Badger Meter Europa GmbH

VHQ 500-SP/SPS

Ultrasonic flow meter
for open channels and partially filled pipes

INSTALLATION MANUAL

April 2003

Version 3.07a

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1. General description

The flow meter VHQ 500-SP was designed for flow measurement in partially filled pipes and open channels.

A sensor measures flow velocity and level.

A 32 bits microprocessor calculates and administrates the measuring data.

A LCD graphic display (128 x 64 pixels) allows data programming and data read out.

The programming is menu driven upon dialog texts and numbers are entered upon a keypad.

A 4digit ID number prevents from unauthorized access and protect the parameters of the measurement site.

The programming is showed in chapter 3 in the form of a flow chart and described in chapter 6.

The flow meter has a 256 KB RAM memory, which records the measuring data. 256 KB RAM corresponds to about 25.000 measuring data. The memory records following data: Date, time, flow, flow velocity, level, quantity, measurement site.

A RS232 serial port makes data read out on PC possible.

The unit can administrate up to 99 measurement sites.

Three potentialfree contacts can be programmed to transmit either quantity pulses or limit values.

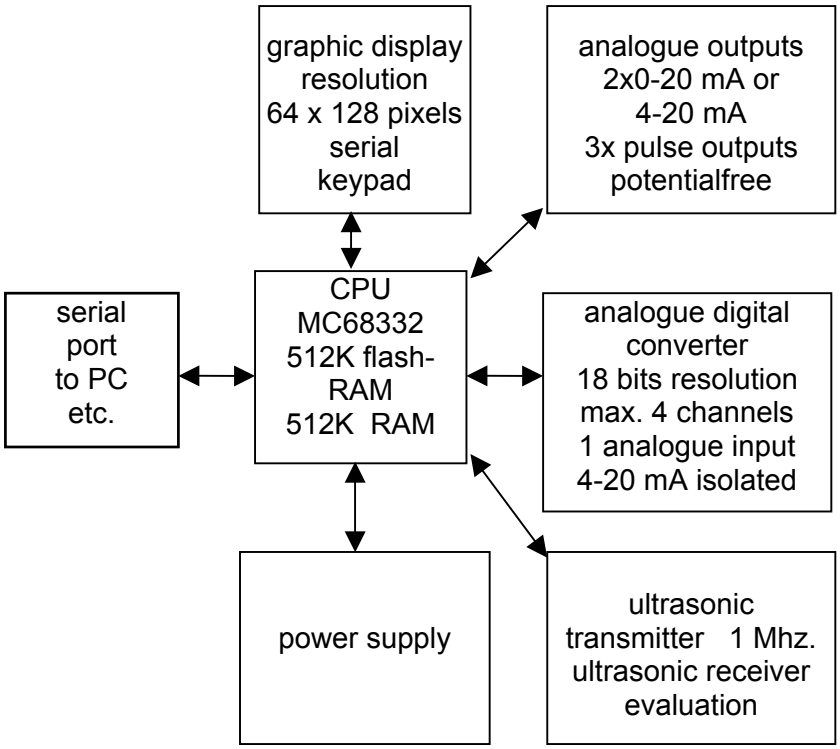
For external level measurement (sensor) an analogue input 4 – 20 mA is available.

Analogue outputs 1 and 2 are isolated. Both can be programmed for 0-20 mA or 4-20 mA and be alternatively assigned to level, flow or flow velocity.

Power supply for the portable meter is ensured by an integrated 12V battery. A battery charger will be connected to the meter from outside to recharge the battery. The battery is protected from low discharging and has a life time of about 7 days. Requested power supply for the stationary meter is 90 to 240 VAC or 18 to 32 VDC.

2. Technical data/Block diagram

2.1 Block diagram



2.2 Data

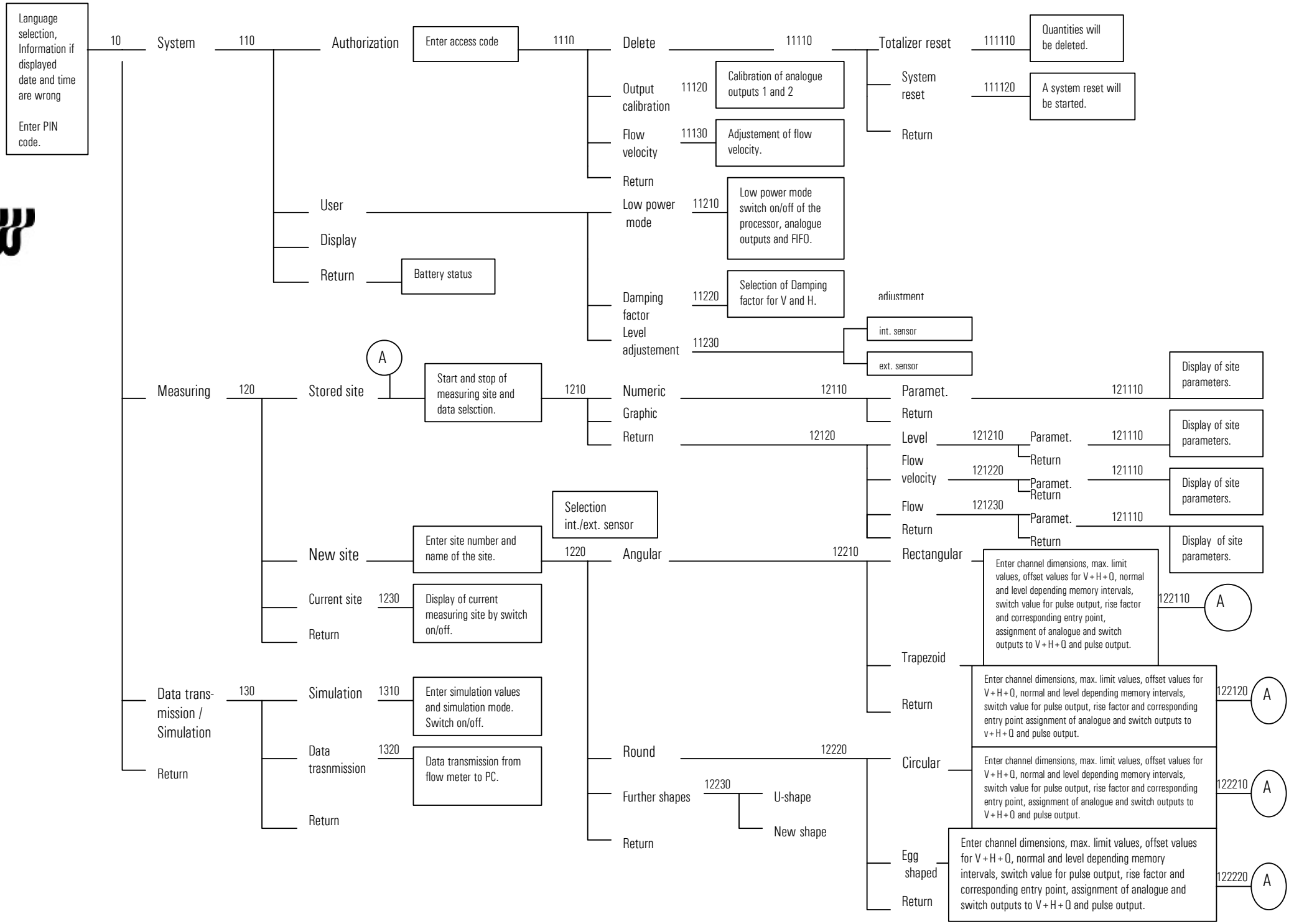
CPU	:	Motorola MC68332 32 bits
Flash-RAM	:	512 K
RAM	:	512 K
Interfaces	:	1 x RS232 serial port
		1 x serial TTL

2.3 Combined sensor V/H

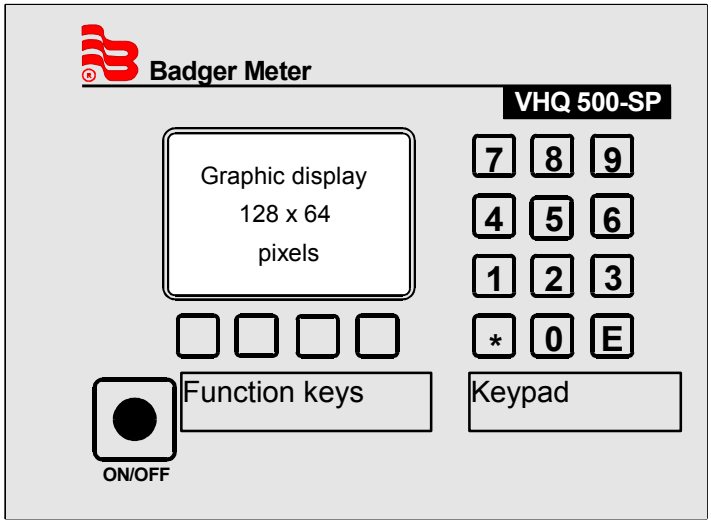
a) Doppler velocity
b) pressure level

2.4 External sensor input 4-20 mA

for level measurement power supply 24 VDC / max. 300 mA


Language selection, Information if displayed date and time are wrong
Enter PIN code.
10
System
110
Authorization
Enter access code
1110
Delete
11110
Totalizer reset
111110
Quantities will be deleted.
System reset
111120
A system reset will be started.
Return
Output calibration
11120
Calibration of analogue outputs 1 and 2
Flow velocity
11130
Adjustement of flow velocity.
Return
User
Display
Return
Battery status
Low power mode
11210
Low power mode switch on/off of the processor, analogue outputs and FIFO.
Damping factor
11220
Selection of Damping factor for V and H.
Level adjustement
11230
adjustment
int. sensor
ext. sensor
Measuring
120
Stored site
A
Start and stop of measuring site and data selsction.
1210
Numeric
12110
Paramet.
121110
Display of site parameters.
Return
Graphic
Return
12120
Level
121210
Paramet.
121110
Display of site parameters.
Return
Flow velocity
121220
Paramet.
121110
Display of site parameters.
Return
Flow
121230
Paramet.
121110
Display of site parameters.
Return
New site
Enter site number and name of the site.
Selection int./ext. sensor
1220
Angular
12210
Rectangular
Enter channel dimensions, max. limit values, offset values for V+H+Q, normal and level depending memory intervals, switch value for pulse output, rise factor and corresponding entry point, assignment of analogue and switch outputs to V+H+Q and pulse output.
122110
A
Current site
1230
Display of current measuring site by switch on/off.
Return
Trapezoid
Enter channel dimensions, max. limit values, offset values for V+H+Q, normal and level depending memory intervals, switch value for pulse output, rise factor and corresponding entry point assignment of analogue and switch outputs to v+H+Q and pulse output.
122120
A
Return
Round
12220
Circular
Enter channel dimensions, max. limit values, offset values for V+H+Q, normal and level depending memory intervals, switch value for pulse output, rise factor and corresponding entry point, assignment of analogue and switch outputs to V+H+Q and pulse output.
122210
A
Further shapes
12230
U-shape
New shape
Return
Egg shaped
Enter channel dimensions, max. limit values, offset values for V+H+Q, normal and level depending memory intervals, switch value for pulse output, rise factor and corresponding entry point, assignment of analogue and switch outputs to V+H+Q and pulse output.
122220
A
Return
Data trans-mission / Simulation
130
Simulation
1310
Enter simulation values and simulation mode. Switch on/off.
Data trasnmission
1320
Data transmission from flow meter to PC.
Return
Return

4. Description of front panel

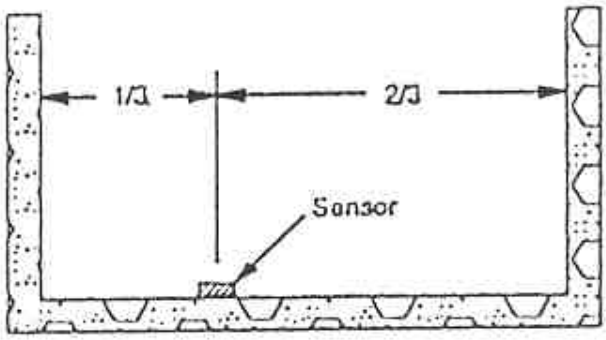


- Key on/off to switch on/off
- Function keys are used to retrieve measuring data and to program the unit.
- Keypad for programming.

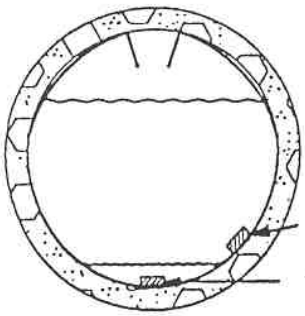
5. Sensor installation

Sensor mounting into the channel:

- rectangular shaped channel



- typical sensor mounting in a circular channel is always on the deepest place of the pipe. The sensor is usually screwed on a mounting band.



sensor mounting by sludge

standard sensor mounting

CAUTION FOR STATIONARY VERSION!
After connection of the sensor cable at the terminal, please remove the rubber protection cap from the capillary tube.

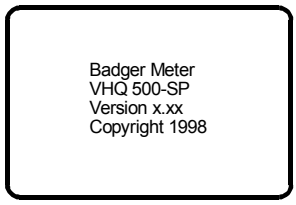
6. Programming

6.1 Programming on stage „ON“

Once the meter has been switched on, the operation software is loaded into the RAM.

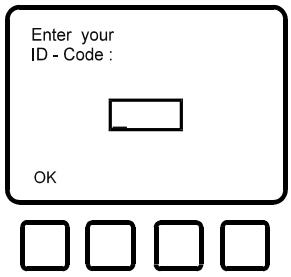
Following screen appears on the display:

Illustration 10



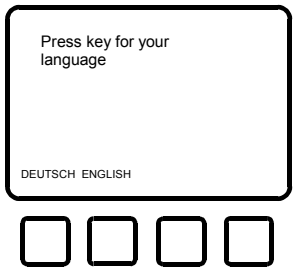
After this indication, the display switches to the input of ID number.

Illustration 10.1



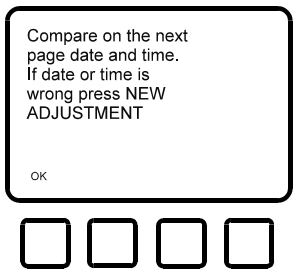
Enter ID number.
The ID number is a factory adjusted 4-digit code.
If you lose this code, please call Badger Meter and give the serial number f.i. 01.1999.001.

Illustration 11



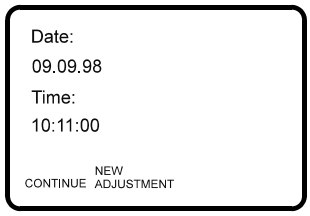
Selection of language. Press the key accordingly.

Illustration 12



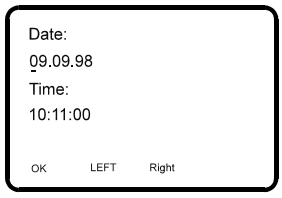
Please check date and time.

Illustration 13



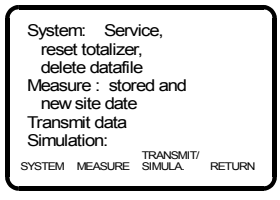
If date and time is correct, press CONTINUE.
If date and/or time is wrong, press NEW ADJUSTMENT.

Illustration 14



Adjust date and time with LEFT/RIGHT keys.
Enter the figures by pressing numbers on the keypad and confirm with OK.

Illustration 15

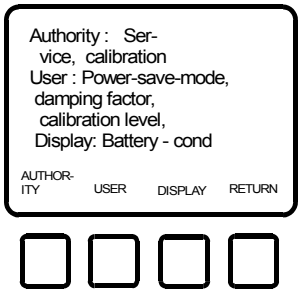


Choice of programming stage:
SYSTEM, MEASURE, TRANSMIT DATA

or RETURN.

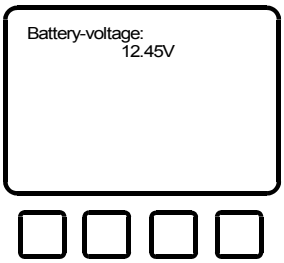
Select SYSTEM	Illustration 16
Select MEASURE	Illustration 36
Select TRANSMIT-SIMUL.	
Select RETURN	Illustration 12

Illustration 16



Select USER	Illustration 17
Select AUTHORITY	Illustration 25
Select DISPLAY	Illustration 16.1

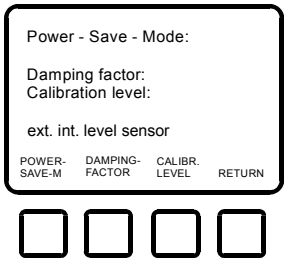
Illustration 16.1



Indication of the actual battery voltage.

If the battery voltage is below the minimum, this will appear on the display.

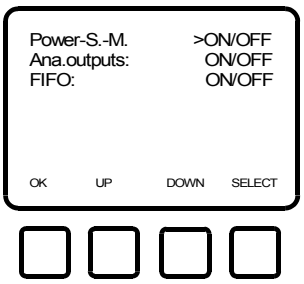
Illustration 17



Power-Save-Mode (save battery power)
Damping factor
Level sensor calibration (ext./int.)

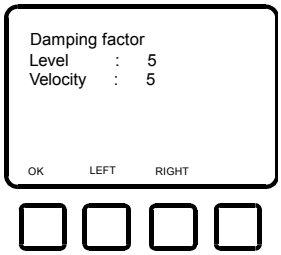
Select POWER-SAVE-M	Illustration 18
Select DAMPING FACTOR	Illustration 19
Select CALIBR. LEVEL	Illustration 20
Select RETURN	Illustration 16

Illustration 18



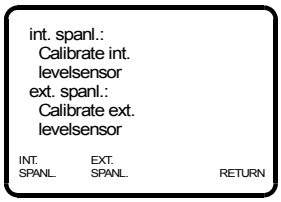
Power-Save-Mode ON/OFF (if this mode is ON, the electronic will go into sleep mode between the programmed measuring intervals).
Analogue outputs ON/OFF (if no analogue output is requested, select OFF to save power).
FIFO ON/OFF (ON means first in, first out)
(OFF means storing until memory filled)
Select ON/OFF with key SELECT and UP/DOWN.
Confirm with OK.

Illustration 19



Damping factors
1 = 1 x measurement and indication
2 = 2 x measurements with average values
3 = 3 x measurements with average values
4 = 4 x measurements with average values
5 = 5 x measurements with average values
Select with LEFT/RIGHT.
Confirm with OK.

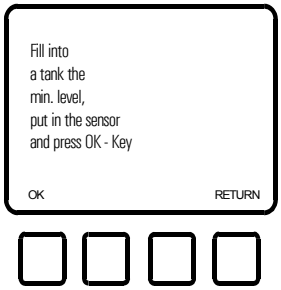
Illustration 19.1



Selection of the level sensors ext./int.
int. spanl. = standard V/H sensor, illustr. 20
ext. spanl = sensor with 4-20 mA output, illustr. 24.1
Return = illustr. 17

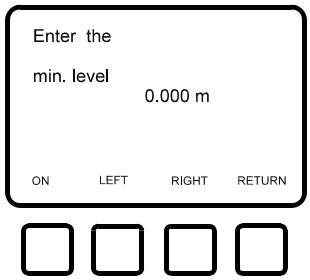
6.2 Level adjustment

Illustration 20



Adjustment of minimum level of the internal sensor, press OK.

Illustration 21

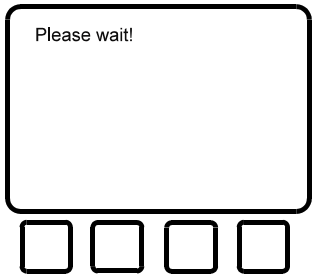


Enter minimum level and confirm with OK.
Use LEFT/RIGHT keys and keypad.

Illustration 22

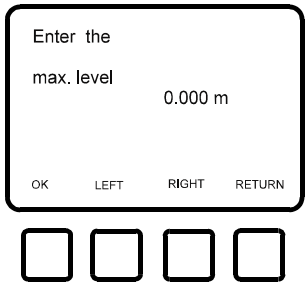
Adjustment of maximum level of the int. sensor.
Confirm with OK.

Illustration 23



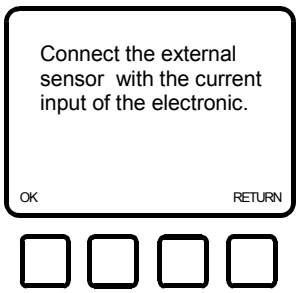
Capturing maximum level.

Illustration 24



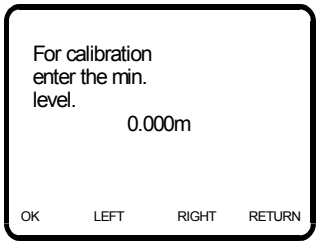
Enter maximum level and confirm with OK.
Use LEFT/RIGHT keys and keypad.

Illustration 24.1



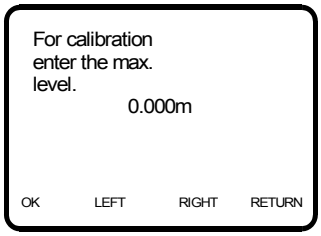
Adjustment of the external sensor.

Illustration 24.2



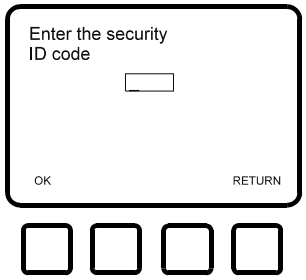
4 mA from external sensor, confirm with OK.

Illustration 24.3



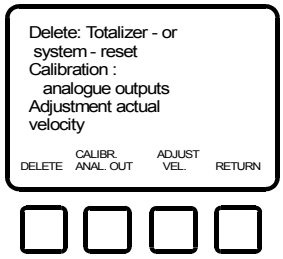
20 mA from external sensor, confirm with OK.

Illustration 25



Enter 4 digit ID-number (authorized persons only).
Use keypad and confirm with OK.

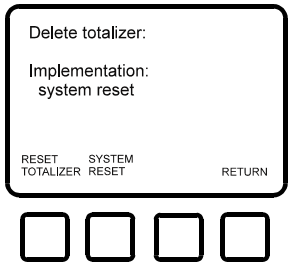
Illustration 26



Delete totalizator, measuring data and system reset.
Calibration of analogue outputs.
Adjustment of flow velocity.

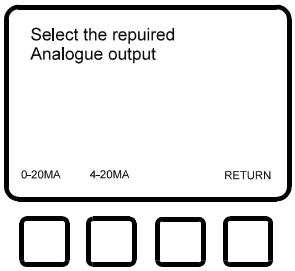
Key DELETE	Illustration 27
Key CALIBR. ANAL. OUT.	Illustration 28
Key ADJUST. VEL.	Illustration 33
Key RETURN	Illustration 16

Illustration 27



Select RESET TOTALIZATOR and measuring data
Select SYSTEM RESET (all measuring data and stored parameters are deleted).
Select RETURN to return to illustration 26

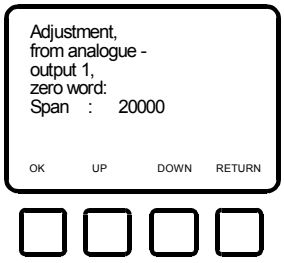
Illustration 28



Select calibration of analogue outputs 0-20 mA or 4-20 mA.

Key 0-20 mA	Illustration 29
Key 4-20 mA	Process like 0-20 mA
Key RETURN	Illustration 26

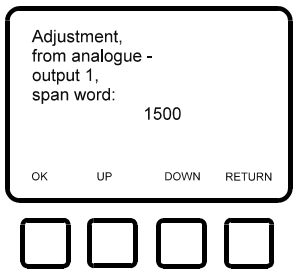
Illustration 29



Calibration of analogue output 1, connect current meter.
Adjust 0 mA with UP/DOWN keys.

Confirm with OK	Illustration 30
Key RETURN	Illustration 28

Illustration 30

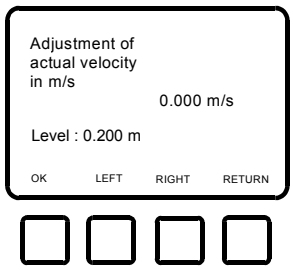


Calibration of analogue output 1.
Adjust 20 mA with UP/DOWN keys.

Confirm with OK	Illustration 31
Key RETURN	Illustration 29

Illustration 31 is like illustration 29 but calibration analogue output 2.
Illustration 32 is like illustration 30 but calibration analogue output 2.

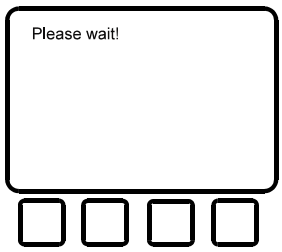
Illustration 33



Adjustment of flow velocity.
Enter actual velocity with LEFT/RIGHT buttons and keypad.

Confirm with OK	Illustration 34
Key RETURN	Illustration 26

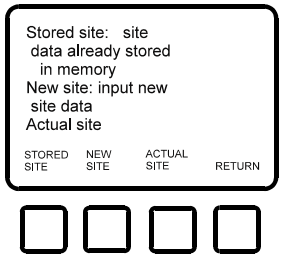
Illustration 34



Compensation of velocity is released by pressing OK.

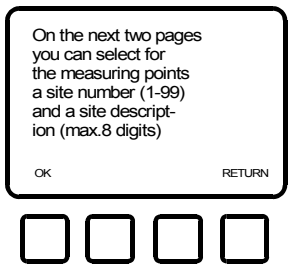
After display „Please wait“, you go automatically back to illustration 26.

Illustration 35



Key STORED SITE (already configurated)	Illustration 36
Key NEW SITE	Illustration 46
Key ACTUAL SITE	Illustration 72
Key RETURN	Illustration 15

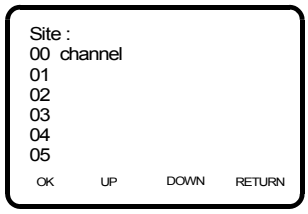
Illustration 36



Select an already stored site by pressing OK.

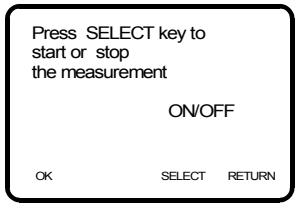
Key RETURN Illustration 35

Illustration 37



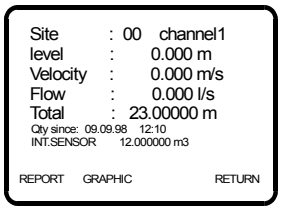
Select a stored site with UP/DOWN keys.
Confirm with OK.
Key RETURN Illustration 35

Illustration 38



Start or stop the measuring procedure by pressing SELECT.
Confirm with OK. Illustration 39
Key RETURN Illustration 37

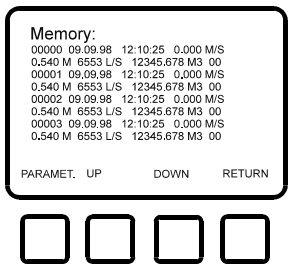
Illustration 39



Indication of measuring values incl. site #, total, display and actual working sensor.

Key REPORT Illustration 40
Key GRAPHIC Illustration 43
Key RETURN Illustration 38

Illustration 40

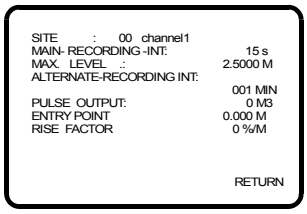


Stored measuring data:

1. Position #	2. Date	3. Time	4. Flow velocity
5. Level	6. Flow	7. Total	5. Site #

Key PARAMET.	Illustration 41
Key UP/DOWN	shift measuring values
Key RETURN	Illustration 39

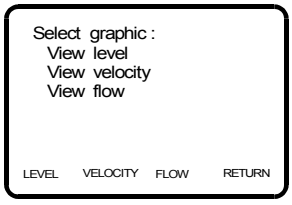
Illustration 41



Indication of adjusted parameters.

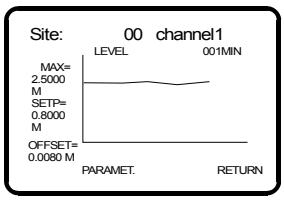
Key RETURN	Illustration 39

Illustration 42



Select graphic LEVEL	Illustration 43
Select graphic VELOCITY	Illustration 44
Select graphic FLOW	Illustration 45
Key RETURN	Illustration 39

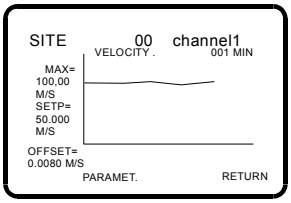
Illustration 43



Graphic of level with site #, offset of sensor and set point.

Key PARAMET.	Illustration 41
Key RETURN	Illustration 42

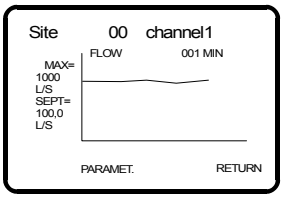
Illustration 44



Graphic of flow velocity with site #, offset of sensor and set point.

Key PARAMET.	Illustration 41
Key RETURN	Illustration 42

Illustration 45

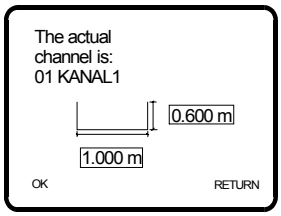


Graphic of flow with site #, and set point.

Key PARAMET.	Illustration 41
Key RETURN	Illustration 42

6.3 New site

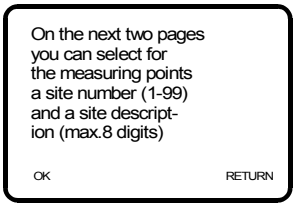
Illustration 46



Indication of the shape of the latest selected site.

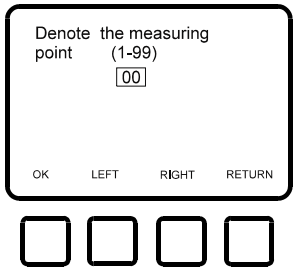
Key OK	Illustration 46.1
Key Return	Illustration 35

Illustration 46.1



Continue with OK	Illustration 47
Back with RETURN	Illustration 35

Illustration 47



Enter site # upon the keypad.

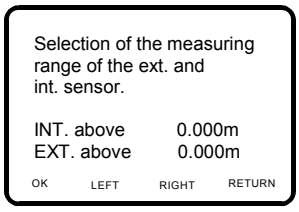
Continue with OK	Illustration 48
Select with LEFT/RIGHT	
Back with RETURN	Illustration 35

Illustration 48

Select letters or figures by moving the flashing line under the digits with LEFT/RIGHT keys.
Store the site description with STORAGE.

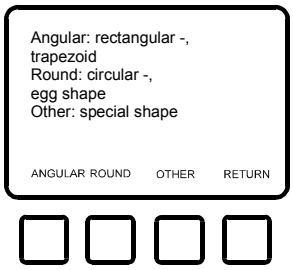
Continue with OK	Illustration 49

Illustration 48.1



Example:
- Measuring only with internal sensor adjustement = 0.000m
- Measuring only with external sensor adjustement = 0.001 m
- Measurement with internal sensor up to 0.200 m and external sensor up to 1.000 m
  adjustment internal = 0.000 m
  adjustment external = 0.200 m
- Measurement with external sensor up to 0.200 m and internal sensor up to 1.000 m
  adjustment internal = 0.200 m
  adjustment external = 0.000 m

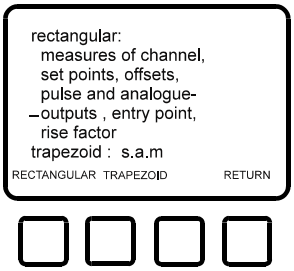
Illustration 49



Selection of channel shape:

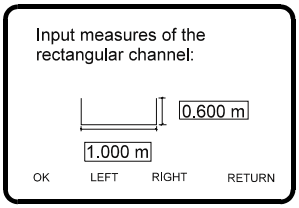
Key ANGULAR	Illustration 50
Key ROUND	Illustration
Key OTHER (special)	Illustration
Key RETURN	Illustration 46

Illustration 50



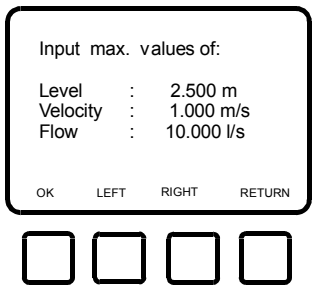
Select RECTANGULAR channel	Illustration 51
Select TRAPEZOIDAL channel	Illustration 64
Key RETURN	Illustration 49

Illustration 51



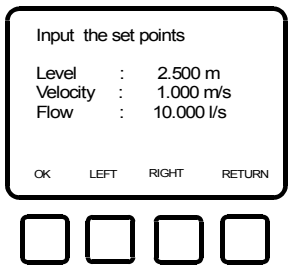
Enter channel dimensions.	
Select with LEFT/RIGHT keys.	
Enter figures upon the keypad.	
Continue with OK	Illustration 52
RETURN	Illustration 50

Illustration 52



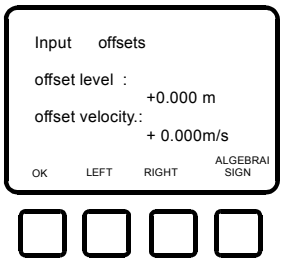
Enter max. values for V, H and Q (assignment of analogue outputs).
Select with LEFT/RIGHT keys (or figures upon the keypad).
Continue with OK Illustration 53
RETURN Illustration 49

Illustration 53



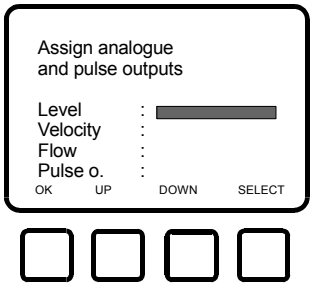
Enter alarm set points for V, H and Q.
Select with LEFT/RIGHT keys (or figures upon the keypad).
Continue with OK Illustration 54
RETURN Illustration 52

Illustration 54



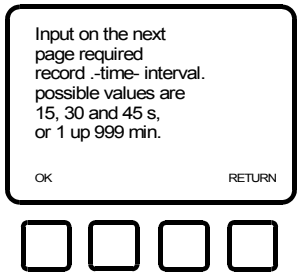
Enter offset values for level and velocity.
Select with LEFT/RIGHT keys (or figures upon the keypad).
Select positive/negative with ALGEBRAIC SIGN.
Continue with OK. Illustration 55

Illustration 55



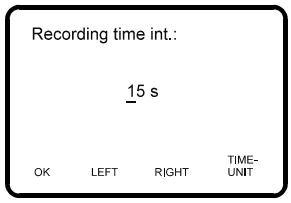
Assign analogue and pulse outputs to V, H and Q.
Select 0-20 mA, 4-20 mA, pulse output 1, pulse output 2.
Select between V, H, Q and pulse output with UP/DOWN.
Confirm with OK Illustration 56.

Illustration 56



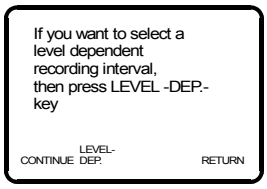
Continue with OK — Illustration 57
Back with RETURN — Illustration 53

Illustration 57



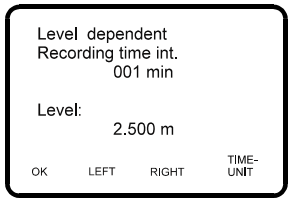
Select the storage time interval:
15 sec., 30 sec., 45 sec.
1 minute up to 999 minutes.
Select with LEFT/RIGHT keys (or figures upon the keypad).
Select seconds or minutes with TIME UNIT.
Confirm with OK — Illustration 58

Illustration 58



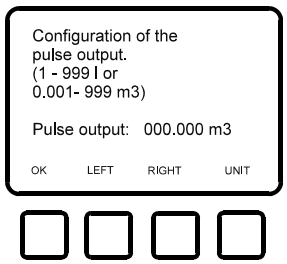
Change the storage time interval at a determined level.
Possible intervals are 15, 30, 45 sec. or 1 to 999 minutes.
Continue with OK — Illustration 60
Save with LEVEL-DEP. Storage — Illustration 59
Back with RETURN — Illustration 56

Illustration 59



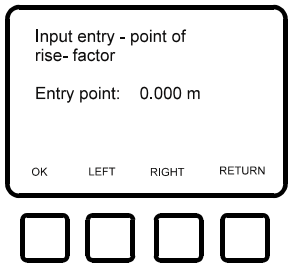
Select time and level with LEFT/RIGHT keys and enter time and level upon the keypad.
Select seconds or minutes with TIME UNIT.
Confirm with OK. — Illustration 60

Illustration 60



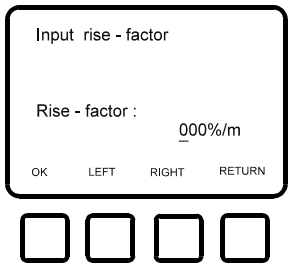
Configuration of the totalizer pulse output 1 to 999 litres or 0,001 to 999 m³.
Select with LEFT/RIGHT keys and keypad.
Select between litres and m³ with UNIT key.
Confirm with OK Illustration 61

Illustration 61



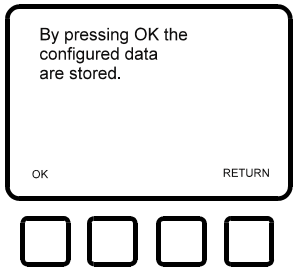
Configuration of the entry point (start point) of rise factor.
Enter level with LEFT/RIGHT keys and keypad.
RETURN Illustration 58
Confirm with OK Illustration 62

Illustration 62



Configuration of the rise factor.
Enter rise factor in % per metre (max. 255%/m).
Select with LEFT/RIGHT keys and keypad.
Key RETURN Illustration 61
Confirm with OK Illustration 63

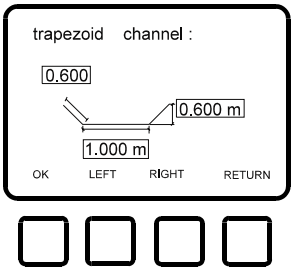
Illustration 63



Save all configured data by pressing OK.

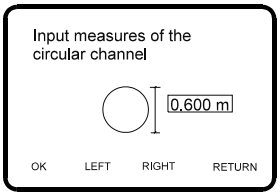
Press OK for storage Illustration 37
Key RETURN Illustration 62

Illustration 64



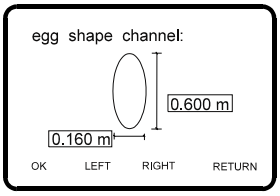
Enter trapezoidal channel dimensions.
Select with LEFT/RIGHT keys and keypad.
Key RETURN Illustration 49

Illustration 65



Enter circular channel dimensions.
Select with LEFT/RIGHT keys and keypad.
Key RETURN Illustration

Illustration 66



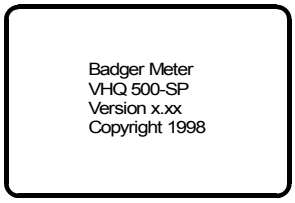
Enter egg shaped channel dimensions.
Select with LEFT/RIGHT keys and keypad.
Key RETURN Illustration

7. Switch on and measure

By configuring actual site „ON“ in chapter 6, page 14, illustration 35, you come directly after having switched on the VHQ into the measuring mode. The latest channel you have chosen appears on the display.

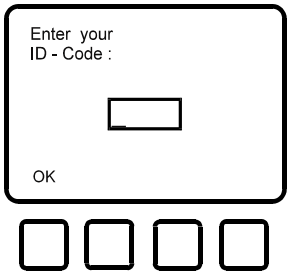
Switch on the meter.

Illustration 70



After this indication, the display switches to the input of ID-number.

Illustration 71

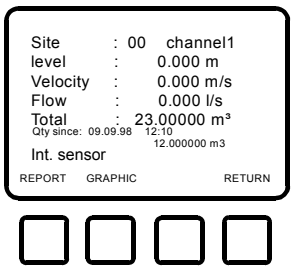


Enter ID number.
The ID number is a factory adjusted 4-digit code.
If you lose this code, please call Badger Meter and give the serial number.

Illustration 72

Press SELECT key to choose ON/OFF (start or stop the measuring mode).
Confirm with OK Illustration 73
Press RETURN to
choose a new site Illustration 74 resp. 37

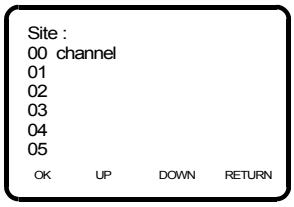
Illustration 73



Indication of measuring values incl. site #, total, etc.

Key REPORT	Illustration 40
Key GRAPHIC	Illustration 43
Key RETURN	Illustration 72 or 38

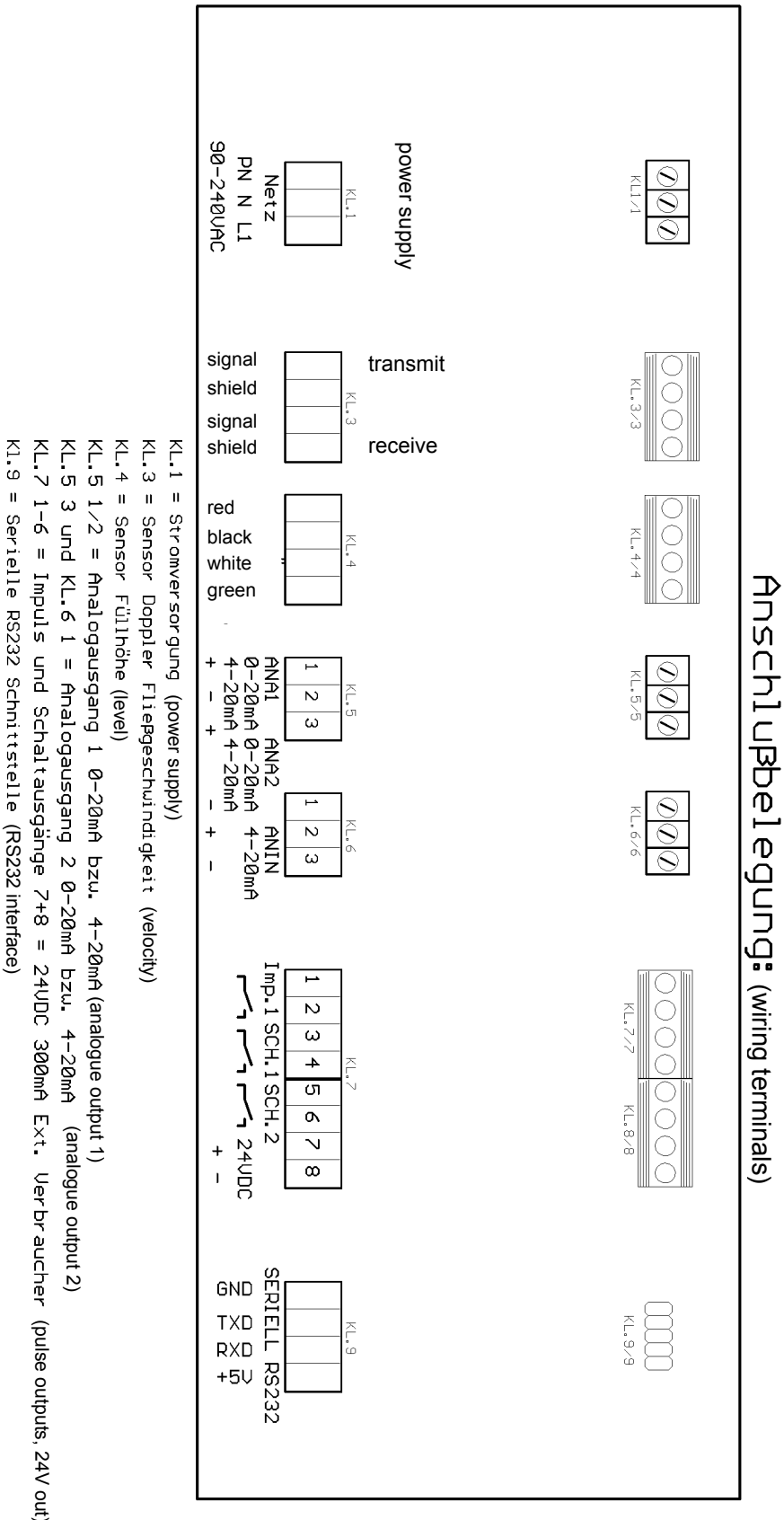
Illustration 74



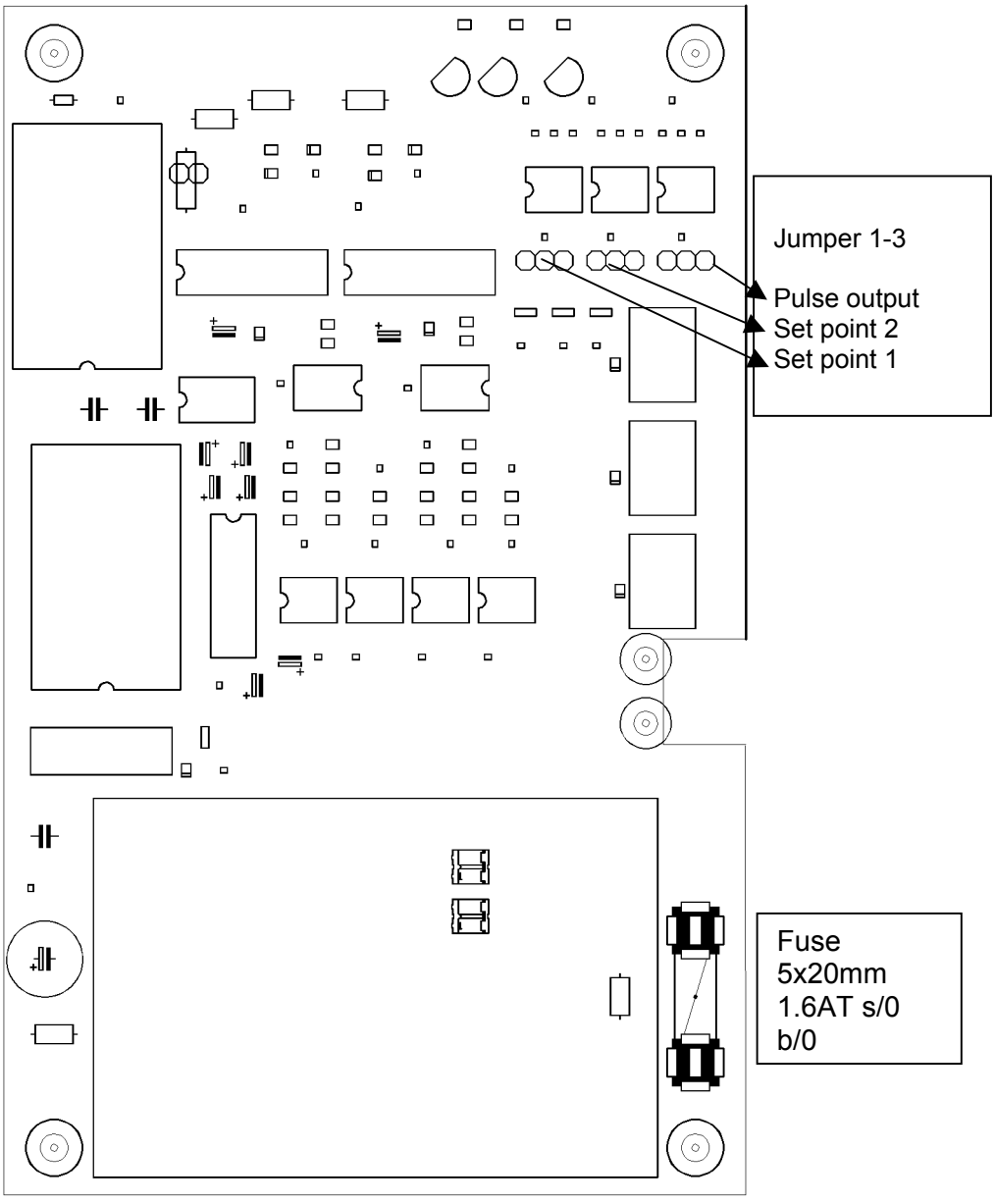
Select a stored site with UP/DOWN keys.
Confirm with OK.

Key RETURN	Illustration 46

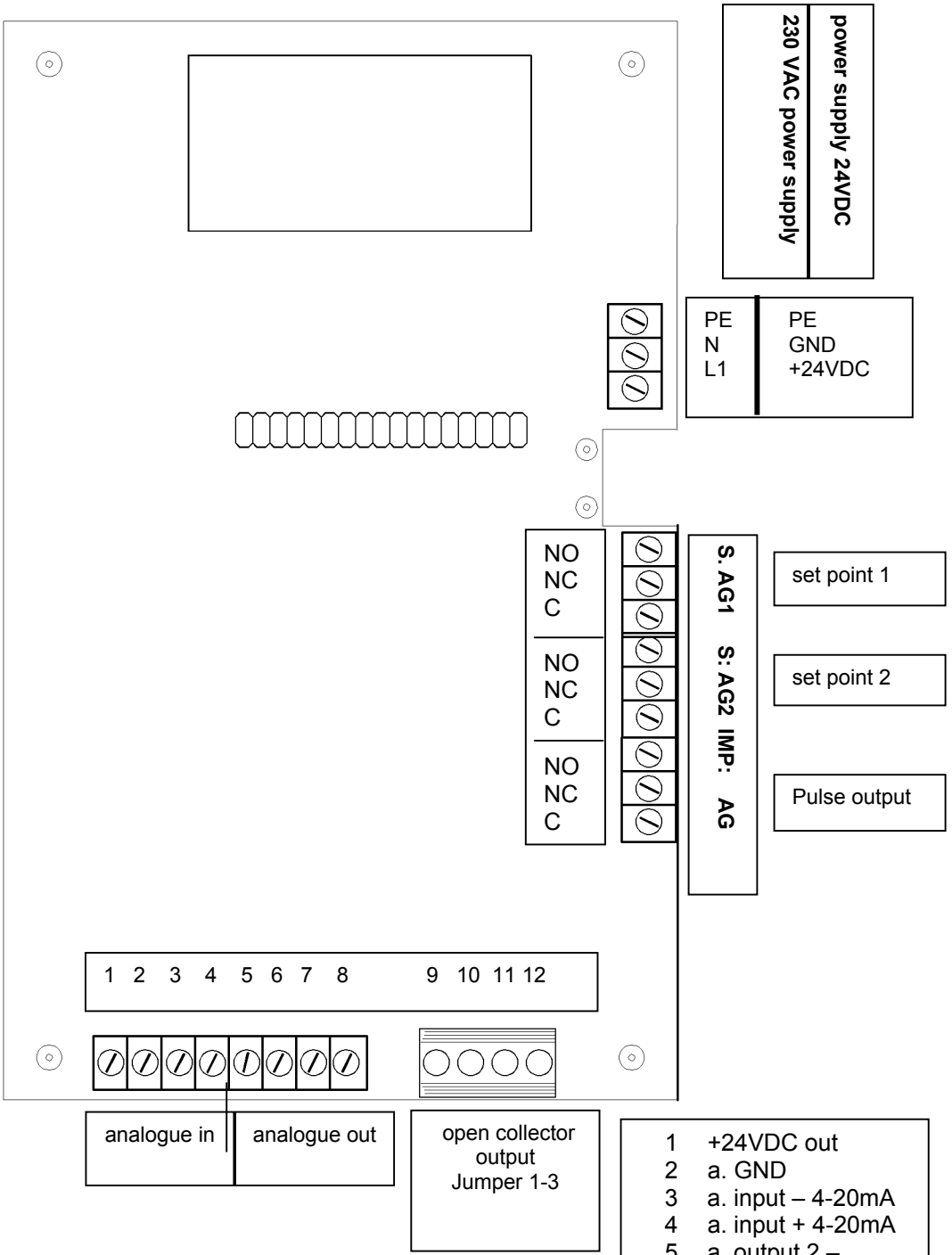
8. Wiring terminals



9. Analogue board input/output



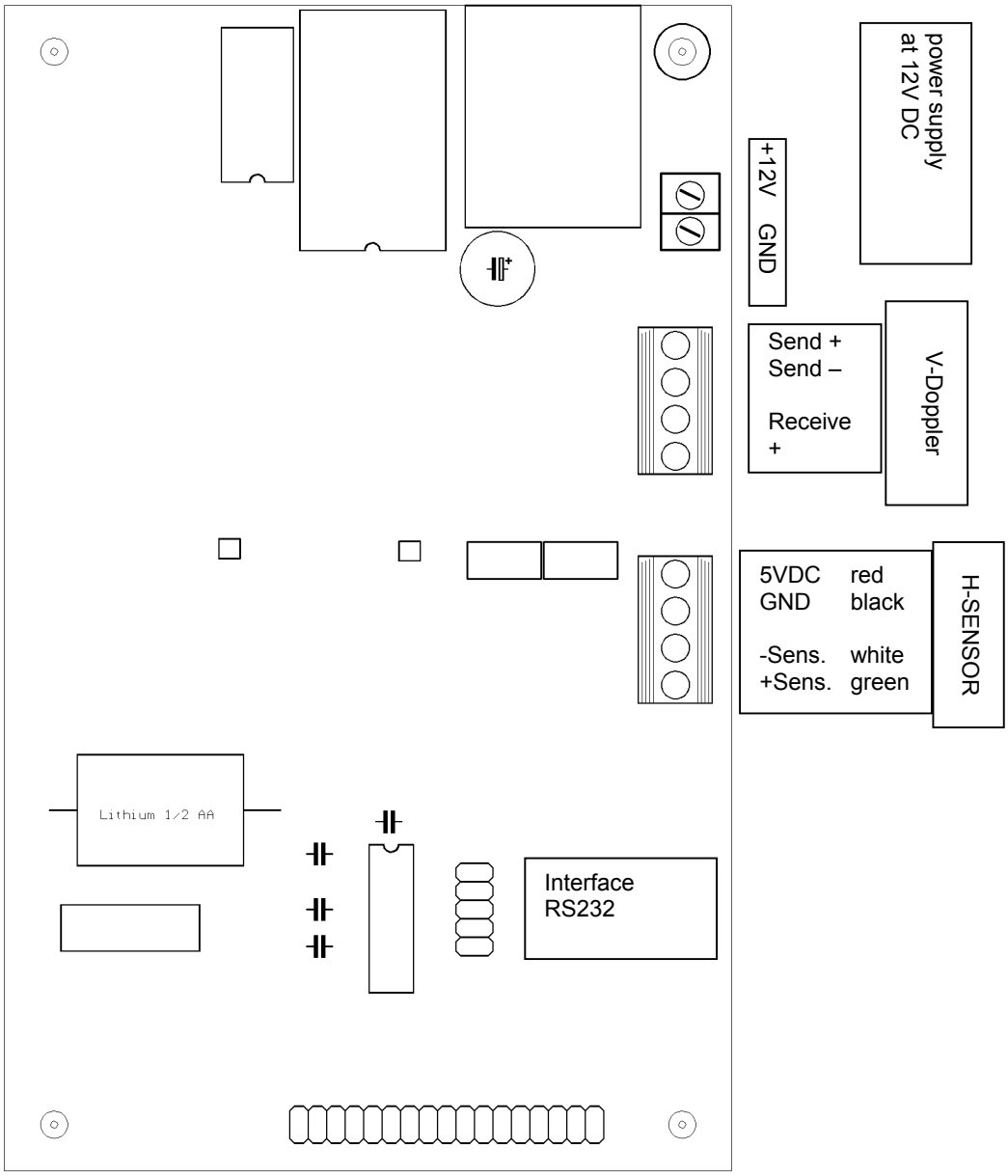
connection analogue in/out (component side)



connection analogue in/out (solder side)

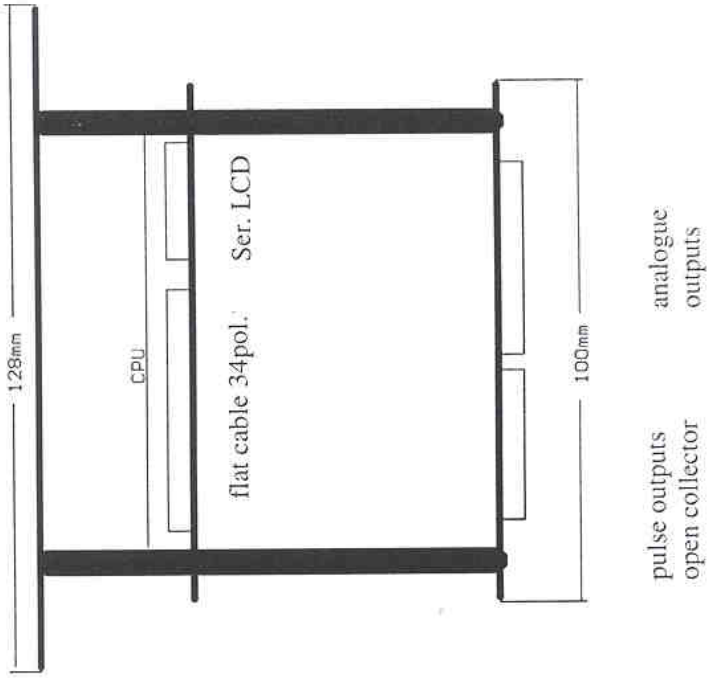
10. CPU board

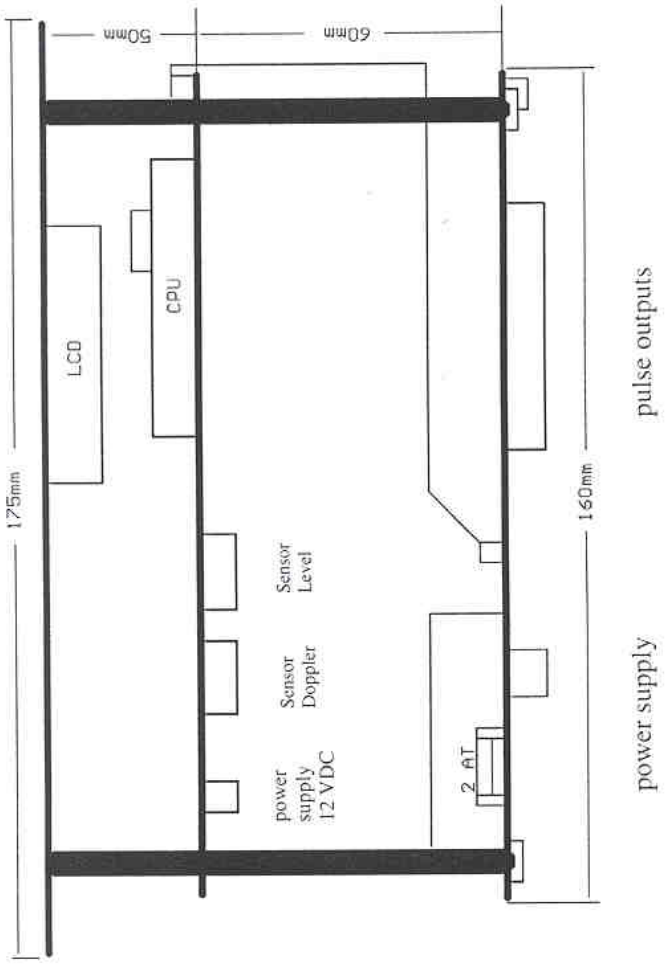
Connection CPU - board



connection analogue in/out (solderside)

11. Electronic assembly





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