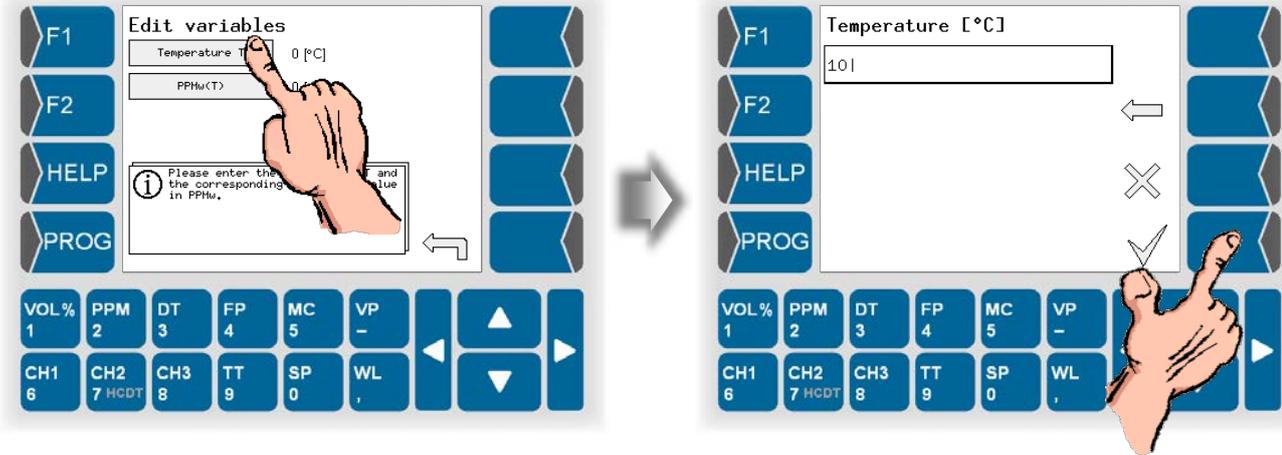
● Add further points to the curve and enter the pairs of variates as described.
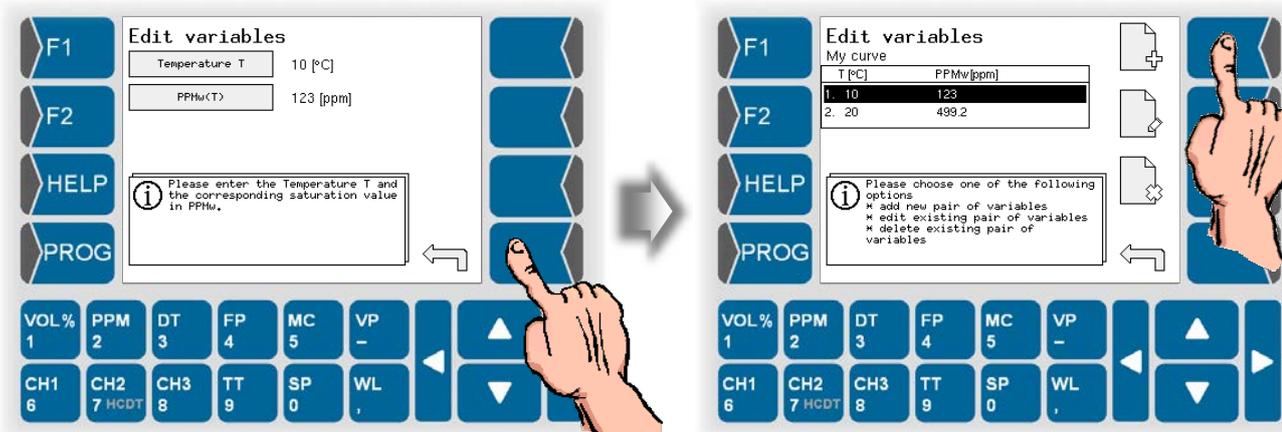
Edit a curve

● Choose the curve to be changed and touch the „Edit" key.
Then you can change the name of the curve or edit points (add, delete or edit pairs of variates) as described above.
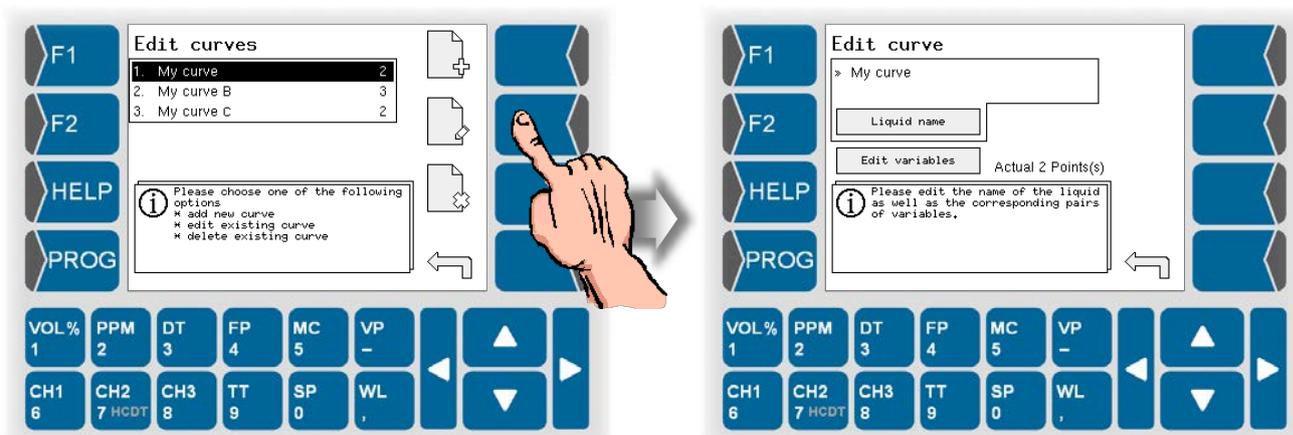
Delete a curve

● Choose the curve you want to delete and touch the "Delete" key.
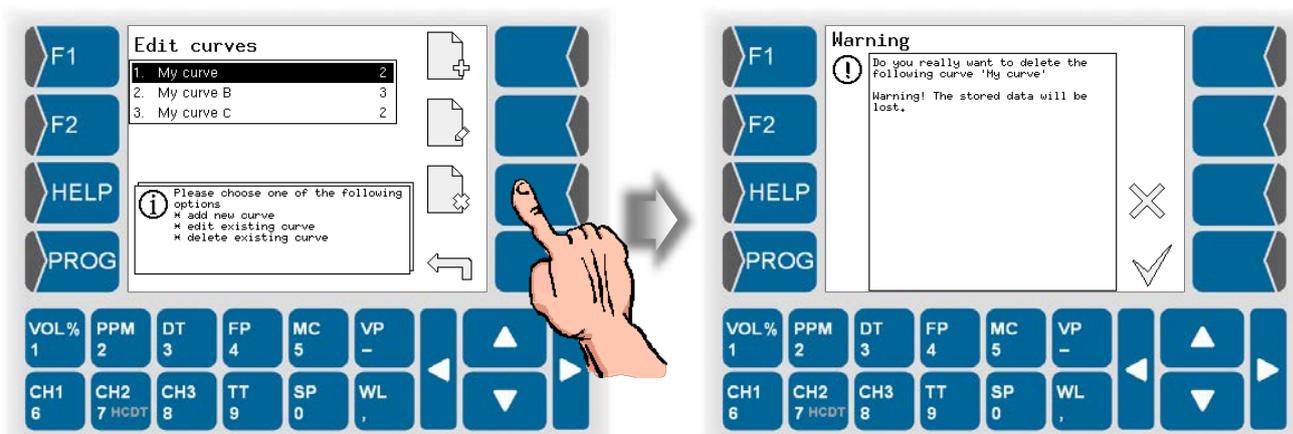
If you confirm the safety warning the selected curve will be deleted.

5.6.12 Offset

Various operating conditions or measurement tasks may necessitate an off-set setting on the evaluation unit HYGROPHIL® F 5673. A constant shift of the wave length over the entire operating range is then implemented for each measurement.

N.B.: At a gas temperature of 30°C, this shift has a linear effect on the displayed measured value within the dew-point range –40...+20 °C DT. Outside this range the offset correction has a greater effect on the displayed measured value on account of the sensor characteristic.

● Open the menu "Offset".

● Choose one of the three possible measurement channels for which you want to program an offset.
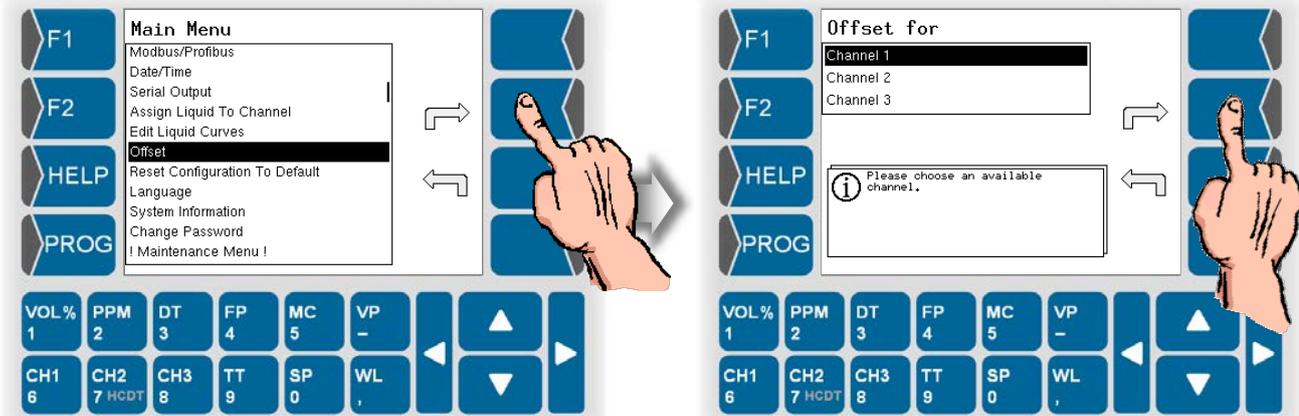
● Select whether to set the offset for DT or for PPM or if you directly want to set the wave length shift (ΔWL Offset).
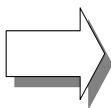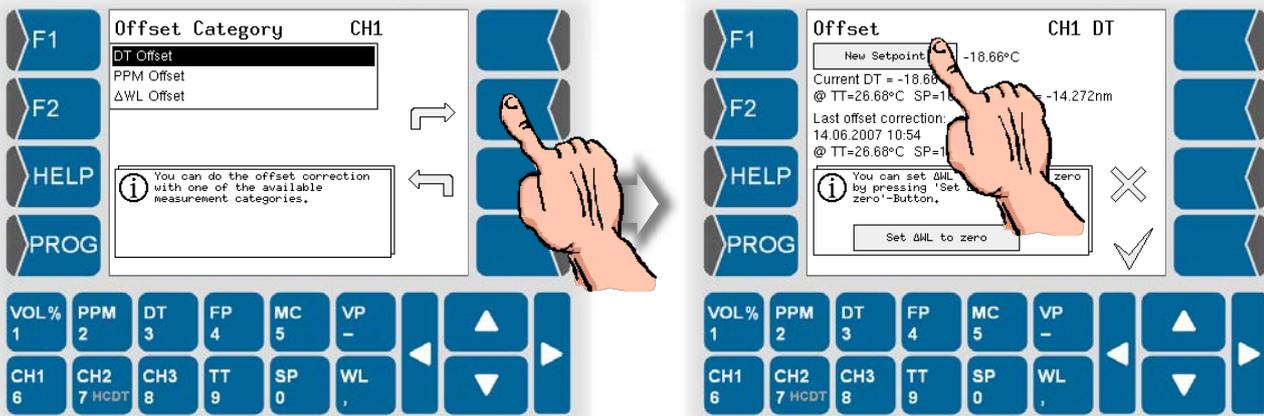
When proceeding moisture measurement in liquids you cannot set the DT Offset.

● Under "New Setpoint" enter the externally measured reference value for the displayed value resp. the direct wave length shift.
The display indicates the current measured values, the date of the last offset correction and the conditions prevailing at that time (TT and SP) as well as the wave length shift (ΔWL).

Cancel offset

If you want to cancel an offset setting, touch the Set ΔWL to zero field. The wave length shift is reset to zero, consequently no offset is set any more.

5.6.13   Reset configuration to default

In this menu you can reset the complete device configuration to default values. This may be necessary if error messages indicate that configuration files cannot be loaded.
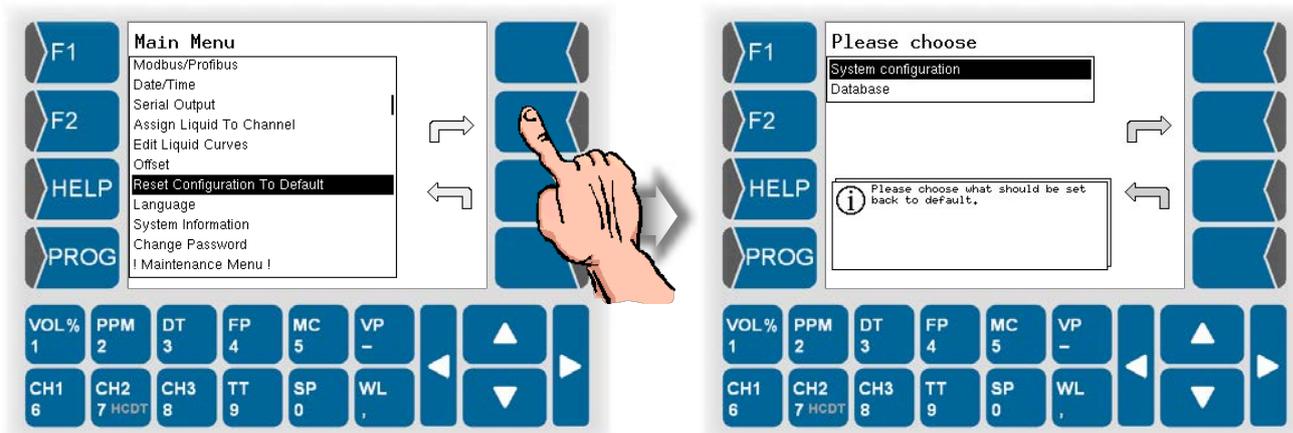
Reset system configuration may be necessary if error messages indicate that configuration files cannot be loaded.
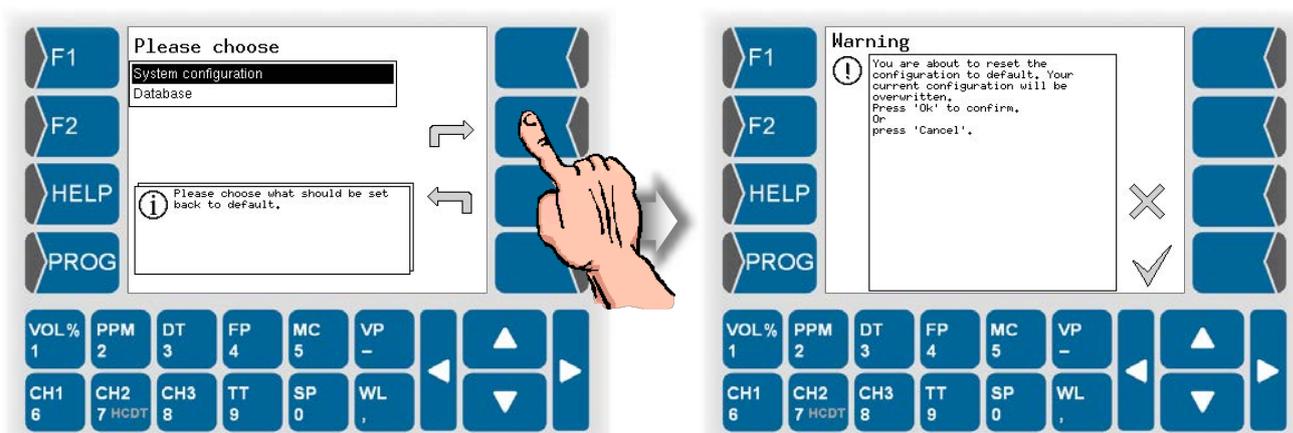
After the resetting the system configuration, you have to set all parameters in accordance with your required configuration again.

When **resetting the database** the stored measurement history will be cleared.
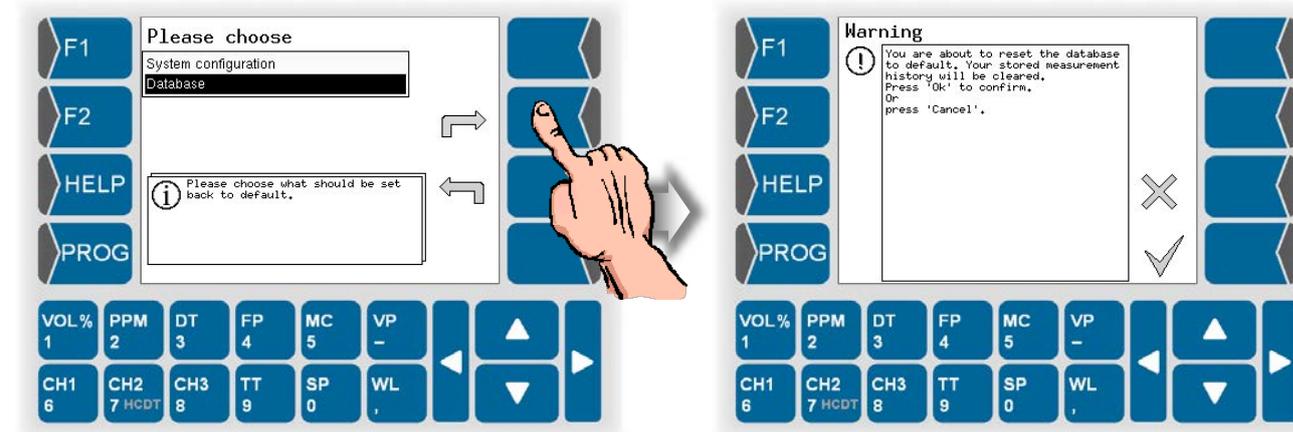
5.6.14 Language

- Open the Menu „Language".

- Select the language used for all messages on the display.
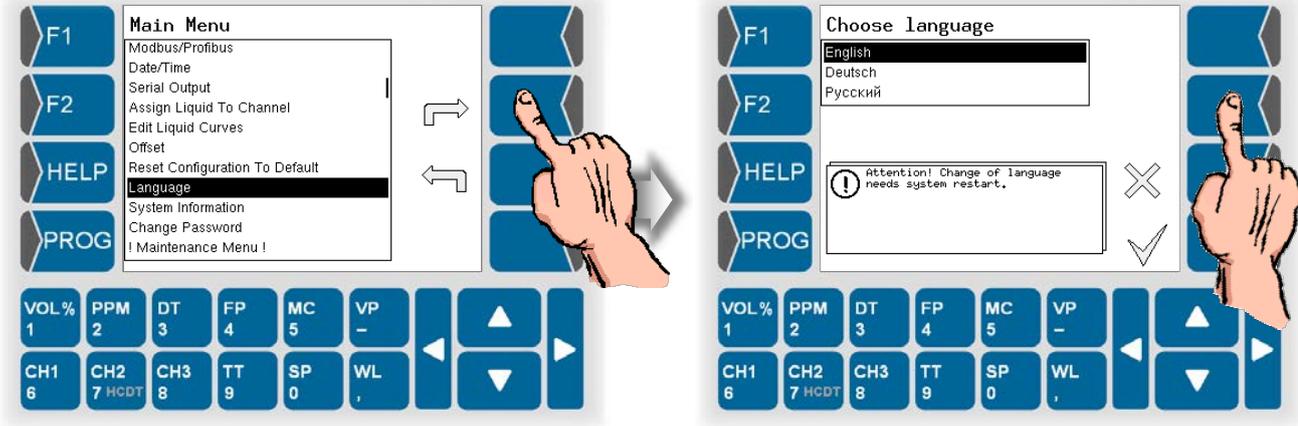
Please mind that the device will be rebooted if you save these settings.
Do not implement these settings if the ongoing measurement process must not be interrupted!
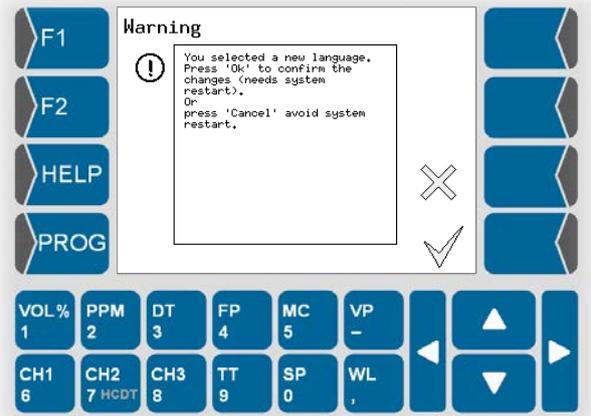
If you select another language, the operating voltage has to be applied until the device is back in the measuring operation mode. Disconnection of the voltage will cause a data loss.

This message appears during the restarting process:
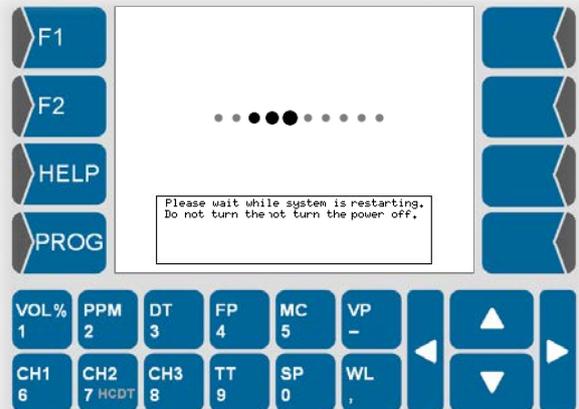
5.6.15   System Information

Information on the manufacturer and on the software version is displayed.
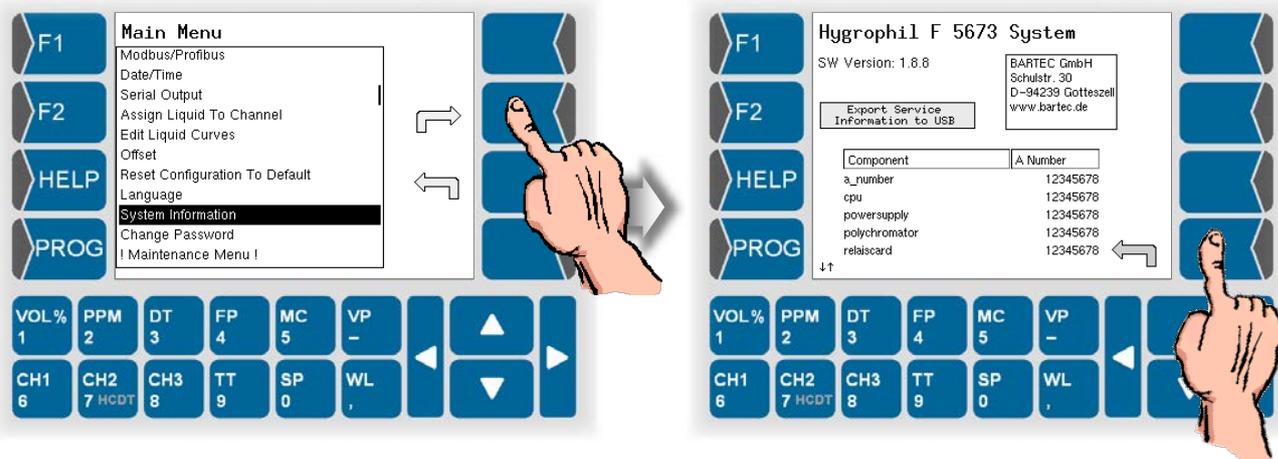
Export service information to an external data medium

For an analysis by your service staff you can export service information via USB interface to an external data medium. Databases, logfiles and configuring information will be copied to the data medium.

● Connect the external medium (e.g. USB-stick) to the USB-port at the back of the evaluation unit.

> The data medium must be FAT 32 formatted!

● Touch the button Export Service Informationen to USB .
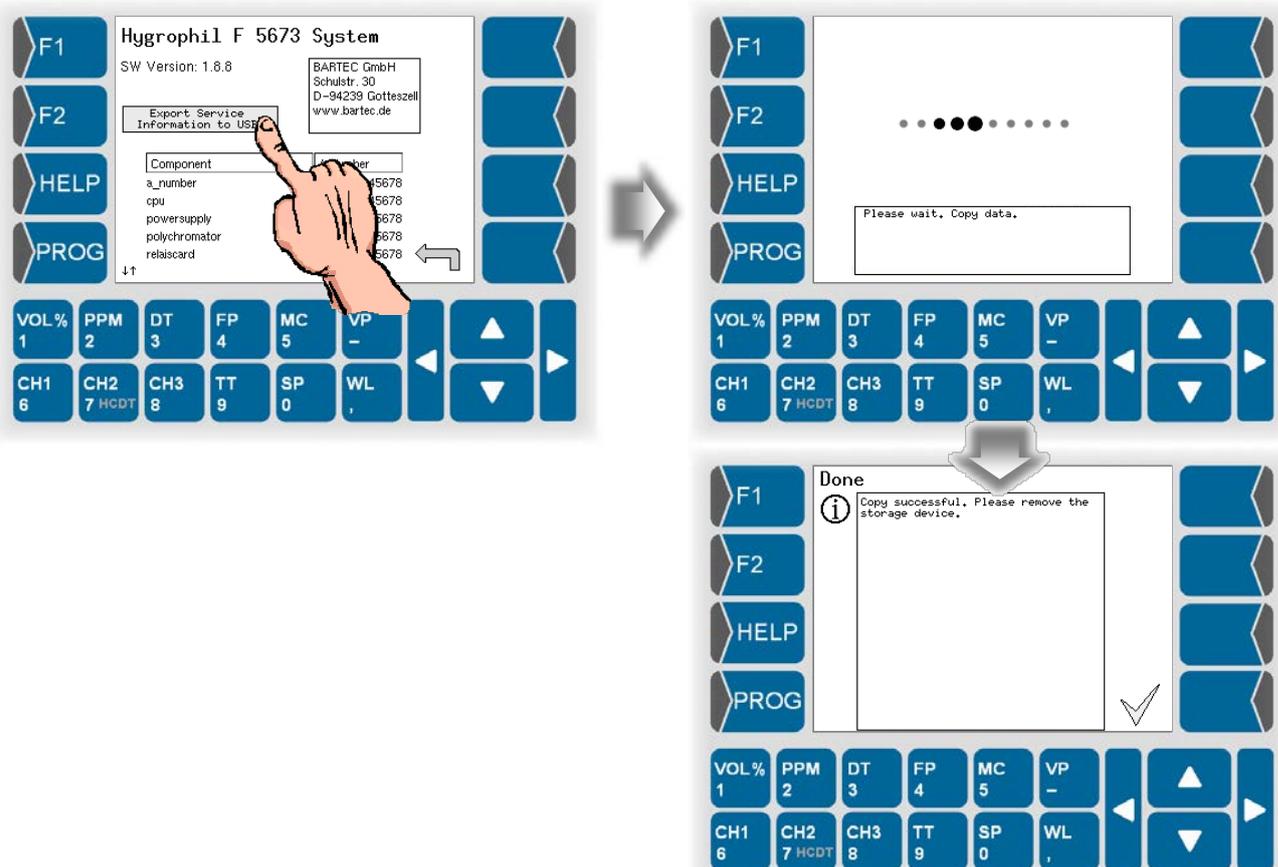
5.6.16   Change Password

To call up the programming mode you must enter a password (see section 5.2). The default password is 5673. You can change the password that is set as default.

● Open the menu „Change Password". A warning will be displayed.
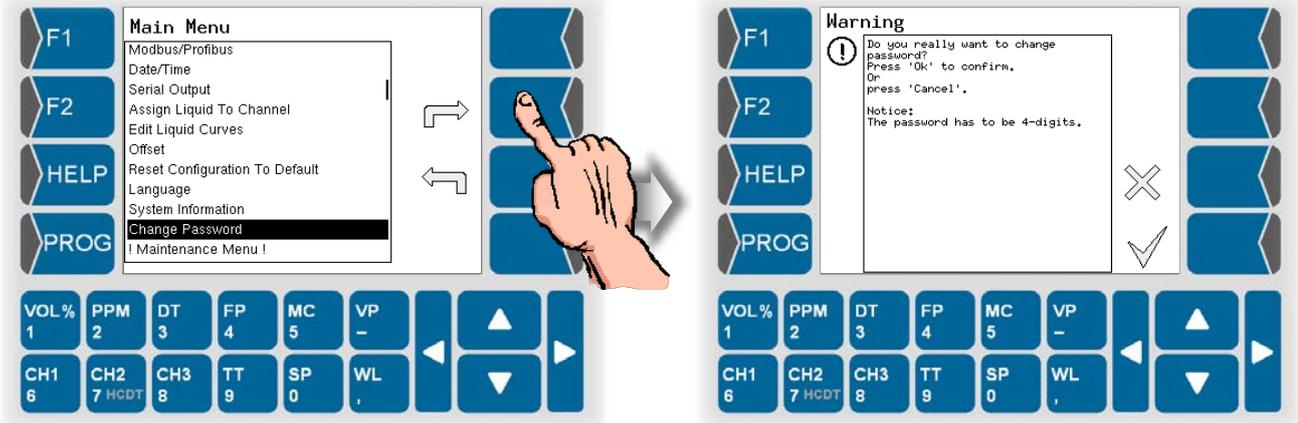
● Confirm the warning if you want to change the password.

● Enter the new password. The password must consist of four digits.
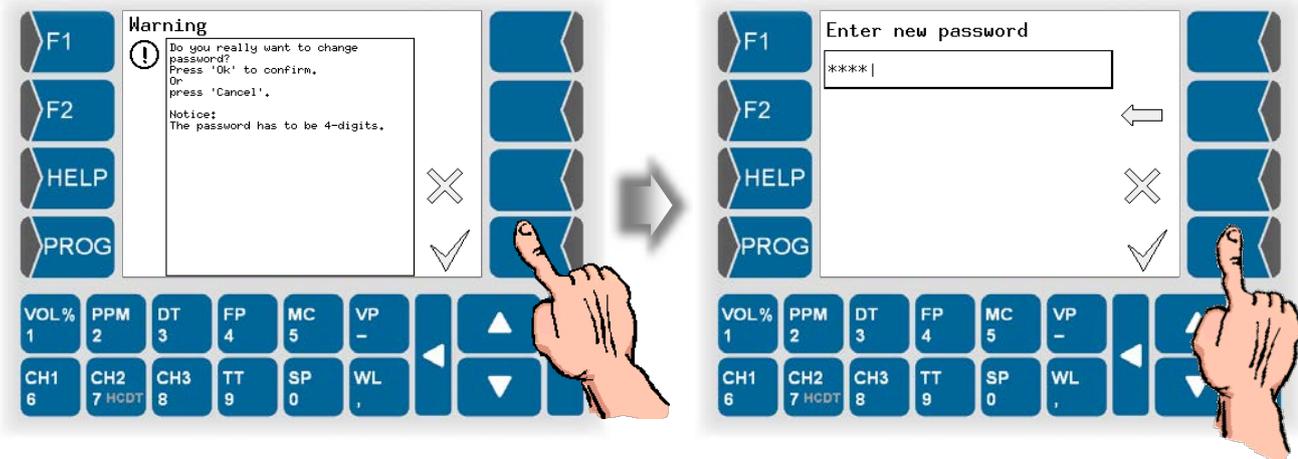
After confirming the new password it is valid immediately.

5.6.17   Maintenance menu

This menu is exclusively reserved for authorised service staff. The access is protected by a password.

6   Error handling

Warnings and errors as well as indications of limit transgressions are displayed in the appropriate measurement value line and in the info line in the field for the respective channel. If warnings or errors are indicated, you will get further information and instructions on error correction if you touch HELP (see section 6.4).

Malfunctions during the operation of HYGROPHIL® F 5673 may result from faulty plug connections. First verify that all connections (sensors, analog cards) have been correctly plugged. If there is any suspicion of defective sensors or cards, check if the problem is remedied when they are replaced.

Another possible reason for malfunctions can be electromagnetic fields. Check if there are any potential sources of interference near the device. In the case of temporary interferences, the problem can usually be remedied after a few minutes or after a restart of the device.

If you have any doubts as to the correctness of the measurement values or if there are any malfunctions which cannot be remedied with the measures indicated when you touch HELP, please contact the BARTEC BENKE service team. It may be necessary to send the device to the manufacturer for repair.

6.1   Limit transgressions

If a programmed limit value (see section 5.6.4) for a measurement variable is overshot resp. fallen below, this is indicated by an arrow in the status display of the measurement value line and in the info line. Below the arrow there is the measurement variable whose limit has been overshot or fallen below.
A signal is displayed at the limit output.
This is no error and no malfunction.

Example

In measurement channel 1, the measured value exceeded the programmed value for the upper limit of the water vapour content VOL% and in measurement channel 2, the measured value fell below the programmed value for the lower limit of the temperature at the measuring point TT.
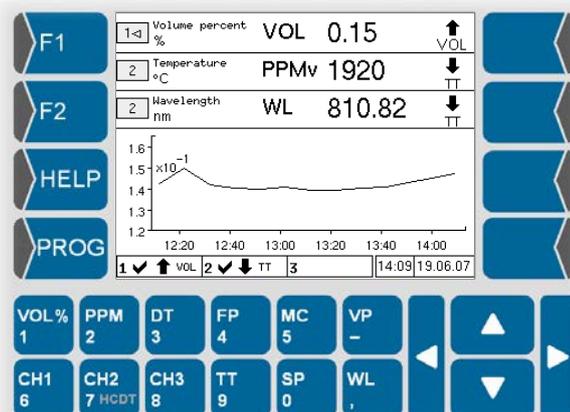
6.2 Warnings

These messages indicate particularities in the measurement conditions. The measurement operation is maintained. A warning sign appears in the info line.

Example

A pressure sensor should be used in measurement channel 1 but the pressure sensor is not connected or it is defective.
The programmed fixed value for pressure is used.
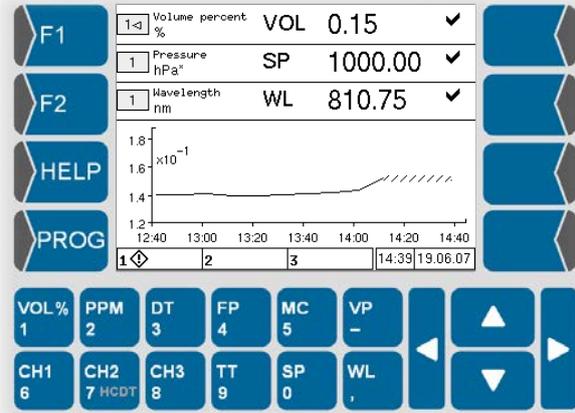
Touch HELP to receive further information on the warning that is displayed (see section 6.4).

6.3 Errors

All errors preventing the measurement operation are indicated by an error sign in the status display and in the info line.
A signal is issued at the error output. In addition, limit transgressions due to wrong or missing calculation bases can be reported.

Example

There is a malfunction in the optical system in measurement channel 1, e.g. the fibre-optic humidity sensor is not connected or is defective.
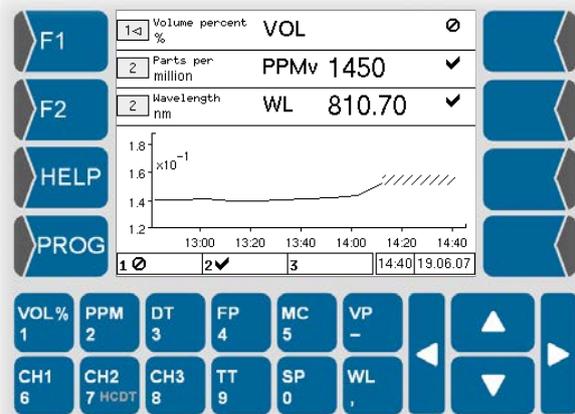
Touch HELP to receive further information on the error that is displayed (see section 6.4).

6.4   HELP key

In the case of warnings and errors (but not for limit transgressions), touch HELP to receive details on the reported errors. You also get instructions on how to remedy malfunctions and errors.

If there are several errors at the same time, they are displayed in one line after another. Use △ and ▽ to select an error message. In the lower part of the display, the appropriate information and solution possibilities are indicated.

In the lower line on the left, the total number of currently existing errors is displayed.

On the right, the error code of the currently selected error is displayed.

The errors code unequivocally defines each error. If required, send this code to the service company.

As soon as a malfunction or an error has been remedied, the message and the corresponding info text disappear.

Error code
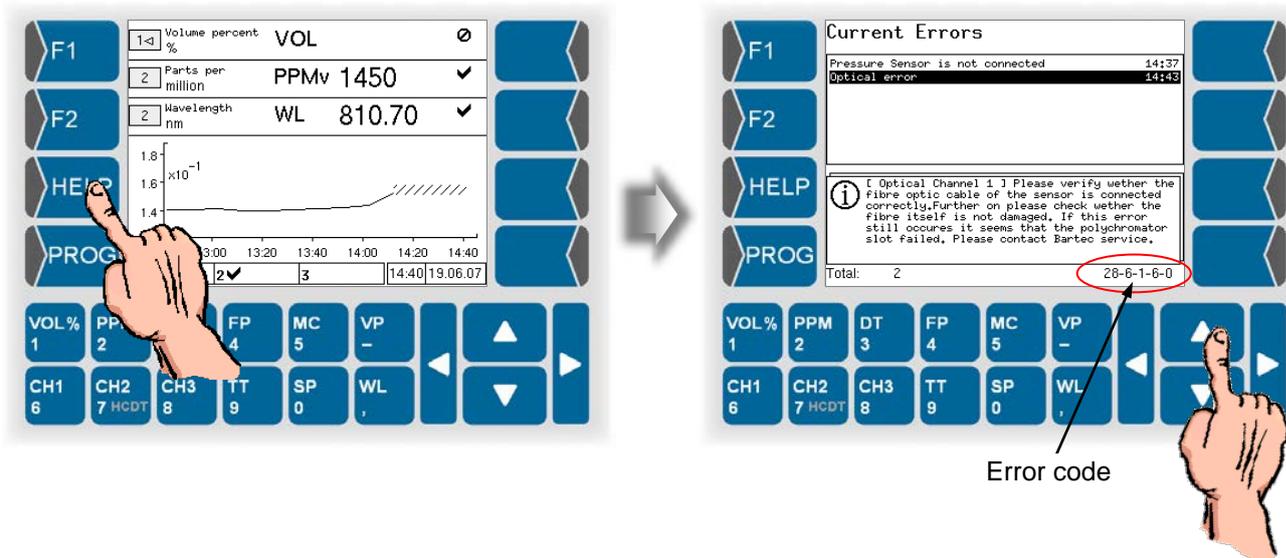
7 Maintenance

Cleaning the sensor

Maintenance of the HYGROPHIL® F 5673 is limited to cleaning the moisture-sensitive layer on the tip of the sensor L 166x.

The cleaning intervals depend on how dirty the sample gas is.

⚠️ | Handle the sensor very carefully. The moisture-sensitive layer is very susceptible to knocks and scratches. Never use pointed or sharp edged objects to clean the sensor. Damage may result in incorrect measurements.

● Take the probe out of the measuring line. [1]

Use soft cleaning cloths only.

● Clean the sensor tip with a soft cloth twisted to a tip, preferably one impregnated with alcohol (isopropyl). BARTEC BENKE recommends OpticPads CT811 supplied by CleanTex, or similar products

Moisture-sensitive layer
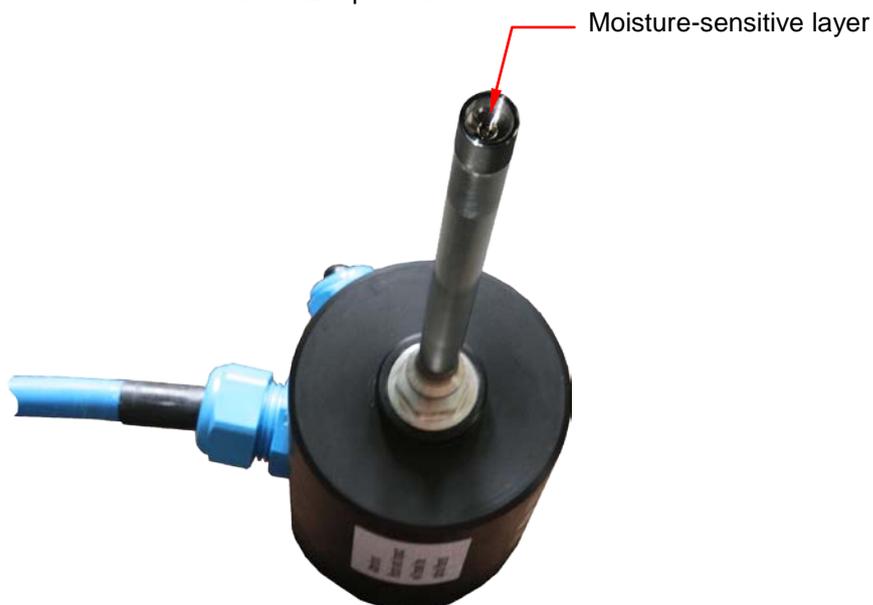
● Then wipe the surface several times with a soft cloth to remove any residues of alcohol.

Use the cloths only once!

● Reinsert the sensor in the measuring line.[1]

[1] When removing and reinserting the sensor, follow the instructions provided with the accessories used (e.g. sensor retraction tool).

If a L1660 sensor is used you can unscrew the protective cap. If you cannot undo the cap by hand, loosen it carefully with pliers.

● After cleaning the sensor tip, screw the protective cap carefully back on the sensor.

8   Bus systems

8.1   Modbus

The MODBUS data transfer of the HYGROPHIL® F 5673 uses the **RTU** (**R**emote **T**erminal **U**nit) mode. It is always a MODBUS slave and is physically transmitted through a RS485 connection. The RS485 line has to be connected on clamps 414(-) and 415(+).

Alternatively the MODBUS can be operated via RS232 interface. You can select the interface in the "Modbus/Profibus" menu (see section 5.6.7).
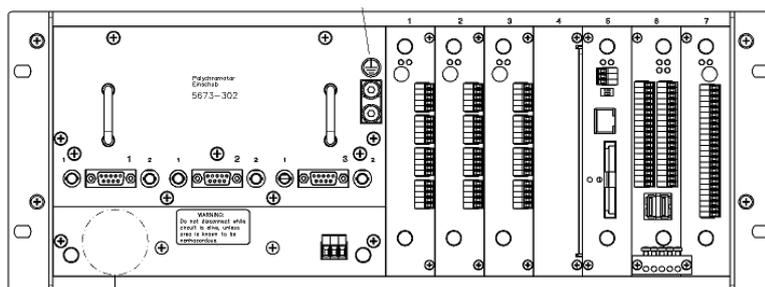
Interface
module

5673−110

	Design.	Signal	Design.	Signal	
Analog Out 1 0/4−20mA	401	OUT 1+	404	OUT 2+	Analog Out 2 0/4−20mA
	402	OUT 1−	405	OUT 2−	
	403	Shield	406	Shield	
Analog Out 3 0/4−20mA	407	OUT 3+	410	free	
	408	OUT 3−	411	free	
	409	Shield	412	free	
MODBUS RTU RS485, +24V, max 50mA	413	+24V	417	+24V	RS485, +24V, max 50mA
	414	A1	418	A2	
	415	B1	419	B2	
	416	GND	420	GND	
	421	+24V	424	GND	Serial Out RS232, +24V, max 50mA
	422	RxD 1	425	TxD 1	
	423	CTS 1	426	RTS 1	
	427	+24V	430	GND	MODBUS RTU RS232, +24V, max 50mA
	428	RxD 2	431	TxD 2	
	429	CTS 2	432	RTS 2	
	433	+5V	436	GND	Profibus, +5V max 50mA
	434	PB_A	437	Shield	
	435	PB_B	438	Shield	

USB 1		USB 2	

281686.dwg

The MODBUS slave address has a range from 1 to 247 and could be easily changed by means of the application software. On the same way the baud rate (1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200) and the interface's parity (even, odd, none) can be changed (see section 5.6.7).

The HYGROPHIL® F 5673 MODBUS supports function codes „**01 → Read single coils**" and „**03 → Read multiple holding registers**"

Function code **„01"** supplies the master system with the data listed in *Table 1*.

Request Host

Function code	1 Byte	**0x01**
Start Address	2 Bytes	**0 to 60**
Count of bits	2 Bytes	**1 to 61**

Response HYGROPHIL® F

Function code	1 Byte	0x01
Number of bytes	1 Byte	Number of bytes for the bit information to be transferred
Bit information		data (bitwise coded) corresponding to the specified number of bytes

Table 1				
01 Read Single Coils				
0	CH1 Present?		30	Is Sample CO2 CH1 Valid?
1	CH2 Present?		35	Is Wavelength CH2 Valid?
2	CH3 Present?		36	Is Volume percent CH2 Valid?
3	HCDT HW Present?		37	Is PPM CH2 Valid?
4	Error Status CH1		38	Is Dew Point CH2 Valid?
5	Limit Status CH1		39	Is Frost Point CH2 Valid?
6	Liquid measurement CH1		40	Is Vapour pressure CH2 Valid?
7	Error Status CH2		41	Is Moisture content CH2 Valid?
8	Limit Status CH2		42	Is Sample Temperature CH2 Valid?
9	Liquid measurement CH2		43	Is Sample Pressure CH2 Valid?
10	Error Status CH3		44	Is Sample CO2 CH2 Valid?
11	Limit Status CH3		49	Is Wavelength CH3 Valid?
12	Liquid measurement CH3		50	Is Volume percent CH3 Valid?
13	HCDT Error		51	Is PPM CH3 Valid?
21	Is Wavelength CH1 Valid?		52	Is Dew Point CH3 Valid?
22	Is Volume percent CH1 Valid?		53	Is Frost Point CH3 Valid?
23	Is PPM CH1 Valid?		54	Is Vapour pressure CH3 Valid?
24	Is Dew Point CH1 Valid?		55	Is Moisture content CH3 Valid?
25	Is Frost Point CH1 Valid?		56	Is Sample Temperature CH3 Valid?
26	Is Vapour pressure CH1 Valid?		57	Is Sample Pressure CH3 Valid?
27	Is Moisture content CH1 Valid?		58	Is Sample CO2 CH3 Valid?
28	Is Sample Temperature CH1 Valid?		61	Is Hydro Carbon Dew Point Valid?
29	Is Sample Pressure CH1 Valid?			

Function code „03" answers with registers of measurement variables and parameters as showed in *Table 2*. The field 60-79 represent states and error codes. Special measurement variables need a more detailed resolution. Therefore some variables are spanned over two 16-bit registers (such values are marked with HI and LO in the 16-/32- bit column).

Request Host

Function code	1 byte	**0x03**
Start address	2 bytes	**0 to 79**
Number of registers	2 bytes	**1 to 80**

Response HYGROPHIL® F

Function code	1 byte	**0x03**
Number of bytes	1 byte	Number of transmitted registers multiplied with 2
Values of registers		Number of transmitted registers x 2 bytes

The values in the holding registers are spread to the available range.

Example

A **16 bit value** has a range of values **0 ... 65535**.
Register 4, dewpoint channel 1 is between -100 °C and +100 °C.
-100 °C   correlates   0   (min)
+100 °C   correlates   65535   (max)

The conversion is as follows:

$$\frac{Register\ value * (max - min)}{65535} + min = \textbf{value}$$

When HYGROPHIL for the dewpoint at channel 1 reports the register value 12345, results:

$$\frac{12345 * 100 - (-100)}{65535} + (-100) = \underline{\textbf{62,32}} \quad °C$$

Conversion of **32 bit values** is analogous.
The range of values is here **0 ... 4294967295**.

Table 2					
03 Read Holding Registers					
Addr.	16-/32 Bit	Description	Min	Max	Unit
0		Wavelength CH1	780	830	nm
1		Volume percent CH1	0	100	%
2	HI	PPM CH1	0	25000	ppm
3	LO				
4		Dew Point CH1 (-100-100 °C or -148-212 °F)	-100	100	°C
5		Frost Point CH1 (-100-100 °C or -148-212 °F)	-100	100	°C
6	HI	Vapour pressure CH1 (0-250hPa/mbar or 0-3.626psi)	0	250	hPa/mbar
7	LO				
8	HI	Moisture content CH1 (0-30000mg/m^3 or 0-1873.83lb/MMScf)	0	30000	mg/m^3
9	LO				
10		Sample Temperature CH1 (-50-100 °C or -58-212 °F)	-50	100	°C
11	HI	Sample Pressure CH1 (0-250000hPa/mbar or 0-3626psi)	0	250000	hPa/mbar
12	LO				
13		Sample CO_2 CH1	0	100	%
14	HI	RH CH1	0	100	%
15	LO				
18		Wavelength CH2	780	830	nm
19		Volume percent CH2	0	100	%
20	HI	PPM CH2	0	25000	ppm
21	LO				
22		Dew Point CH2 (-100-100 °C or -148-212 °F)	-100	100	°C
23		Frost Point CH2 (-100-100 °C or -148-212 °F)	-100	100	°C
24	HI	Vapour pressure CH2 (0-250 hPa/mbar or 0-3.626 psi)	0	250	hPa/mbar
25	LO				
26	HI	Moisture content CH2 (0-30000mg/m^3 or 0-1873.83lb/MMScf)	0	30000	mg/m^3
27	LO				
28		Sample Temperature CH2 (-50-100 °C or -58-212 °F)	-50	100	°C
29	HI	Sample Pressure CH2 (0-250000 hPa/mbar or 0-3626 psi)	0	250000	hPa/mbar
30	LO				
31		Sample CO_2 CH2	0	100	%
32	HI	RH CH2	0	100	%
33	LO				

Addr.	16-/32 Bit	Description	Min	Max	Unit
36		Wavelength CH3	780	830	nm
37		Volume percent CH3	0	100	%
38	HI	PPM CH3	0	25000	ppm
39	LO				
40		Dew Point CH3 (-100-100 °C or -148-212 °F)	-100	100	°C
41		Frost Point CH3 (-100-100 °C or -148-212 °F)	-100	100	°C
42	HI	Vapour pressure CH3 (0-250 hPa/mbar or 0-3.626 psi)	0	250	hPa/mbar
43	LO				
44	HI	Moisture content CH3 (0-30000mg/m^3 or 0-1873.83lb/MMScf)	0	30000	mg/m^3
45	LO				
46		Sample Temperature CH3 (-50-100 °C or -58-212 °F)	-50	100	°C
47	HI	Sample Pressure CH3 (0-250000 hPa/mbar or 0-3626psi)	0	250000	hPa/mbar
48	LO				
49		Sample CO_2 CH3	0	100	%
50	HI	RH CH3	0	100	%
51	LO				

Addr.	16-/32 Bit	Description	Min	Max	Unit
54		Hydro Carbon Dew Point (if available. -50-30 °C or -58-86 °F)	-50	30	°C
55		HCDT Sensor current mirror temperature (if available)	-50	100	°C
			-58	212	°F
56		HCDT Sensor max. mirror temperature (if available)	-50	100	°C
			-58	212	°F
57		HCDT Sensor min. mirror temperature (if available)	-50	100	°C
			-58	212	°F
58		HCDT State 0=Error 1=Heat Mirror 2=Fast ajust sensor temperature 3=Seeking current HCDT	0	65535	
59		Software Version	0	65535	
60		Error 1	0	65535	
...		...	0	65535	
79		Error 20	0	65535	

8.2   Profibus

The Hygrophil F 5673 device supports data transfers via a certificated Profibus DP interface. All Profibus specified data are written down in the GSD file **„BARx0bc9.gsd"**. The devices slave address is on the fly changeable by both the Profibus Master and on the device itself.

The data field has a size of 122 bytes and is consistent over the whole data frame. This allows the user a detailed overview and shows the state and the measurement variables of the devices. *Table 3* shows the positions of state and measurement variables within the 122 bytes data field.

Table 3 (from software version 1.8.12*)							
HYGROPHIL® 5673 Profibus Data Description							
Byte	***Content Description***						
	Status Information						
0	*MSB*						*LSB*
	CH1 Present	CH2 Present	CH3 Present	HCDT Present	CH1 Error	CH2 Error	CH3 Error	HCDT Error
1	*MSB*						*LSB*
	CH1 Limit	CH2 Limit	CH3 Limit	HCDT Limit	CH1 LiqMeas	CH2 LiqMeas	CH3 LiqMeas	reserved
2-3	reserved						

Byte 0 and Byte 1 represent the status of the device.

*   *To software versions less than 1.8.12 applies for bytes 0 to 3, the following constellation:*

Table 3 (Software versions earlier than 1.8.12)							
HYGROPHIL® 5673 Profibus Data Description							
Byte	***Content Description***						
	Status Information						
0-1	reserved						
2	*MSB*						*LSB*
	reserved	CH3 LiqMeas	CH2 LiqMeas	CH1 LiqMeas	HCDT Limit	CH3 Limit	CH2 Limit	CH1 Limit
3	*MSB*						*LSB*
	HCDT Error	CH3 Error	CH2 Error	CH1 Error	HCDT Present	CH3 Present	CH2 Present	CH1 Present

Byte 2 and Byte 3 represent the status of the device.

<u>*Table 3*</u> *continued*

Starting on byte 4 to byte 115 the system mirrors four-byte float values.

Channel 1 Data

4-7	TT	C
8-11	SP	hPa/mbar
12-15	WL	nm
16-19	VOL	%
20-23	PPM	ppm
24-27	DT	C
28-31	FP	C
32-35	MC	mg/m³
36-39	VP	hPa/mbar

Channel 2 Data

40-43	TT	C
44-47	SP	hPa/mbar
48-51	WL	nm
52-55	VOL	%
56-59	PPM	ppm
60-63	DT	C
64-67	FP	C
68-71	MC	mg/m³
72-75	VP	hPa/mbar

Channel 3 Data

76-79	TT	C
80-83	SP	hPa/mbar
84-87	WL	nm
88-91	VOL	%
92-95	PPM	ppm
96-99	DT	C
100-103	FP	C
104-107	MC	mg/m³
108-111	VP	hPa/mbar

HCDT Data

112-115	HCDT	C
116-122	reserved	

If the HYGROPHIL® F is the physically last device on the Profibus, the termination resistors on the COMM board have to be activated with the onboard jumpers (see figure below).
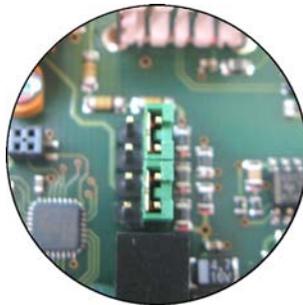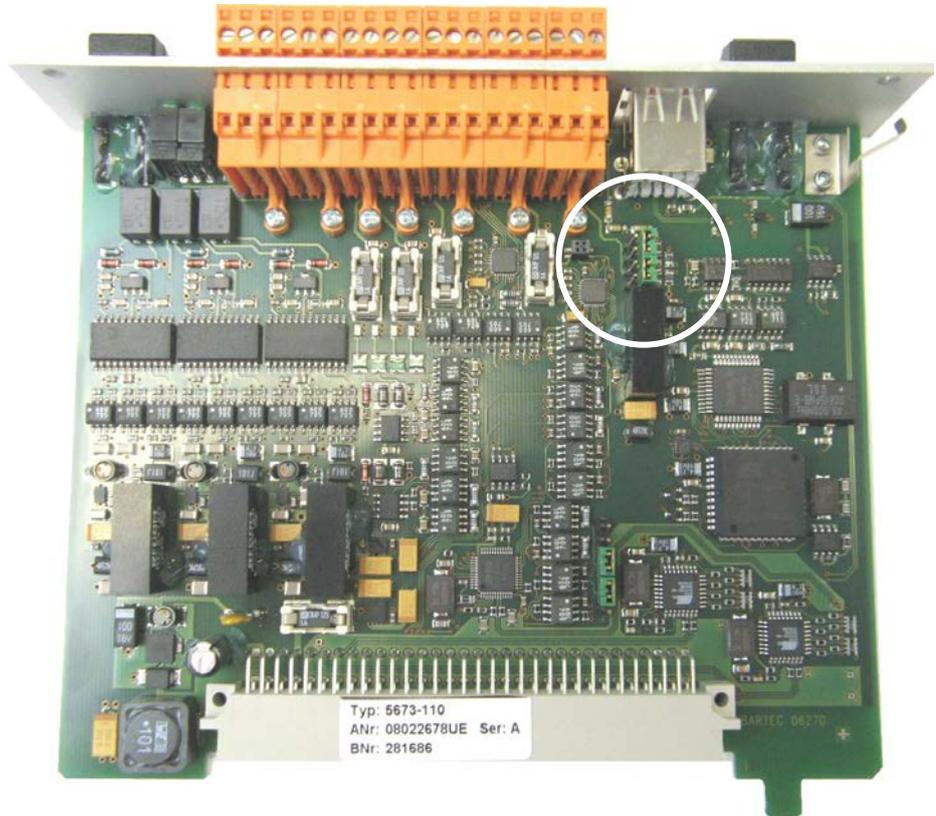
Jumpers open,
termination deactivated
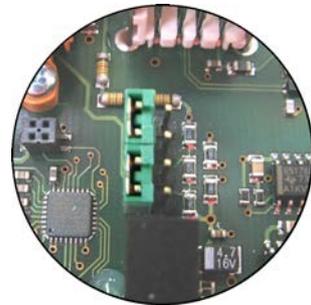
Jumpers closed,
termination active

Please connect the Profibus on 434 (A), 435 (B) and 438 (shield).

Interface
module
5673-110

Design.	Signal	Design.	Signal
401	OUT 1+	404	OUT 2+
402	OUT 1−	405	OUT 2−
403	Shield	406	Shield
407	OUT 3+	410	free
408	OUT 3−	411	free
409	Shield	412	free
413	+24V	417	+24V
414	A1	418	A2
415	B1	419	B2
416	GND	420	GND
421	+24V	424	GND
422	RxD 1	425	TxD 1
423	CTS 1	426	RTS 1
427	+24V	430	GND
428	RxD 2	431	TxD 2
429	CTS 2	432	RTS 2
433	+5V	436	GND
434	PB_A	437	Shield
435	PB_B	438	Shield

Analog Out 1
0/4−20mA

Analog Out 3
0/4−20mA

MODBUS RTU
RS485, +24V,
max 50mA

Analog Out 2
0/4−20mA

RS485, +24V,
max 50mA

Serial Out
RS232, +24V,
max 50mA

MODBUS RTU
RS232, +24V,
max 50mA

Profibus, +5V
max 50mA

USB 1	USB 2

281686.dwg

9   Appendix

List of resistance and side effects
for fibre-optic sensor L166x

This list only gives general recommendations. At definite applications this has to be confirmed by tests.
This list is not subject of liabilities.

Medium *medium*			Beständig *resistant*	Bemerkung *remarks*
Acetylen	*acetylene*	G	+	
Alkohole	*alcohols, generally*	F	+	Ex, aufgrund der Wasserstoffbrückenbindung der OH-Gruppen muss der Alkohol erhitzt werden, um die Wassermoleküle freizusetzen *Because of the hydrogen bonds you have to heat up the fluid to set free the water molecules*
Ammoniak NH$_3$	*ammonia*	G	X	Verhält sich wie Wasserdampf, daher Messung kaum möglich. *Acts like water vapour to the sensor, hence measurement almost impossible.*
Argon		G	+	
Äthanol	*ethyl alcohol*	F	+	
Benzol	*benzene*	F	+	
Blausäure HCN	*hydrogen cyanide*	G	x	Ätzt das Glassubstrat des Sensors an *Attacks the glass substrate*
Chlor	*chlorine*	G	?	Tests sind im Gange *Tests are in progress*
Di-Chlor-Ethan	*ethylene dichloride*	G	+	
Druckluft	*compressed air*	G	+	
Erdgas	*natural gas*	G	+	Ex; auch bei Glykol-Belastung *Even when glycol is present*
Ester	*ester*	F	+	
Flüssigkeiten	*liquids, generally*	F	+	Messung generell gut möglich, Sonderkalibrierung erforderlich *measurement generally possible, special calibration necessary.*
Flußsäure H	*hydrofluoric acid*	G	x	ätzt die SIO-Schicht an *will seriously etch the layer*
Helium		G	+	
Hexan	*hexane*	G F	+	Ex
Kerosin	*kerosene*	F	+	Mit Sonderkalibrierung möglich *With special calibration possible*
Kohlendioxid CO$_2$	*carbon dioxide*	G	+	Mit Sonderkalibrierung möglich *With special calibration possible*
Kohlenmonoxid CO	*carbon monoxide*	G	?	
Kohlenwasserstoffe	*hydrocarbons, generally*	F G	+	Messung generell gut möglich, Sonderkalibrierung erforderlich *Measurement generally possible, special calibration necessary.*
Krypton		G	+	
Lachgas	*Nitrous oxide*	G	**+**	Ex
Methan	*methane*	G	**+**	Ex
Methanol	*methyl alcohol*	F	**+**	Ex,
Methylenchlorid	*methyl chloride*	G	**+**	
Naphtha	*naphtha*	G	**+**	
Narkosegas	*narcotic gas*	G	**+**	möglicherweise außerhalb Messbereich *possibly outside measuring range*
Neon		G	**+**	

Medium *medium*			Beständig *resistant*	Bemerkung *remarks*
Nonylalkohol	*nonanol / INA*	G	**+**	
Propan	*propane*	F	**+**	Ex
Raffineriegas	*refinery gas*	G F	**+**	
Recyclegas	*recycle gas*	F	**+**	
Sauerstoff	*oxygen*	G	**+**	
Schwefelhexafluorid SF6	*sulphur hexafluoride*	G	**+**	Aber: Verunreinigungen können SIO-Schicht ätzen *Warning: pollutants may etch the measuring layer*
Schwefelwasserstoff	*hydrogen sulphide*	G	**+**	Getestet bis zu einem Anteil von 18 Vol% H2S *corrosive at high humidity*
SF4	*sulphur tetrafluoride*	G	x	bildet mit Restfeuchte HF! Ätzt sofort Sensorschicht *With water vapour forms hydrofluoric acid*
Stickoxid	*nitric oxide*	G	**+**	
Stickstoff	*nitrogen*	G	**+**	
Toluol	*toluene*	F	**+**	Restfeuchte in flüssigem Lösungsmittel *Trace humidity in liquid solvent*
Vinylacetat	*vinyl acetate*	F	**+**	Restfeuchte in flüssigem Lösungsmittel *Trace humidity in liquid solvent*
Wasserstoff	*hydrogen*	G	**+**	Ex
Xenon		G	**+**	
Xylol		F	**?**	Tests sind im Gange *Tests are in progress*
Weitere Gase und Flüssigkeiten werden laufend getestet. Fragen Sie bitte an. *Further gases and liquids currently under testing. Please ask.*				

F	Flüssigkeit	*liquid*
G	Gas	*gas*
+	beständig	*resistant*
0	bedingt beständig	*partly resistant*
n	nicht beständig	*not resistant*
X	Quereffekte vorhanden	*possible side effects*
?	Tests nötig	*tests to be made*

Default liquid saturation characteristic curves
in HYGROPHIL® F 5673

	Liquid	PPMw at					
		0°C	10°C	20°C	30°C	40°C	50°C
1	Benzene		454	639	870	1178	1570
2	Bicyclo(2.2.1)hepta-2.5-diem			295	383		670
3	Butadiene		500	730			
4	Butane		34	71	122	149	
5	Butylbenzene		234	331	448		
6	sec-Butylbenzene		226	317	426		
7	tert-Butylbenzene		205	292	389		
8	Butylcyclopentane		56	95	151		
9	Carbon Dioxide	570	760	1000			
10	Carbon Tetrachloride			80			
11	Chlorobenzene			40			
12	Chloroform			600			
13	Cumene	156	219	303	407	550	710
14	Cycloheptatriene				630	773	990
15	Cyclohexane		67	122	194	317	490
16	Cyclohexene		252	317	424	562	
17	Cyclopentane	46	86	142	249	398	
18	1.4-Bis(cyclopentyl)butane		88	139	241		
19	2-Cyclopentyloctane		48	75	122		
20	Decalin			63	105	164	
21	1.2-Dichloroethane			1500			
22	Dichloromethane			1700			
23	Diethylbenzene	159	226	319	431	574	756
24	Diisobutylene		145	191	274		
25	2.3-Dimethylbutane	29	58	110	192	323	516
26	2.3-Dimethyl-1-butene				459		
27	2.6-Dimethylheptane		53	91	160	301	465
28	2.4-Dimethylhexane		53	98	180		
29	2.7-Dimethyloctane		48	87	152		
30	7.8-Dimethyltetradecane			77	134	219	344
31	Ethylbenzene		275	373	502		
32	Ethylcyclopentane		71	119	186		
33	1-Ethyl-2-pentylcyclopentane		103	168	273		
34	Gasoline			40			
35	Heptane	27	54	96	172	308	480
36	1-Heptene		186	249	375		
37	Hexadecane			69	123	209	332
38	Hexane			101	179	317	
39	1-Hexene				477		
40	Hexylcyclopentane		52	84	141		
41	Isoprene			662			
42	Isopropylcyclopentane		59	102	159		
43	p-Isopropyltoluene		223	305	415		
44	Kerosene			100			
45	2-Methylbutane	32	59	112			
46	2-Methyl-2-butene			435			
47	Methylcyclohexane		61	116	179		
48	2-Methylhexane		56	103	182		
49	Methylcyclopentane		73	131	205		
50	2-Methyloctane		52	90	156		
51	3-Methyloctane		50	87	155		

	Liquid	PPMw at					
		0°C	10°C	20°C	30°C	40°C	50°C
52	1-Methyl-2-phenylcyclopentane		105	173	289		
53	Nitrobenzene			3000			
54	Octane		51	160	184	315	507
55	Pentane			94	192	350	
56	n-Pentane			83		350	
57	1-Phenyl-5-methyl-1-cyclopentane				306		
58	2-Phenyl-2.4.6-trimethylheptane		96	154	252		
59	Propane		53	140	200	258	
60	Propylene			416	779		
61	Propylidenecyclopentane				383		
62	Styrene			345			
63	Tetrachloroethylene			20			
64	Transformer Oil	19	28	45	70	100	160
65	Trichloroethane			90			
66	Trichloroethylene			20			
67	1.3.5-Trimethyl-2-allylbenzene			246	331	438	
68	1.3.5-Trimethylbenzene			291	393	519	
69	2.2.3-Trimethylbutane	27	57	160	184	315	507
70	1.3.5-Trimethyl-2-ethylbenzene			259	350	461	
71	1.3.5-Trimethyl-2-propylbenzen			255	343	455	
72	2.2.4-Trimethylpentane	31	59	115	201	332	538
73	Toluene		316	460	615	750	965
74	m-Xylene		289	402	536		

Predefined gases in HYGROPHIL® F 5673

Components			1 Russian H Gas	2 North Sea I H Gas	3 North Sea II H Gas	4 Netherland I L Gas	5 Netherland II L Gas
Methan	CH_4	mol%	98.3	88.6	83.0	81.3	82.9
Ethan	C_2H_6	mol%	0.5	8.4	11.6	2.8	3.7
Nitrogen	N_2	mol%	0.8	0.6	1.5	14.2	11.1
Carbon dioxide	CO_2	mol%	0.1	0	0.3	1.0	1.3
Propan	C_3H_8	mol%	0.2	1.7	3.1	0.4	0.7
2-Methylpropan	$i\text{-}C_4H_{10}$	mol%	0	0	0	0	0
n-Butan	$n\text{-}C_4H_{10}$	mol%	0.1	0.7	0.5	0.3	0.3
2,2-Dimethylpropan	$neo\text{-}C_5H_{12}$	mol%	0	0	0	0	0
2-Methylbutan	$i\text{-}C_5H_{12}$	mol%	0	0	0	0	0
n-Pentan	$n\text{-}C_5H_{12}$	mol%	0	0	0	0	0
n-Hexan	C_6H_{14}	mol%	0	0	0	0	0

Source: Worksheet G 260 of DVGW (Deutsche Vereinigung des Gas- und Wasserfaches e.V.).

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