Manual
Flow Converter 713

Software version 833042 or later

M713GB/9911

Index:

CE - CERTIFICATE OF CONFORMITY

This product complies with the requirements concerning electromagnetic compatibility (EMC) stipulated in Council directive no. 89/336/EEC of 3rd May 1989, altered at directive no. 92/31/EEC, on the approximation of the laws of the Member States relating to electromagnetic compatibility.

MJK Automation A/S declare that the product complies to the values stipulated in EN 50081-1 and EN 50082-1.

Flow converter 713

Thank you for choosing Flow converter 713. Flow converter 713 is a modern construction, in which the relation between functions, and "userfriendliness“ and precision is optimum. In order to gain full use from the equipment, we recommend that you read the instructions very thoroughly. Should any problems occur during installation or operation, our technicians will be at your disposal.

Flow converter 713 is for the measurement of flow in open flumes and weirs. The method of measurement and linearization complies with the norm ISO 1438. This norm indicates how the head over the weir and flumes are constructed, and how the calculations for linearization are to be arrived at. The flowrate is generaly speeking determined by using the following mathematical function:

$$\text{Flow } Q = f(\text{level}^{x} \cdot \text{constant})$$

Where the exponent x and the constant depends on the weir or the flume.

The flow converter has 3 different linearization systems depending on how the volume of water is measured.

- One choose between a number of predefined flumes and weirs, e.g. Parshall flumes and V-notch weirs.
- If the flume or weir differ from the normal types of flumes and weirs, the formula $Q(h)=k \times h^n$ can be applied, where k and n are keyed in directly.
- Some times it can be desirable to linearizate a levelsignal which does not follow a mathematical expression. As an example a flow can be measured in a partly filled pipe, where the menu point-linearization can be applied.

Technical section with the principles of measuring

Flowconverter 713 converts the level to flow from these examples. Some of the examples are simplified. The ISO 1438 norm indicates a number af calculation methods for flumes and weirs. The Flowconverter 713 uses these methods where it is possible.

Rectangular sharp edged weir

according to ISO 1438

Rectangular sharp edged weir is supplied in two types:

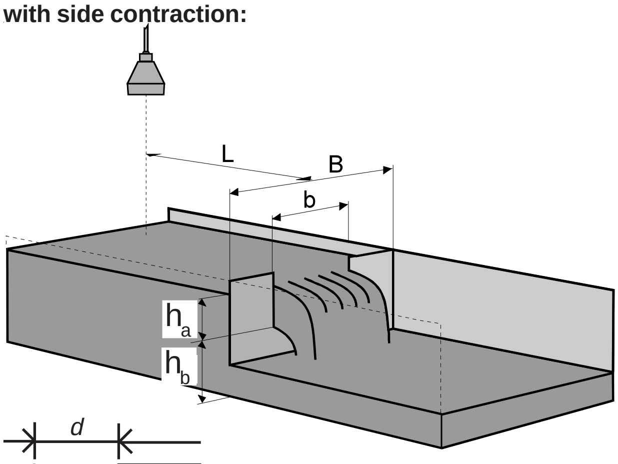
- with side contraction

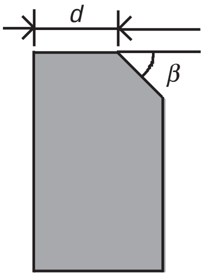
where the opening has a smaller width than the feeder and

- without side contraction

where the width of the opening corresponds to the width of the channel (*B = b).*

Rectangular sharp edged weir with side contraction:





Edge

ß = minimum 45°
d ~ 1-2 mm

Universal formula: (Kindsvater/Carter)

$$Q = 3600 \times Ce \times 2/3 \times \sqrt{2g} \times b_e \times h_e^{1,5}$$

where:
- Q = flow in m^3/h
- b = width of weir in [m]
- b_e = effective width of weir in [m]
- b_e = $b + k_b$
- h_a = height in [m]
- h_e = effective height in [m]
- h_e = $h_a + k_h$, $k_h = 0{,}001$
- h_b = depth below edge in [m]
- B = flume width in [m]
- L = distance to sensor, $4 - 5 \times h_{a\ max.}$
- g = acc. due to gravity = 9,81 m/s^2

k_b is a correction factor in meter.

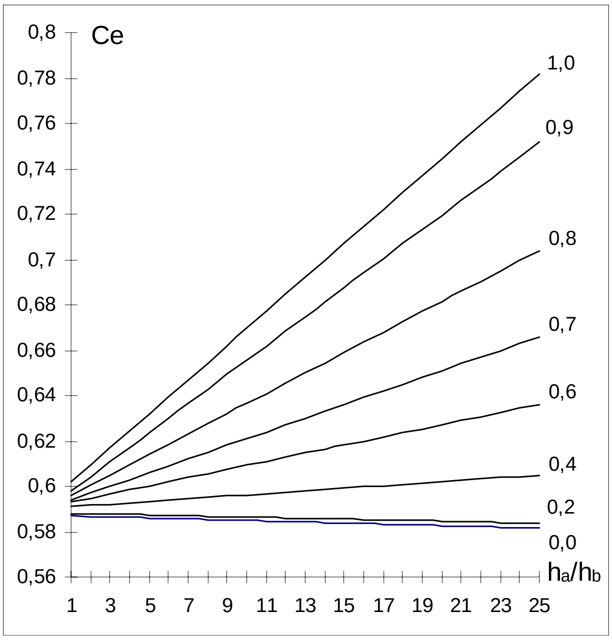
For determination of k_b

b/B = 0	k_b = 0,0024 m
b/B = 0,2	k_b = 0,0024 m
b/B = 0,4	k_b = 0,0027 m
b/B = 0,6	k_b = 0,0036 m
b/B = 0,8	k_b = 0,0042 m
b/B = 1,0	k_b = -0,0090 m

Ce is a contraction coefficient (no unit) depending on the ratio of b/B and h_a/h_b.

For determination of Ce

b/B = 1,0	Ce = 0,602+0,075 h_a/h_b
b/B = 0,9	Ce = 0,598+0,064 h_a/h_b
b/B = 0,8	Ce = 0,596+0,045 h_a/h_b
b/B = 0,7	Ce = 0,594+0,030 h_a/h_b
b/B = 0,6	Ce = 0,593+0,018 h_a/h_b
b/B = 0,4	Ce = 0,591+0,0058 h_a/h_b
b/B = 0,2	Ce = 0,588-0,0018 h_a/h_b
b/B = 0	Ce = 0,587-0,0023 h_a/h_b

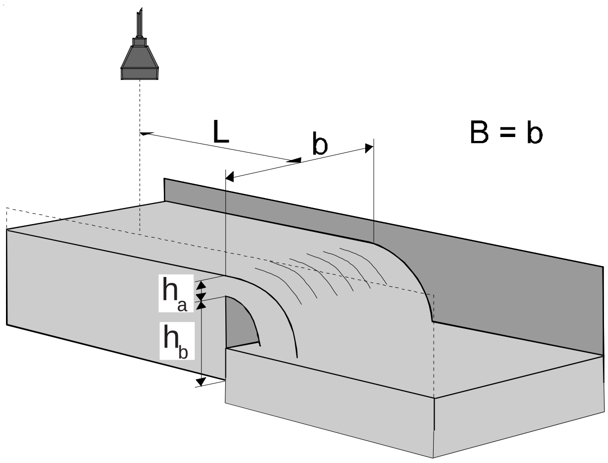


Determination of Ce for different values of b/B.

The following limitations apply for the values of h_a/h_b, h_a, h_b and b:

h_a/h_b = max. 2,5
h_a = min 0,03 m
h_b = min 0,10 m
b = min 0,15 m
(B-b)/2 = min 0,10 m

Rectangular sharp edged weir without side contraction:



The sides of the channel must continue at minimum 0,3 x $h_{a\ max.}$ after the weir.

h_a = height
h_b = depth below edge in [m]
B = flume width in [m]
L = distance to sensor,
4 til 5 × $h_{a\ max.}$

The following limitations apply for the values of h_a/h_b, h_a, h_b and b:

h_a/h_b = max. 1,0
h_a = min 0,03, max 0,75 m
h_b = min 0,10 m
b = min 0,30 m

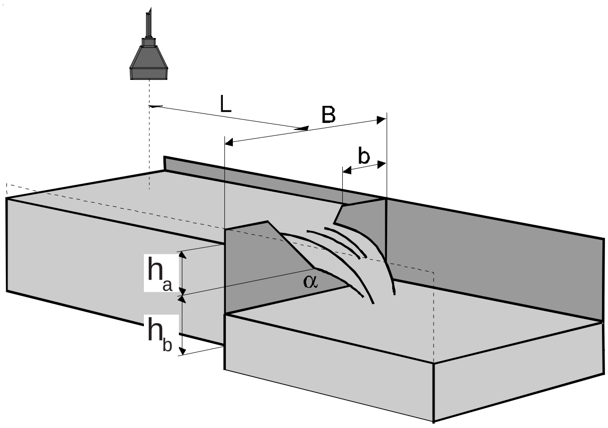
Formula: (Rehbock equation)

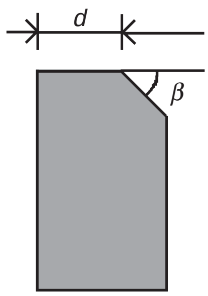
$$Q = 3600 \times Ce \times 2/3 \times \sqrt{2g} \times b \times h_e^{1,5}$$

where: Q = flow in m^3/h
b = width of edge in [m]
Ce = $0{,}602+0{,}083\ h_a/h_b$
h_a = height in [m]
h_e = effective height in [m]
h_e = h_a+k_h, k_h = 0,0012
g = acc. due to gravity = 9,81 m/s^2

Triangular weir

according to ISO 1438





ß = minimum 45°
d = 1-2 mm
h_a = height in [m]
h_b = depth below edge in [m]
B = flumewidth in [m]
L = distance to sensor,
4 to 5 × $h_{a\ max.}$

The following limitations apply:

α = 20° - 100°
h_a/h_b = max 0,4
h_a/B = max 0,2
h_a = min 0,06 m
h_b = min 0,09 m

Formula: (Kindsvater-Shen).

$$Q = 3600 \times Ce \times 8/15 \times \sqrt{2g} \times tg(\alpha/2) \times h_e^{2,5}$$

where: Q = flow in m^3/h
h_a = height in [m]
h_e = the effective height in [m]
h_e = $h_a + k_h$, k_h = 0,001
g = acc. due to gravity = 9,81 m/s^2
α = aperture angle

k_h is set to 0,001 m and is a correction factor.

Ce is the coefficient of discharge (no unit). For determination of Ce, look at diagram below.

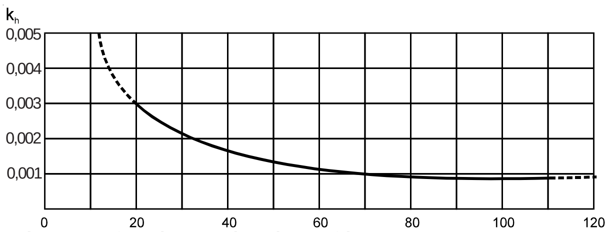


Diagram for determination of k_h

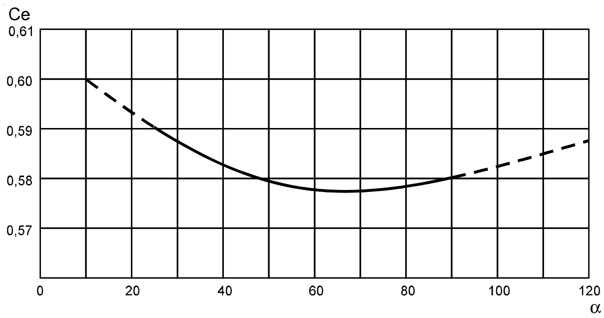
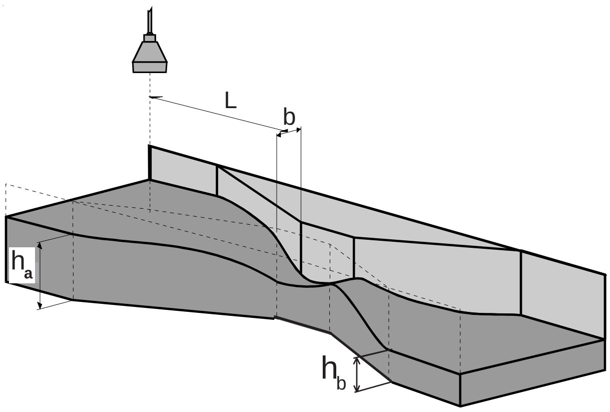


Diagram for determination of Ce.

Parshall flume

The most common type of flume is the Parshall flume. The Parshall flume is a standardized Venturi flume.



At free flow, only the level h_a is measured. The location of the sensor is important and must be carried out as illustrated in the drawing and the table in the next column. It is important to have a laminar flow (horizontal streaming calm water with no whirls) at the out- and inlet from the flume. Upstream the measuring flume, must extend at least ten times the width of the inlet section of the flume. On the outlet side the only demand is that the water should run freely. This is the case when $h_b \leq 0,7 \times h_a$.

The flow is calculated from the formula:

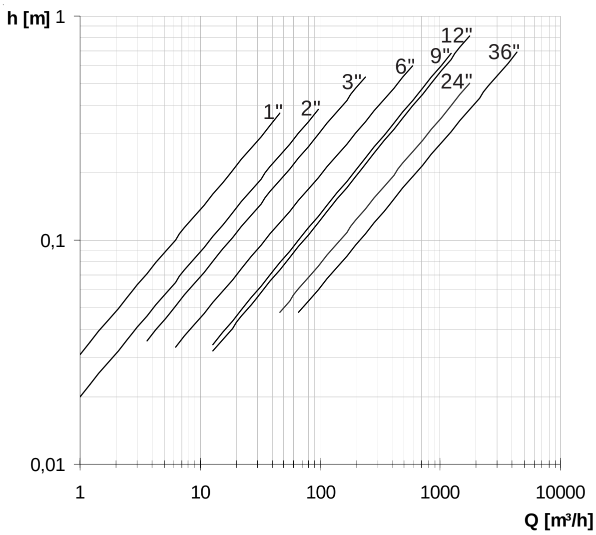
$$Q = k \times h_a^{\,n} \quad \text{hvor:}$$

Q = flow in m^3/h
b = width in the measuring flume in[m]
h_a = water level before the narrowing in [m]
h_b = water level in the narrowing in [m]
L = distance to the sensor (use table below)

The factor k and exponent n are constants.
The formula complies to free flow, $h_{b\ max} < 0,7 \times h_{a\ max}$

b	k	n	L
1"	217	1,548	0,24
2"	425	1,548	0,27
3"	630	1,548	0,30
6"	1310	1,574	0,41
9"	1851	1,528	0,58
12"	2407	1,519	0,89
24"	5142	1,55	0,99
36"	7863	1,566	1,09

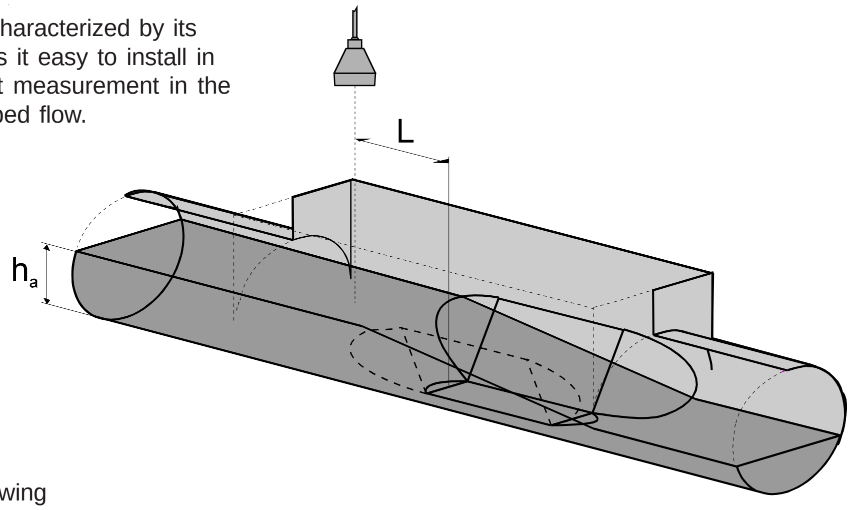
Table for determination of the constants k, n and the distance to the sensor.



Q/h diagram for Parshall flumes, the height h_a is shown as a function of the flow Q.

Palmer - Bowlus flume

The Palmer & Bowlus flume is characterized by its circular connection, which makes it easy to install in pipelines. The flume is aimed at measurement in the scale of 20-100% of the prescribed flow.



where:
h_a = water level before the narrowing
L = ½ × DN (the nominal diameter of the flume), measured from the beginning of the meas. section.

No simple flow formulas can be set up for the Palmer & Bowlus flumes, the formulas are defined individually for every flume. The Flow formulas are derived from the continuity equation and Bernoulli's equation:

$$Q = \sqrt{2g(h_1 - h_2) \times \frac{A_1^2 \times A_2^2}{A_1^2 - A_2^2}}$$

where:
A_1 and h_1= cross section and height in the inlet of the flume

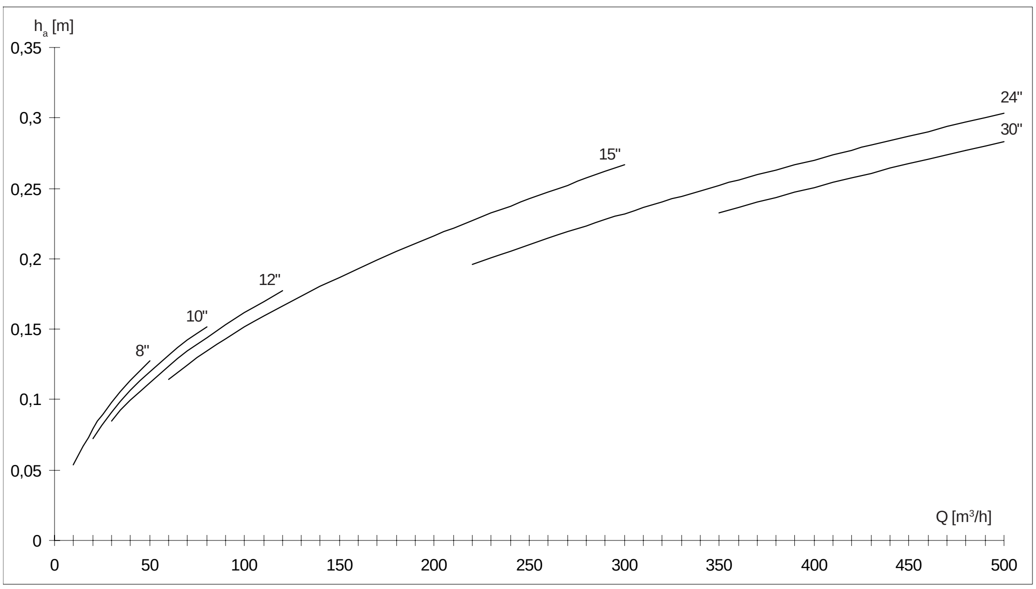
A_2 and h_2= cross section and height in the outlet of the flume

For the Palmer & Bowlus flumes with the dimensions 6", 8", 10", 12", 15", 18", 21", 24" and 30", the flow formulas are defined and incorporated in the flow converter. In the menu „Programming of flow calculation" the relevant flume is chosen.

Size D	Max Flow
6'' (DN 150)	35 m^3/h
8'' (DN 200)	70 m^3/h
10'' (DN 250)	110 m^3/h
12'' (DN 315)	200 m^3/h
15'' (DN 400)	325 m^3/h
18'' (DN 450)	545 m^3/h
24'' (DN 600)	1100 m^3/h
30'' (DN 800)	1750 m^3/h

Table showing the size of D, and the max. flow for the Palmer & Bowlus flumes.

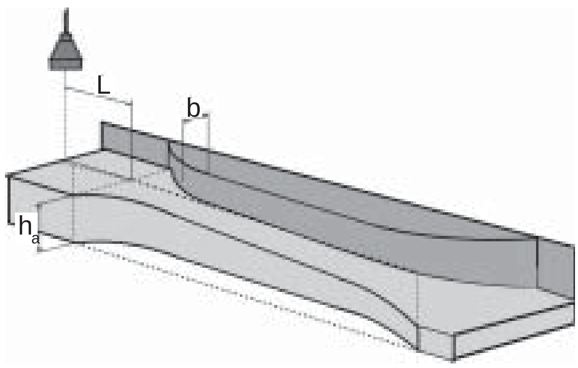
Q/h diagram for the MJK Palmer & Bowlus flumes, the height h_a is shown as a function of the flow Q.



Venturi flume - long throated

according to ISO 1438

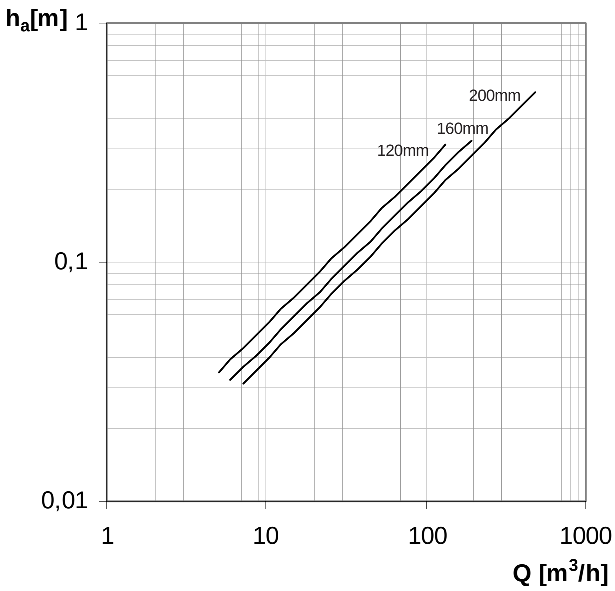
The following formula and diagram concern the long throated Venturi flume.



713 follows the calculation method for long throated Venturi flumes described in ISO 1438. The connection between level and flow is complex and can not be described in a simple formula. When dimensioning the following simplified formula can be applied.

$$Q = 6495 \times b \times h_a^{1,5} \quad \text{(NB! not ISO 1438)}$$

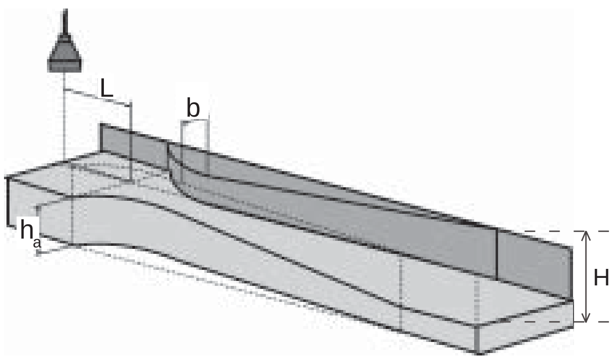
where: Q = flow in [m^3/h]
b = width in the flume in [m]
h_a = water level before the narrowing
L = distance to the sensor = 3 - 4 x $h_{a\ max}$



Q/h diagram for the long throated Venturi flumes, the height h_a is shown as a function of the flow Q.

Venturi flume - Khafagi

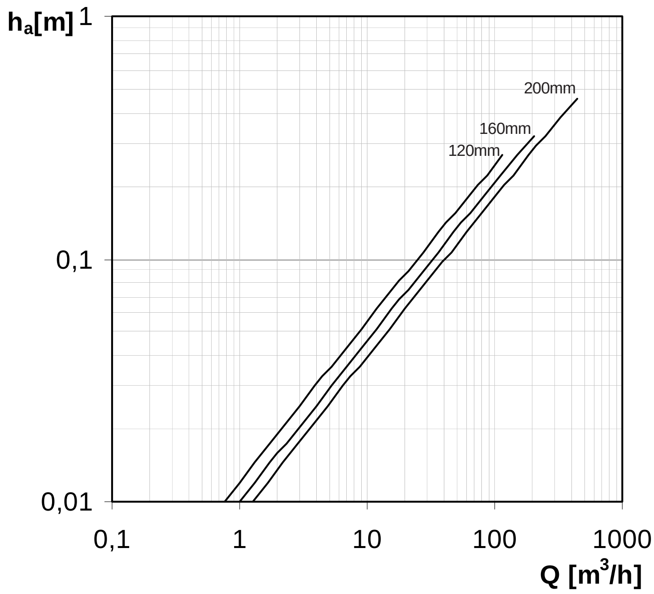
The following formula and diagram concern the Khafagi Venturi flume.



The flow is calculated from the following formula.

$$Q = 6278 \times b \times h_a^{1,5} + 328 \times h_a^{2,5}$$

where: Q = flow in [m^3/h]
b = width in the flume in [m]
h_a = level
L = distance to sensor = 3 - 4 x $h_{a\ max}$
H = height of the flume



Q/h diagram for the Khafagi Venturi flumes, the height h_a is shown as a function of the flow Q.

Size b	H	Max Flow
5'' (DN 120)	150 mm	35 m^3/h
5'' (DN 120)	300 mm	120 m^3/h
6'' (DN 160)	300 mm	150 m^3/h
8'' (DN 200)	320 mm	200 m^3/h
8'' (DN 200)	520 mm	450 m^3/h

Table showing the size of b, and max. flow for the Venturi flume - Khafagi.

Mounting of sensor

Ultrasonic measuring system

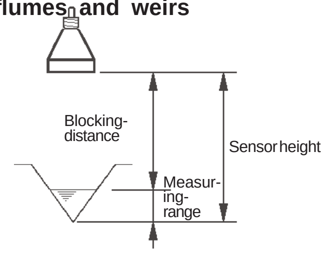
The Ultrasonic sensor must be placed correctly according to the actual measuring stormflows. The sensor has to be installed at right angles above the liquid surface (level tube). We recommend using bracket type MJK 200270, and if necessary it can be used together with universal brackets of type MJK 200205.
The following distances ensure a correct function:

Measuring range	0-30 cm	0-1 m	0-3 m
Blocking distance	40 cm	40 cm	75 cm
Min. meas. range	10 cm	10 cm	30 cm
Max. meas. range	30 cm	1 m	3 m
Max. sensor height	70 cm	140 cm	3,75 m

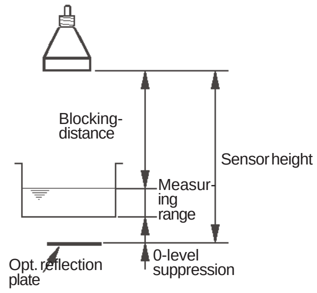
When measuring stormflows, it might be necessary to mount a reflection plate, within the measuring range, to ensure that the echo signals are returned. E.g. if the distance at low levels exceeds the maximal sensor height.
The distance from the reflection plane to the 0-level of the measuring (= normally the height of the weir) is set as the 0-level suppression. Notice that the 0-level suppression must be added to the measuring range, to respect the maximal sensor height
The following always applies to ultrasonic measuring systems:

Maximal sensor height = blockingdistance + measuring range + optional 0-level suppression

Without 0-level suppression - recommended at normal flow measuring in flumes and weirs



With 0-level suppression - recommended at stormflow measurings



Hydrostatisc measuring system

The pressure transmitter must be placed correctly according to actual measuring stormflows. The sensor must be fasted possibly mounted on a pipe with a 1 inch. internal screw thread. In some case it might be necessary to mount the pressure transmitter in a measuring well, so the transmitter will not effect current of water.
The following distances ensures a correct function:

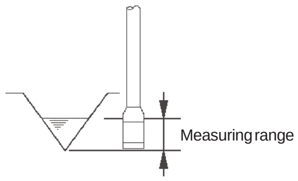
Måleområde	0-30 cm	0-1 m	0-3 m
Min. måleområde	10 cm	30 cm	1 m
Max. måleområde	30 cm	100 cm	3 m

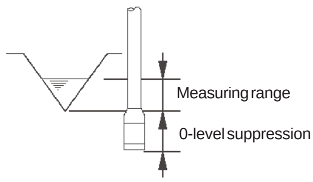
The following always applies to hydrostatic measuring systems:

Maximal sensor height = measuring range + optional 0-level suppression

Notice that the 0-level suppression must be added to the measuring range.

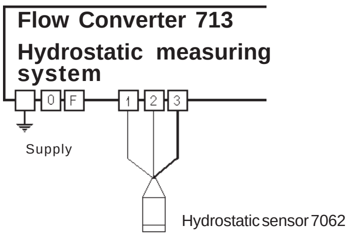
Recommended at flow- and stormflow measurings

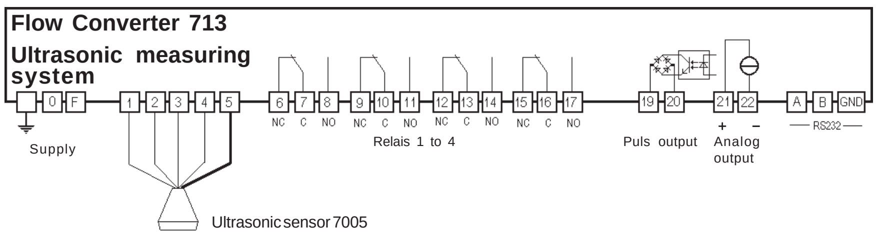


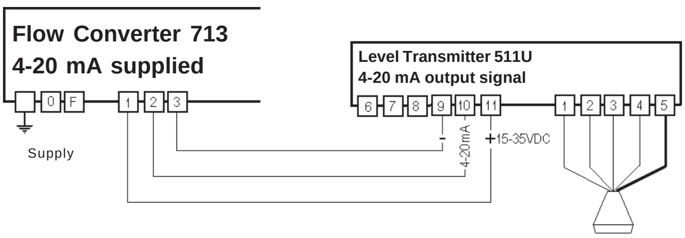


Electrical connection

Electrical connection of the flow converter 713, for hydrostatical, and ultrasonic measurement systems respectively.







An example of an installation, with long distance (more than 50 m) between the measuring location and the amplifier. A MJK 511 Level transmitter (with a 3-wire, 4-20 mA supply) is applied as preamplifier, and the signal is transmitted via an ordinary 3-wire cable. The 511 level transmitteren is set for 100% measuring range, this allows any adjusting of the measuring range to be carried out from the flow-converter. This mounting allows you to have a distance between sensor and amplifier of more than 1000 m.

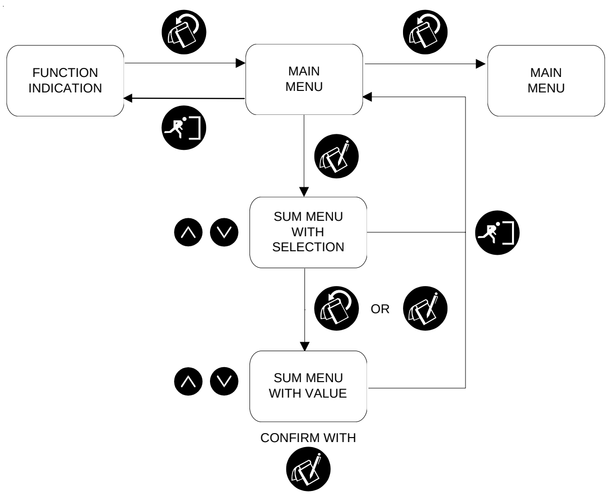
Control

On the front of the Flow Converter, you will find 4 function keys: the flow key, the summation key, the alarm key and the sample key.
When one of these keys are pressed once or more the different function menues appear. The avaliable menus depend on how the Flow Converter is configured.

The configuring of the Flow Converter takes place in the configuring menus, which in turn is divided into several submenus. You gain access to the configuring menus by pressing the MENU key. In each menu the different settings are obtained by pressing the arrow keys.
A complete diagram of the menus can be found on page 17 in this manual.

On the following pages every submenu is described.

The figure below shows the genel function of the key on th Flow Converter:



Display

2 x 24 characters text display for indication of menus and values. The background of the display is illuminated.

The ESCape-key

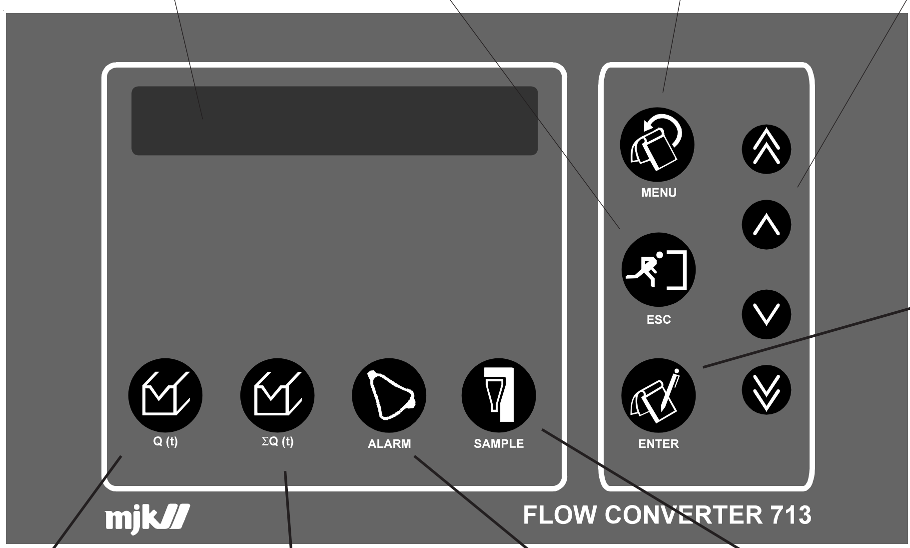
The key will change back to the head menu, or undo a new choice. By pressing the ESC.-button two or three times you will always return to the indication of functions..

MENU

By activating the MENU-key, the display will change to the next head menu in the outline of the menu.

The arrow keys

The arrow keys are used for changing a current setting. An arrow key is pressed to change between a current and not current setting. Activating of the arrow keys also changes the values. By activating the ↑-key, the number in the display will increase. When activating the ↓–key the value decreases.



ENTER

A shift from the head menu to submenu, as well as between submenus is carried out by activating the ENTER-key. A choice from a submenu also needs confirming by pressing the ENTER-key.

Q(t)

Registers for flow:
- Instantaneous value
- Average flow 1 hour
- Average flow i day
- Average flow 24 hours

Σ Q(t)

Registers for **either:**
- Summed flow total
- Summed flow 1 hour
- Summed flow today
- Summed flow 24 hours
- 99 days log

or:
- Number of stormflows
- Time of stormflow
- Total stormflow
- Amount of most recent stormflow
- Start/finish time for last stormflow
- 99 stormflow log

ALARM

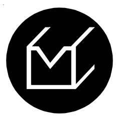
Alarm record with the previous nine alarms incl. date and time of occurance. As well as time for voltage coupling.

SAMPLER

Registration of:
- Total number of samples
- Number of samples today
- Number of samples within 24 hours

Function keys

Flow key:



Q(t)

This key gives access to a number of menues that displayes the values of the current flow, as well as various average values.

F1 Flow

Press once for:

21/06/95 13:34:12
FLOW : 3196 m^3/h

The instantaneous current flow is shown. The flow is calculated from the chosen Q(h)-formula. Measuring value with time and date is indicated.

F2 Average flow 1 HR

Press twice for:

AVERAGE FLOW: 1 HR
FLOW : 3120 m^3/h

The average flow for the last full hour is indicated.

F3 Average flow today

Press three times for:

AVERAGE FLOW: TODAY
FLOW : 3120 m^3/h

The average flow from 00:00:00 to the current time is indicated.

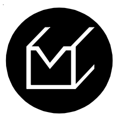
F4 Average flow 24 HR

Press four times for:

AVERAGE FLOW : 24 HR
FLOW : 3120 m^3/h

The average flow for the last 24 hours is indicated (00:00:00 til 23:59:59).

The summation key:



Σ Q(t)

If the flow converter is set up for continuous measuring, this key will give access to indication of summed quantities. If the flow converter is set up for stormflow measuring the stormflow quantities and number of stormflows are indicated.

Measuring of volume:

F5 Σ volume

Press once for :

21/06/95 13:34:12
Σ VOLUME: 223196 m^3

The total volume is indicated, from when the value was last reset or since start-up.

F6 Σ volume 1 HR

Press twice for :

1 HR 11:00 - 12:00
Σ VOLUME : 77376 m^3

Here the summed volume for the previous full hour is indicated (e.g. 14.00-15.00).

F7 Σ volume today

Press three times for :

TODAY 00:00 - 13:51
Σ VOLUME: 776 m^3

The summed volume for today is indicated. The result along with the time interval is updated every full minute (xx:xx:00).

F8 Σ volume 24 HR

Press four times for :

24 HR : 21/05/95
Σ VOLUME: 77376 m^3

The summed volume for the previous 99 days is indicated. The daily quantity is logged every day at (00:00:00).

Use the arrowkeys to browse through the last 99 days log.

Quantity values can be reset by pressing ENTER, see menu F19.

Stormflow measuring:

F9 No. of stormflows

Press once for :

21/06/95 13:34:12
NO. OF STORMFLOWS 19621

The total number of stormflows is indicated. The number is calculated from the last time the value was reset or the system was restarted.

F10 Stormflow time

Press twice for :

21/06/95 13:34:12
STORMFLOW TIME : 00:21

Here the total time (hours:minutes) of stormflow is indicated.

F11 Stormflow volume total

Press three times for :

STORMFLOW VOLUME
TOTAL : 1084 m^3

The total volume of stormflows is indicated. The volume is calculated from the last time the value was reset or the system was restarted.

F12 Volume last stormflow

Press four times for :

STORMFLOW
LAST STORMFLOW : 1084 m^3

The volume of the last stormflow is displayed.

F13 Stormflow start/stop

Press five times for:

START 25/12 12:32
STOP 25/12 13:01 00:29

Start and stop times are indicated as well as the duration of the last stormflow.

All values can be reset by pressing ENTER, see under F18.

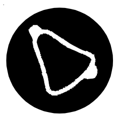
F14 99 days log

Press six times for:

log 12 138 m^3
18/6 12:56 18´/6 14:21

The last 99 stormflows is saved in a log. Use the arrowkeys to browse through the log.

Alarmkey:



ALARM

The digital outputs can be configured as alarms of one of the following alarm types: high flow, low flow, 24 hour volume, one hour volume and sensor error. Press the alarm key to see the previous nine alarms. A new alarm is registered as alarm no 1, the other alarms are moved one place, and the alarm which was previously registered as alarm no 9 is erased.

F15 Alarm display

After pressing the key once alarm no. 1 is shown, which is the latest alarm; press again and alarms 2-9 come up. By using the arrow keys it is possible to move backwards and forwards between the alarms.

The instant an alarm is registered, the alarm type, the digital output and the time shows on the display:

ALARM 1: HIGH FLOW D#
13/03 23:33

When the alarm is no longer active, the time of switch off is registered. Beware that different alarms could have been activated in the meantime, meaning the alarm is no longer no. 1:

ALARM 2: HIGH FLOW D#
13/03 23:33 13/03 23:54

ALARM 3: VOLTAGE FAILURE
21/06 00:22 21/06 11:23

When a new alarm appears the display will change from the previous chosen main menu to F14 - alarm indication, alarm 1.

The start time for voltage failure is detected every 5 min., and the stop time is registered immediately after the voltage is cennected again.

Sample key:

SAMPLE

If one or several of the digital outputs are configured for controlling a sampler, pressing this key will give following indications:

F16 Number of samples

Press once for :

```
22/02/95                   04:39:12
NUMBER OF SAMPLES:     34245
```

This display indicates how many samples have been taken since last reset or system start up. Press ENTER for reset, see menu F19.

F17 Number of samples today

Press twice for :

```
TODAY                 00:00 - 17:22
NUMBER OF SAMPLES:           45
```

This display indicates how many samples have been taken within 24 hours (00:00:00 - now).

F18 Number of samples 24 HR

Press three times for :

```
24 HR :                    30/06/95
NUMBER OF SAMPLES:        11
```

This menu indicates how many samples were taken yesterday. Value and date for the previous 24 hours are indicated.

F19 Reset value

Reset is possible from the menues F5, F6, F7, F9, F10, F11. By using the enter key and the following menu will appear:

```
RESET type
YES: Enter              NO: Menu
```

Menu key:

MENU

This key allows access to the menus with reading and programming of the readings and functions of the flow converter. In menus with various options the choices will be seen on top of one another, the top choice being the current value. By pressing one arrow (up or down) the choice varies. A choice is confirmed by pressing ENTER. Non confirmed choices will flash on the display, where as a current/confirmed choice stands firm.

0.1 Level

Press once for:

```
LEVEL=    543.2        I=  12.3 mA
D1=0   D2=0   D3=1   D4=1   D5=0
```

Here the measured level (LEVEL), the value for the analog output (I) is indicated. The digital outputs are indicated as D1-D5. 0 indicates non activated output, where as 1 indicates activated outputs. Outputs chosen to "not in use" are not shown.

0.2 Language

Press twice for:

```
LANGUAGE          ENGLISH
                  DANSK
```

By pressing arrows the languages can be altered. When changing to a new language the display will be clear for a few seconds.

0.3 Enter access code

Press three times for:

```
KEY IN ACCESS CODE
USE ARROW KEYS          0000
```

This menu shows, when an access code has been chosen (four figures) in the configuring menus. Double arrows changes the first two digits, single arrows changes the last two digits. Press ENTER for confirmation of choice of access key. When the access code is correctly keyed in access to the configuring menus will be given for 5 min. since last key pressed.

0.4 Access denied

What happens when the wrong access code is keyed in:

```
ACCESS DENIED
```

It will not be possible to make changes in the set up. Return to the previous chosen functional menu by pressing the ESC-key once.

Configuring:

1.0 Programming of main functions

Press Enter to obtain access to the configuring menues.

1.1 Set date and time

Time and date is adjusted with the arrow keys, followed by ENTER, if no change is desired, press the MENU key.

1.2 Access code enabled/disabled

Choose whether access code is desired or not. The code blocks the access to the configuring menus, but allows reading and operation of the flow converter. Use the arrow keys to change between options and confirm with ENTER.

1.3 Enter new access code

This menu shows a chosen access code (4 figures) on the configuring menus. The arrow keys are used for keying in the code as well as for configuring. Double arrows changes the first two digits, single arrows changes the last two digits. Press ENTER to confirm choice of access codes.

1.4 Measurement Stormflow / Continuous

In this menu a choice can be made of whether the flow converter measures a continous flow or a stormflow. Use the arrow keys to change between choices and confirm with ENTER.

1.5 Calc. for stormflow delayed

In this menu a delay of the level reading is chosen, in order to ensure that the level is over the setpoint for a certain time before the calculation begins. This time interval is keyed in with the arrow keys. Double arrow shows a rapid reading of the value with 10 second jumps. Single arrow runs the value slowly with one second jumps. The scale is in seconds (0-999).

1.6 Stormflow counter delayed

Here a time interval is keyed in, where the stormflows must be 0 before a new stormflow can be registered in the stormflow counter. Use the arrow keys. Double arrow runs the value rapidly with one hour jumps. Single arrow runs the value slowly with one minute jumps.
The format is hours:minutes. Maximum time interval is 99 hours and 59 minutes.

2.0 Sensor, data for mounting

The flow converter is delivered with one of two measuring principles, hydrostatic measuring or ultrasonic measurement, In menu 2.0 the setting is shown.

2.1 Sensor and range

When hydrostatic measurement is applied this is where the type of sensor applied can be keyed in, use the arrow keys to choose between options, and confirm with ENTER. When ultrasonic measurement is applied, the type of sensor applied is preset by the factory, the sensor type can be read here.

2.2A Sensor optional range

This menu is only accessible in connection with hydrostatic measurement. When optional range is chosen the sensor range is set using the arrow keys, double arrow change the value with 10,0 cm steps, single arrow change the value with 0,1 cm steps, confirm with ENTER.

2.2B Sensor level

This menu is only accessible in connection with ultrasonic measurement. The sensors height above the actual zero is keyed in, use the arrow keys to adjust the value, and confirm with ENTER.

2.3 Flow measurement 0-point level

The level where the flow is to start being registered is keyed in. At measurement in e.g. a Palmer/Bowlus weir, the level is measured from the bottom of the weir. That is, a flow does not occur further down than 54 mm from the bottom due to the bulge at the bottom. Therefore 5.4 cm is keyed in as the zero point of flowmeasuring. Another possibility is when a pressure sensor is placed under a sharp edged plate. Meaning that the flow will begin at ex. 10.4 cm. This height is keyed in with the arrow keys. Double arrow runs the value fast with 10 cm steps, single arrow runs the value slowy with 0,1 cm steps.

2.4 Min. level for flow calculations

Here the level for 0-point can be keyed in over the flow calculation for starts of the flow measurement. This function is used for instance when a weir has to be measured. The flow calculation is not done before the level is above the minimum level, while the actual calculation is made from the 0-point for flow measurements.

2.5 Level for max. flow

Here the span for flow measuring is keyed in. This is the level at the maximum flow. This level is keyed in with the arrow keys. Double value runs the value fast with 10 cm steps. Single arrow runs the value slowly with 0,1 cm steps. When the chosen level has been confirmed by the enter key, the flow converter calculates the max. flow according to the chosen weir/type of storm flow. By choosing the linearization point this menu does not appear, as the highest level automatically provides the span.

2.6 Averaging of level over time

In this menu the time for which the level measurement is to be averaged is keyed in before Q(h) is calculated.

The interval is optional between 1 and 60 seconds. Use arrow keys; double arrow runs the value fast with 10 second steps, single arrow runs the value slowly with 1 second steps. The format is seconds.

3.0 Programming of flow calculation

Here the type and size of flume/weir used for the flow measuring is chosen.

3.1 Flow measuring unit

Here the unit is chosen between m^3/h and l/s. Use arrow keys to move between options, and confirm with ENTER.

3.2 Select type and range

There are six options for calculation of flow: Parshall flume, Palmer/Bowlus flume, V-notch weir, rectangular weir, linearization and optional flow formula. Select the desired parameter with arrow keys and confirm choice with ENTER.

3.3 Venturi flumes

If a Venturi-flume has been selected, there is a choice between various sizes: 5", 6" and 8". Change between the various types withe the arrow keys. Confirm with ENTER. Both the longthroated and the Khafagi flumes can be chosen.

3.4 Parshall flumes

If a Parshall-flume has been selected, there is a choice between various sizes: 1", 2", 3", 6", 9", 1', 2' og 3'. Change between the various sizes with the arrow keys. Confirm choice with ENTER.

3.5 Palmer/Bowlus flumes

If a Palmer/Bowlus-flume has been selected there is a choice between various sizes: 6", 8", 10”, 12”, 15” 18”, 24” og 30”. Change between the various sizes with the arrow keys. Confirm choice with ENTER.

3.6.1 V-notch weir

If a V-notch weir has been selected there is a choice between 28.1°, 53.1°, 90° and optional weirs. Below the weir type the measuring range is shown. Change between the various types with arrow keys. Confirm choice with ENTER.
The ISO 1438 standard describes the height and flow relations in detail for a stormflow of 90°, if this angle is chosen the width of weir and depth under weir must be keyed in. For other angles only the angle is keyed in. Provided that a straight inflow on at least 10 x width of the letter V, and free flow from the under weir of the letter V.

3.6.2 Key in optional angle

If optional angle is choosen, key in the angle with the arrow keys. The angle can be choosen between 10° and 89°, confirm selection with the ENTER key.

3.6.3 V-notch weir flume width

Here the width of the flume where the v-notch weir is placed, is keyed in. Double arrow runs the value fast with 10 cm steps, single arrow runs the value slowly with 0,1 cm steps.

3.6.4 V-notch weir depth below edge

Here the depth of the flume below the bottom of the trianglular weir is keyed in with the arrow keys. Double arrow runs the value fast with 10 cm steps. Single arrow runs the value slowly with 0,1 cm steps.

3.7.1 Rectangular weir flume width

Here the total width of the channel where the rectangular weir is placed is keyed in. Use arrow keys. Double arrow runs the value fast with 10 cm steps, single arrow keys runs the value slowly with 0,1 cm steps.

3.7.2 Rectangular weir edge width

Here the width of the rectangular weir is keyed in with the arrow keys. Double arrow runs the value fast with 10 cm steps, single arrow runs the value slowly with 0,1 cm jumps.

3.7.3 Rectangular weir depth below edge

Here the depth of the channel below the bottom of the rectangular weir is keyed in with the arrow keys. Double arrow runs the value fast with 10 cm steps, single arrow key runs the value slowly with 0,1 cm steps.

3.8.1 Linearization number of Q(h) points

The desired number of Q(h)-points, are indicated for the linearization. The figure can range between 1 and 10. Use arrow keys. The number of points decides how many times you run through the menus 3.8.2 og 3.8.3. Always start with the lowest value, then the next and so on until the largest value is reached.

3.8.2 Linearization height point

Here level [h] in a Q(h)-point is keyed in. The level is keyed in with the arrow keys. Double arrow runs the value fast with 10 cm steps, single arrow runs the value slowly with 0,1 cm steps. The level can be set in the level span area. The level MUST be higher than previously keyed in levels. The quantity can only be shown in total of m^3/h or l/sec. The highest Q(h)-point automatically gives the measuring range.

3.8.3 Linearization flow point

The volume [Q] in a Q(h)-point is keyed in. The volume is keyed in with the arrow keys. Double arrow runs the value fast with 1 m^3 jumps, single arrow runs the value slowly with 0.1 m^3 jumps. The volume can be set in the volume-span area. The quantity MUST be greater than previously keyed in quantities. The flow can only be set in whole numbered m^3/h or l/s. The highest Q(h) gives the measuring field.

3.9.1 Optional formula enter exponent

The exponent in the flow formula ($Q(h)=K*h^x$) is keyed in. Q is the flow in m^3/h, h presents the level in meters, K is a factor between 1 and 9999 and x is the exponent which is between 1.000 and 2.500, K and x is unitless. Key in with the arrow keys. Double arrow runs the value fast with 0.1 steps. Single arrow runs the value slowly with 0.001 steps.

3.9.2 Optional formula enter factor

The factor K in the flow formula ($Q(h)=K*h^x$) is keyed in. Key in with the arrow keys. Double arrow runs the value fast with 100 steps. Single arrow runs the value slowly with 1 steps. The factor can be adjusted in the area 1 - 99999.

4.0 Programming of digital outputs

4.1 Enter digital output

Configuring of the 5 digital outputs. Select with the arrow keys which digital output to program, confirm with ENTER.
Digital output 5 (DO5) is standard an output for an external counter. DO5 can be ordered as an option for a relay output.

4.2 Select function for DO

For digital output 1-4 select with arrow keys between 8 various functions: counter output, sampler, flow>0%, flow high, flow low, alarm 24 hour volume, alarm 1 hour volume and alarm sensor error. The choice is confirmed with ENTER.

Counter output:	After a programmed number of m^3, the output is activated for an external counter.
Sampler:	After a programmed number of m^3, the output is activated for start up of an externally connected sampler, or to a possibly connected chemical dosing.
Flow>0%:	Signal to indicate that flow is greater than 0, is applied i.e. when measuring emergency stormflow.
Alarm flow high:	Activated if flow exceeds an adjusted value.
Alarm flow low:	Activated if flow drops below an adjusted value.
24 hour volume:	Activated is 24hour volume alarm exceeds a programmed value.
Hour volume:	Activated if hourly volume exceeds a programmed value.
Sensor error:	Activated at sensor error.
Out of action:	Is chosen when the output is not applied.

4.3 Alarm flow high

The limit for flow high is keyed in with the arrow keys. Double arrow runs the value fast with 10cm steps, single arrow runs the value slowly with 0,1 cm steps. The area is 0.0 to (maximum flow+10%).

4.4 Alarm flow low

The limit for flow low is keyed in with the arrow keys. The area is 0.0 to (maximum flow+10%).

4.5 Alarm 24 HR volume

The limit for max. 24 hour volume is keyed in with the arrow keys.

4.6 Alarm 1 HR volume

The limit for max. hourly volume is keyed in with the arrow keys.

4.7 Enter signal delay

The time a limit for an alarm can be exceeded before a DO is activated, is set. The format is as follows - hours:minutes. The maximum delay is 99 hours and 59 minutes. The delay is working for chamge from not active to active mode as well as change from active to not active mode.

4.8 Enter volume between pulses

The volume in m^3 that passes between each time a pulse is sent to a DO is keyed in.

4.9 Digital output ON-time

In this menu the ON-time for the DO is keyed in. Key in with arrow keys. The area is (0,1-30 sec).

4.10 Digital output NC/NO

In this menu the relay function for digital output is keyed in, as Normally Open (NO) or Normally Closed (NC). Select with arrow keys, confirm with ENTER.

5.0 Programming of analog output

In this menu the mA-output of the flow converter is adjusted.

5.1 Analog output 0-20 / 4-20 mA

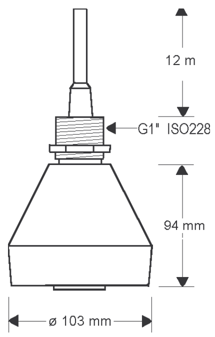
Here you select between mA-output 0-20 or 4-20 mA. Select with arrow keys, confirm with ENTER. The output follows the flow at max flow, keyed in menu 2.5 generated 20mA.

Specifications

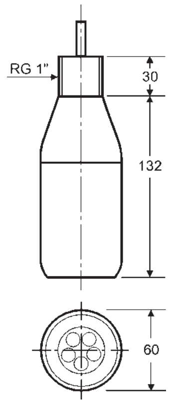
Ultrasonic sensor	**7005-1013**	**7005-1023**	
Measuring range:	3 m (10 m)	30 cm or 100 cm	
Frequency:	30 kHz	100 kHz	
Spreading:	3^o		
Temperature compensation:	built-in		
Temperature:	-20 - $+60^oC$		
Dimensions:	ø103 x 94 mm		
Materials:	PP Green / POM Black		
Cable: Can be extended to:	Screened oil resistant PVC, length 12 m 100 m	 50 m	
Housing:	IP 68, water proof, withstands immersion, max. 1 bar		
Pressure Transmitter	**7062-1413**	**7062-1423**	**7062-1433**
Measuring ranges:	0-30 cm	0-1 m	0-3 m
Function:	2-wire, 4-20mA		
Accuracy:	±0,5%		
Temperature:	-10 - $+60^oC$		
Dimensions:	ø60 x 132 mm		
Materials:	House: PP Diaphragm: Gold-plated ceramic, socket in steel (AISI 316L)		
Cable:	2x0,5mm^2, length 12 m, can be extended.		
Mounting:	1" thread. Mounted on pipe.		
Housing:	IP 68, water proof, max. 0,5-2 bar		
Flow Converter 713			
Measuring ranges:	0 - 30 cm, 0 - 1 m, 0 - 3 m		
Supply:	220-240, 110-120 or 24V AC, ca. 10 VA		
Temperature:	-20 - $+60^oC$		
Input signal:	From ultrasonic sensor or pressure transmitter, 4-20 mA		
Accuracy:	±1% (min. ±1 mm)		
Outputs: plug 6-17	Relay 1 to 4, max. 250V, 4A ohmic, max. 100 VA Inductive load 100VA. Can be chosen as alarm, counter, Flow>0 or sampler outputs.		
plug 18-20	Relay 5 (as 1-4) or Pulse (optocoupler) max. 36 V, 50 mA one shot, 100msec. - 10 sec. programmable		
plug 21-22	Analogue: 0-20 / 4-20 mA max. 500Ω galvanic isolation		
Facultative formula: 1438)	$Q = k \cdot h^x$; Q=Flow, h=heigth, k=factor, x=exponent (ISO or point linearization		
Indication:	2x24 characters LCD display for reading and programming		
Dimensions:	185 x 240 x 115mm (HxWxD)		
CE:	EN50081-1, EN50082-1		
Housing:	IP 65		

Dimensions

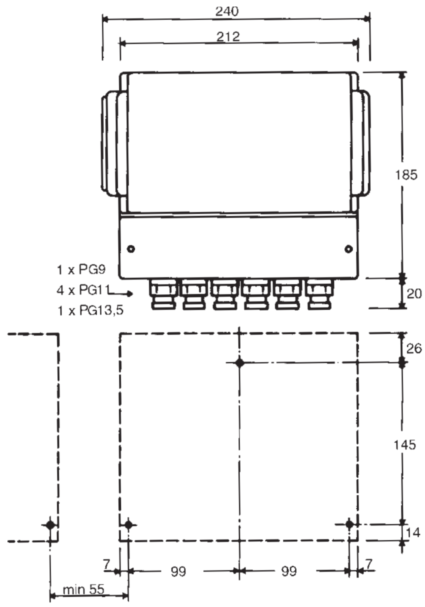
Ultrasonic sensor 7005



Pressure transmitter 7062



Flow Converter 713



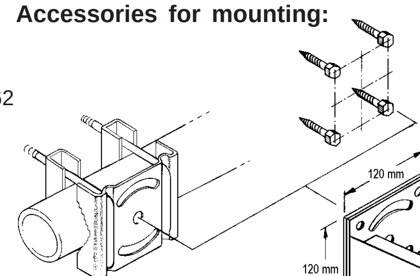
Order numbers

Part no: Specifications:
201450 713U-1111 Ultrasonic measuring system, range 0-30 cm
201455 713U-1121 Ultrasonic measuring system, range 0-1 m
201460 713U-1131 Ultrasonic measuring system, range 0-3 m
202600 713-1104 Flow Converter without sensor, 4-20 mA input
202650 713P-1114 Hydrostatic measuring system, range 0-30 cm
202655 713P-1124 Hydrostatic measuring system, range 0-1 m
202660 713P-1134 Hydrostatic measuring system, range 0-3 m

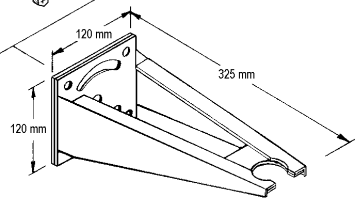
Accessories Flow Converter 713:
200105 Panel Mounting kit
200115 Local mounting set with rain roof
200205 Universal bracket
Accessories Pressure Transmitter 7062:
202922 Connection box for cable for pressure transmitter 7062
Accessories Ultrasonic Sensor 7005:
200205 Universalbracket
200220 Bracket for ultrasonic sensor 7005
200590 Connection box for cable for ultrasonic sensor 7005
690010 Cable for ultrasonic sensor 7005

Sensors:
200570 Ultrasonic sensor 7005-1013, 30 kHz
200575 Ultrasonic sensor 7005-1023, 100 kHz
202942 Pressure Transmitter 7062-1413, 0-30 cm
202943 Pressure Transmitter 7062-1423, 0-1 m
202944 Pressure Transmitter 7062-1433, 0-3 m

Accessories for mounting:

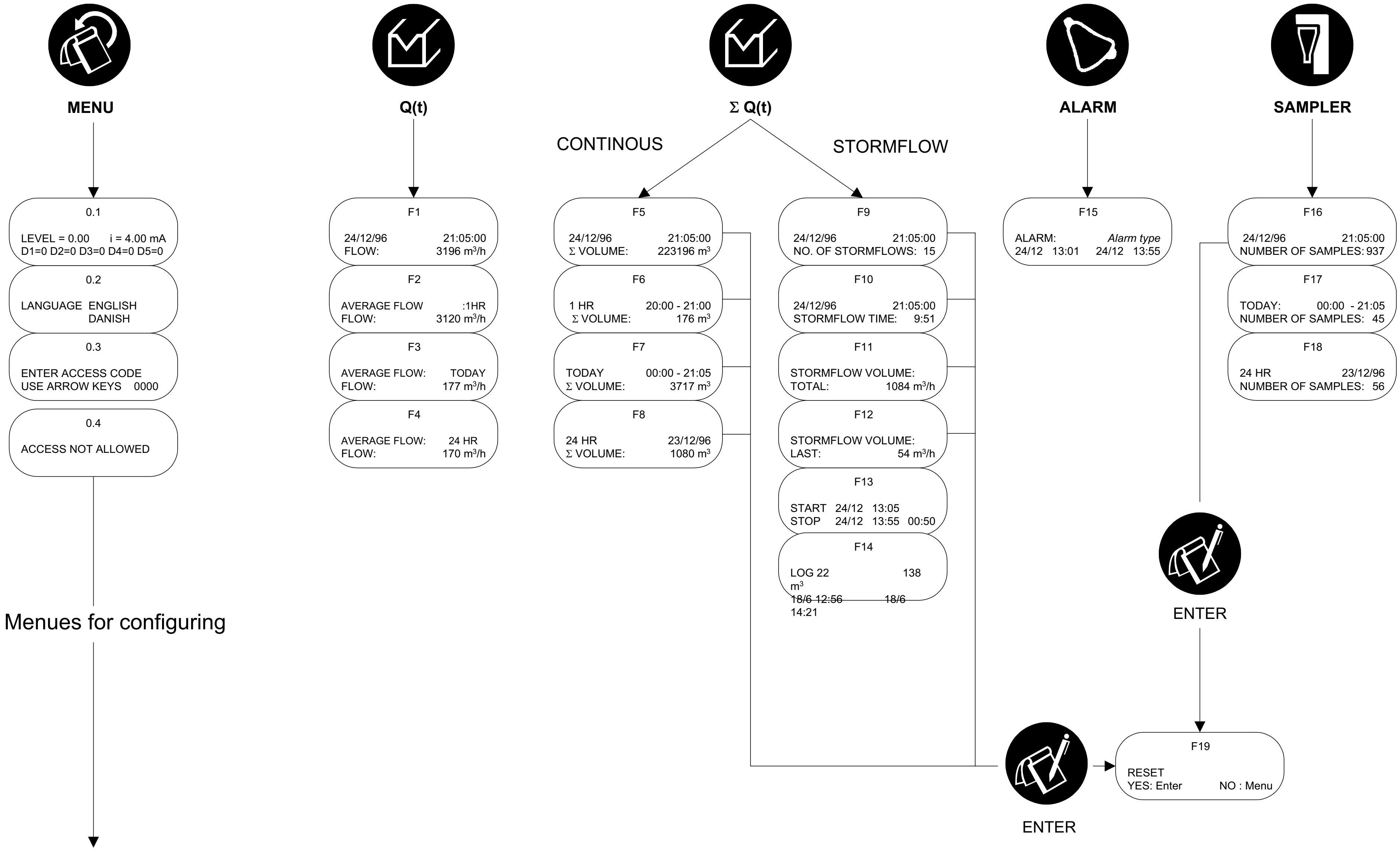


Universal bracket

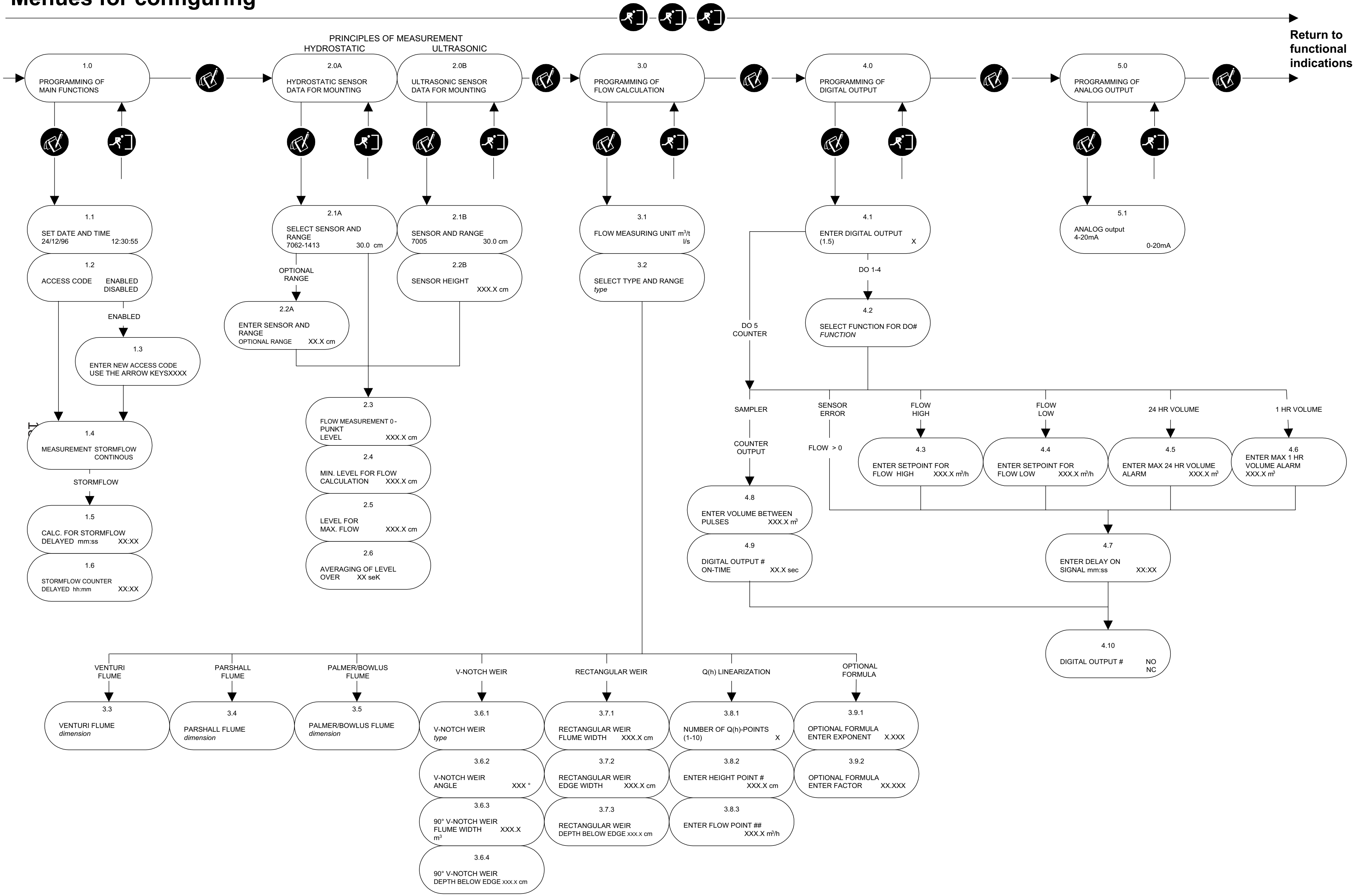


Bracket for ultrasonic sensor 7005

Functional Indications



Menues for configuring



Setting of MJK 713 Open Channel Flow Converter

Measuring range:	Series No.:
	Date:
Measuring station:	

PROGRAMMING OF MAIN FUNCTIONS

Access key	Wanted / Un wanted	Access key:
Measuring	Continiuosly / Storm flow	
Calculations for storm flow delayed		min sec
Storm flow counter delayed		h min

HYDROSTATIC SENSOR / ULTRASONIC SENSOR - DATA FOR MOUNTING

Sensor type:	
Sensor range:	
Ultra sonic sensor height	cm
0-point for flow measuring	cm
Min. level for flow calculation	cm
Level for max. flow	cm
Averaging of level over	sec

PROGRAMMING OF FLOW CALCULATION

Flow measuring unit		m^3/h / l/sec										
Parshall flume / Palmer & Bowlus flume Range:		m^3/h										
Triangular weir / Rectangular weir Weir width:		cm										
Flume width:		cm										
Depth below edge:		cm										
Q(h) Linearization	High point: h											
	Flow point: Q											
Optional formular	Exponent:	Factor:										

PROGRAMMING OF DIGITAL OUTPUTS

DO1 NO / NC	Function:	Setting:	Delay on signal	m^3 between pulses	On-time:
DO2 NO / NC	Function:	Setting:	Delay on signal	m^3 between pulses	On-time:
DO3 NO / NC	Function:	Setting:	Delay on signal	m^3 between pulses	On-time:
DO4 NO / NC	Function:	Setting:	Delay on signal	m^3 between pulses	On-time:
DO5 NO / NC	Counter output			m^3 between pulses	On-time

PROGRAMMING OF ANALOG OUTPUTS

Analog output	4-20mA / 0-20mA