Manual

EN 3.1 Version 2009

Flow Converter 713

SOFTWARE VER. 833042 OR LATER

mjk
a xylem brand

Your notes:

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In general

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 of 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 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:

Flow Q = f(level ^{x} · constant)

where the exponent **x** and the constant depends on the weir or the flume.

The flow converter has three 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

Flow converter 713 converts level to flow from these examples. Some of the examples are simplified.

The ISO 1438 norm indicates a number of calculation methods for flumes and weirs. The Flow converter 713 uses these methods where possible.

Rectangular sharp edged weir

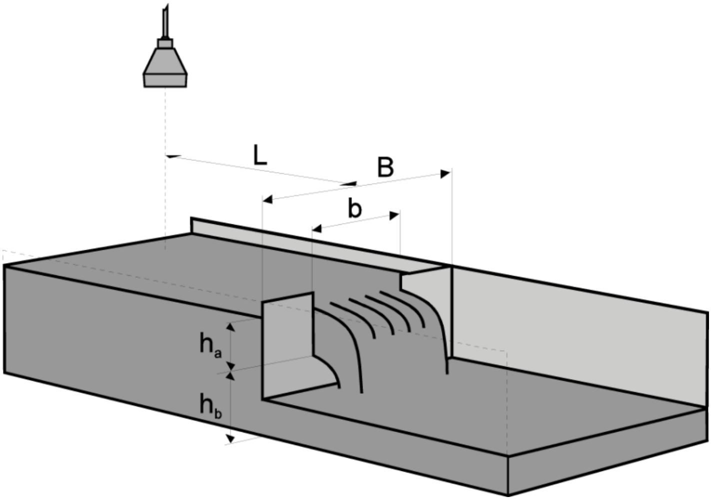
According to ISO 1438, a rectangular sharp edged weir is supplied in two types:

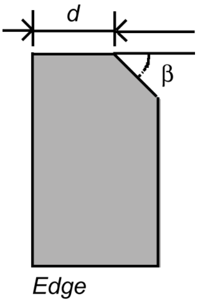
- with side contraction where the opening has a smaller width than the feeder

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:





ß = minimum 45°, d ~ 1-2 mm

Universal formular: (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 i [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 × $h_{a\ max.}$
g =	acc. due to gravity = 9,81 m/s^2

k_b is a correction factor in meter.

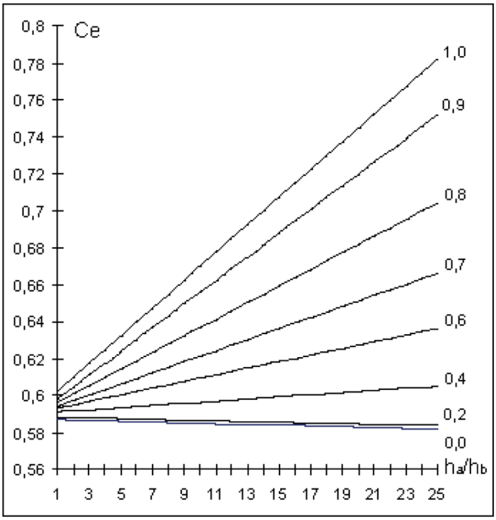
For determination of k_b

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

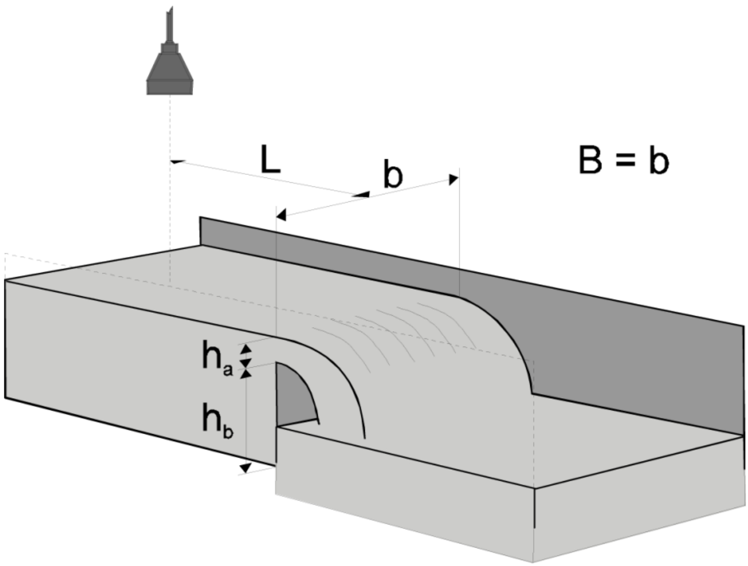


Determination of Ce for different values of b/B.

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 to 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):

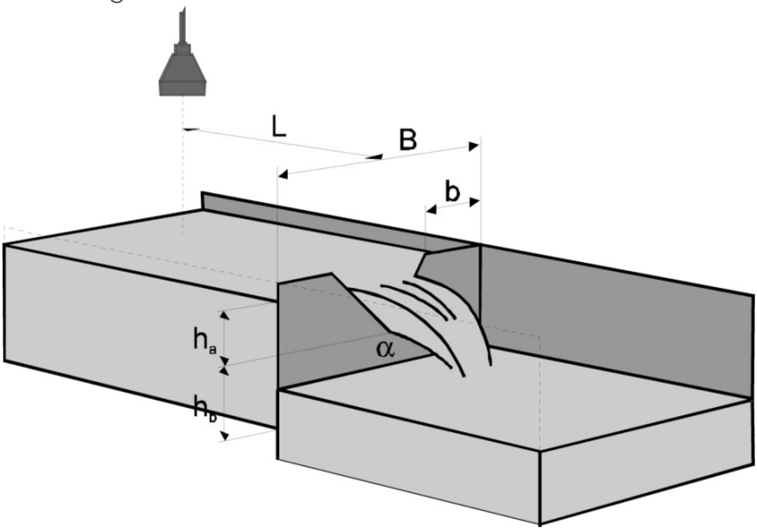
$Q = 3600 \times Ce \times 2/3 \times \sqrt{2g} \times b \times h_e^{1,5}$

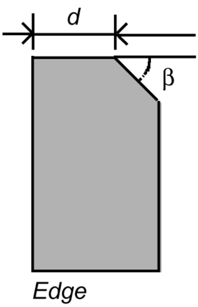
where:

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

B =	flumewidth
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 meter
h_e =	the effective height in meter
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.

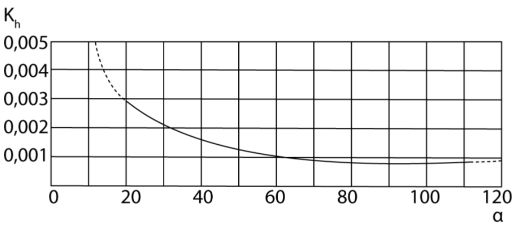


Diagram for determination of k_n.

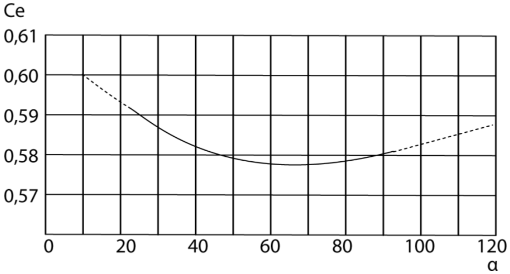
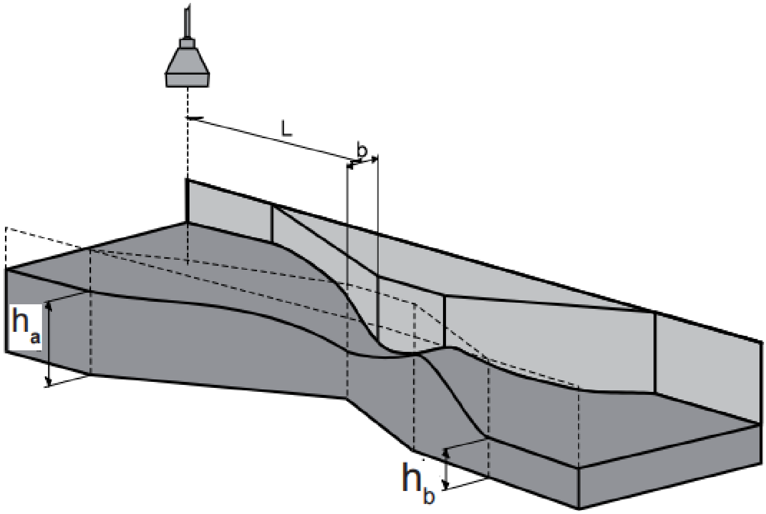


Diagram for determination of Ce.

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 in the next table. 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: $Q = k \times h_a n$

where:

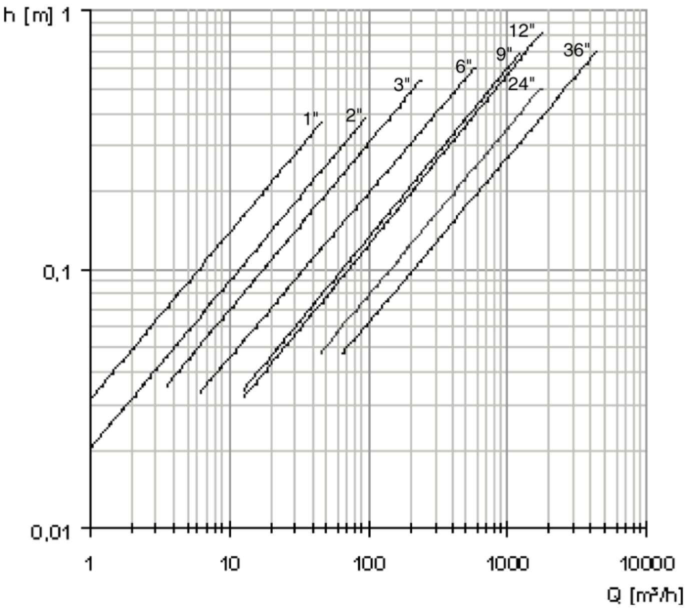
Q=	flow in m^3/h
b=	width in the measuring flume in m
h_a=	water level before the narrowing in m
h_b=	water level in the narrowing in m
L=	distance to the sensor (use the next table)

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

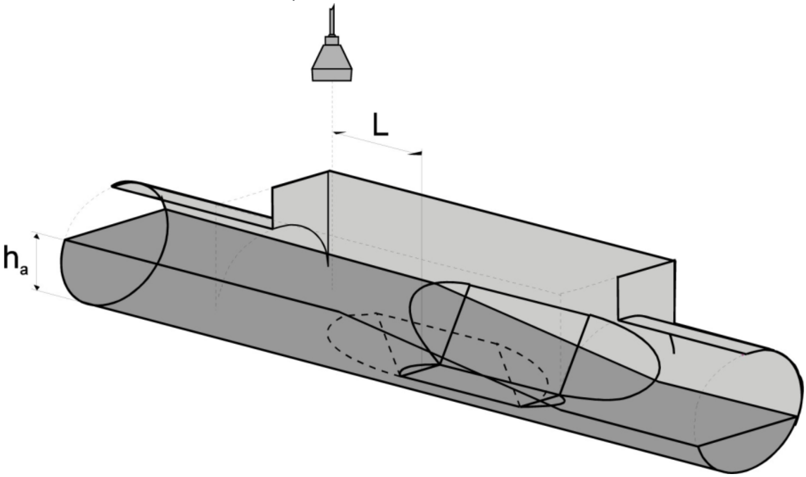
Table for determination of the constants k, n and the distance to the sensor.



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:

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

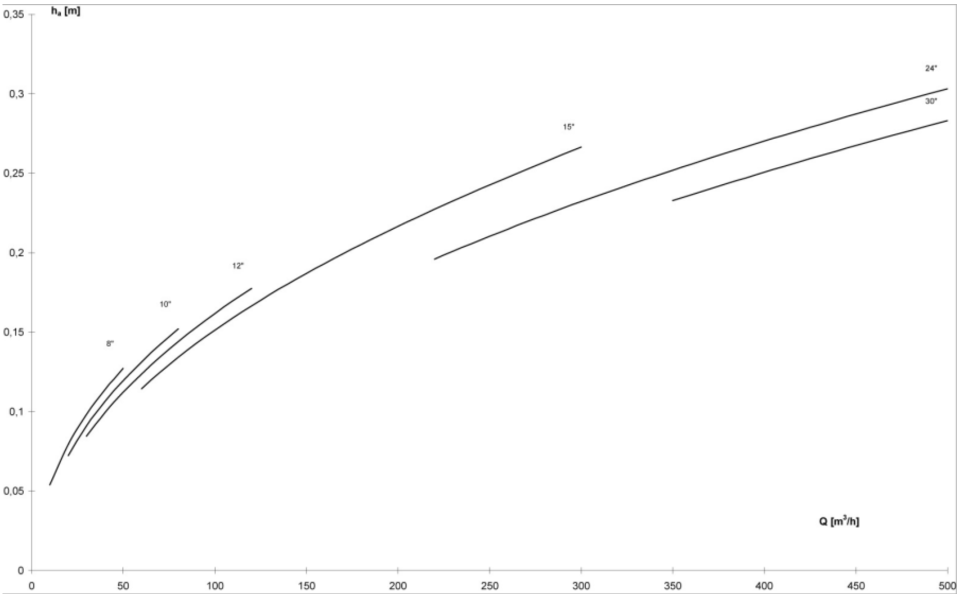
where:
A_1 and h_1 = cross section and height in the inlet of the flume.

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** (see page 37) 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.



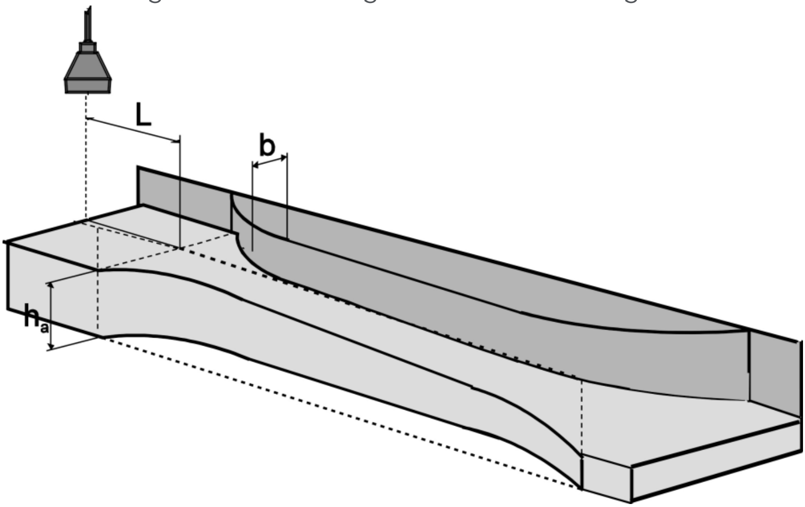
Q/h diagram for the MJK Palmer & Bowlus flumes, the height h_a is shown as a function of the flow Q.

Venturi flumes

Venturi flume - long throated

According to ISO 1438.

The following formula and diagram concern the longthroated Venturi flume.

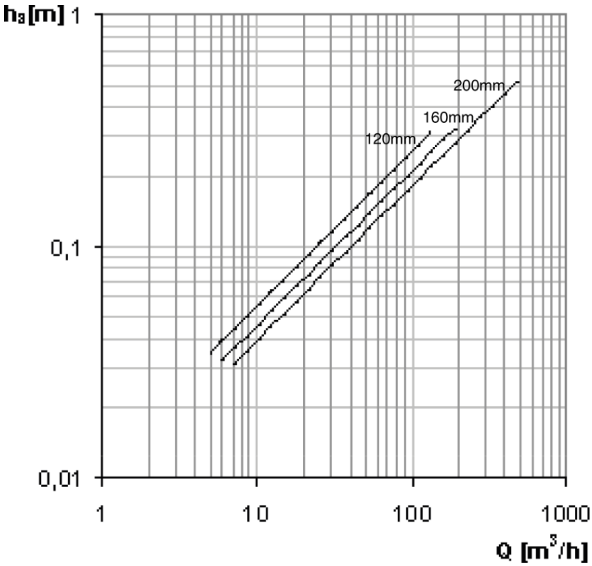


713 follows the calculation method for longthroated Venturi flumes described in ISO 1438. The connection between level and flow is complex and can not be described in a simple formula. When dimensioning the following simplified formula can be applied.

$Q = 6495 \times b \times h_a 1{,}5$ (NB! Not ISO 1438)

where:

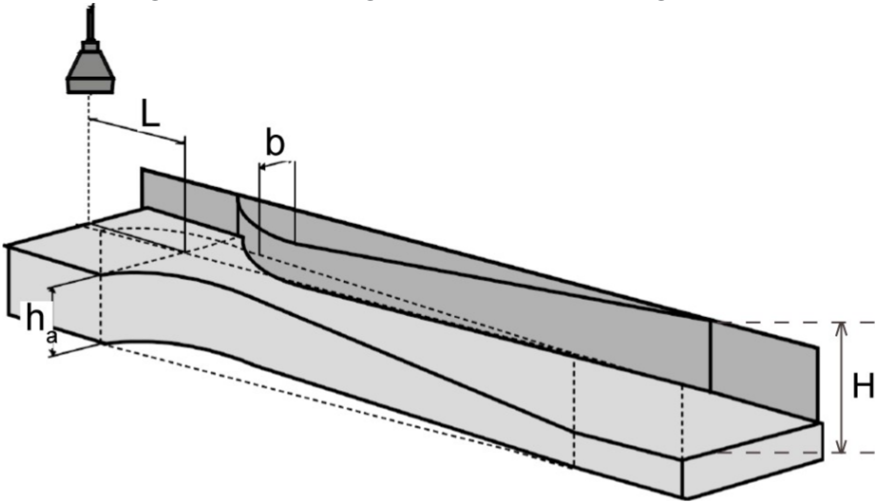
Q=	flow in [m^3/h]
b=	width in the flume in [m]
h_a=	water level before the narrowing
L=	distance to the sensor = 3 - 4 x $h_{a\ max}$



Q/h diagram for the longthroated 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.

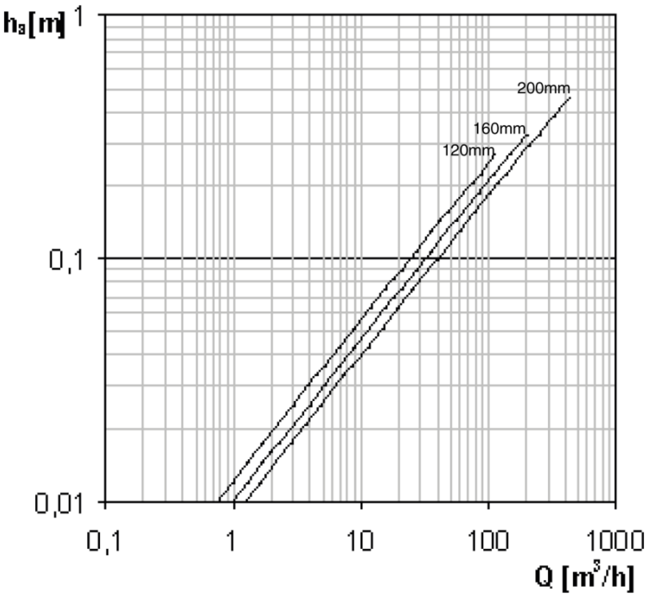


The flow is calculated from the following formula.

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

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
5" (DN 160)	300 mm	150 m^3/h
5" (DN 200)	320 mm	200 m^3/h
5" (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.

Hydrostatic 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:

Measuring range	0-30 cm	0-1 m	0-3 m
Min. range	10 cm	30 cm	1 m
Max. range	30 cm	100 cm	3 m

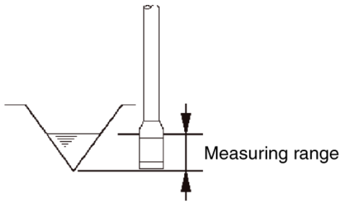
The following always applies to hydrostatic measuring systems:

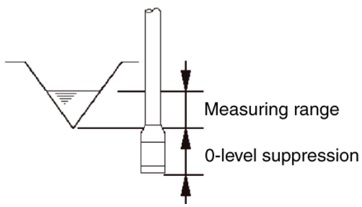
Maximal sensor height = measuring range + optional 0-level suppression

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

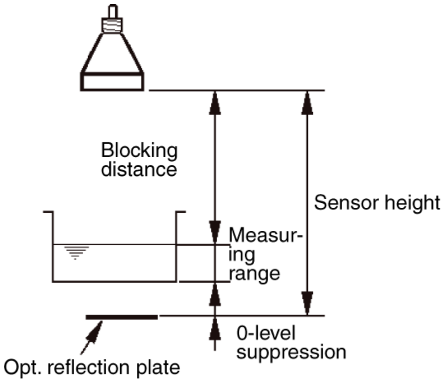
0-level suppression

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

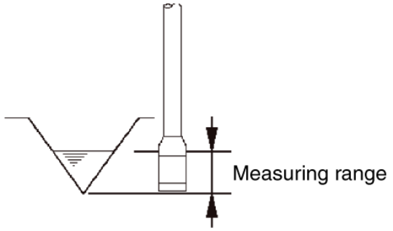


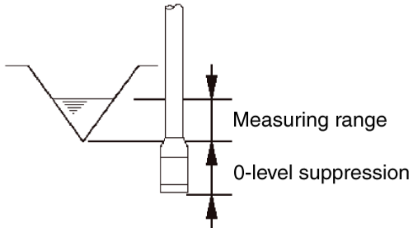


With 0-level suppression - recommended at stormflow measurings



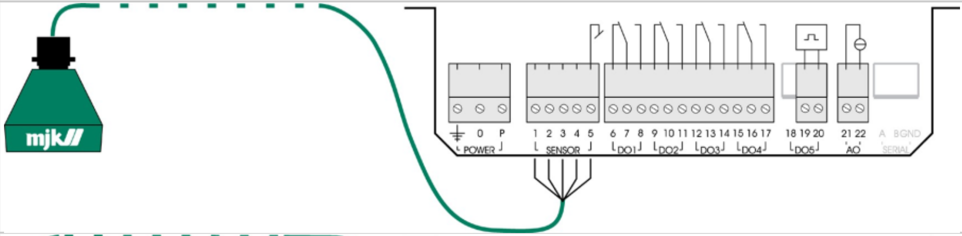
Recommended at flow- and stormflow measurings

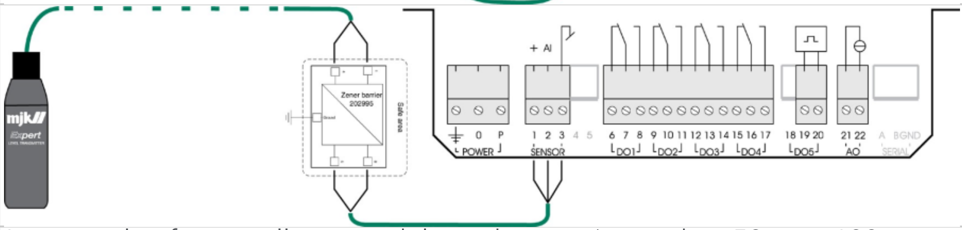




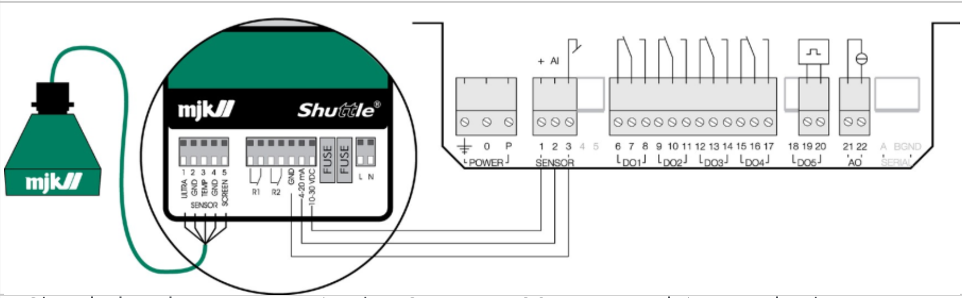
Electrical connection

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 or 100 m depending of model) between the measuring location and the amplifier:



A Shuttle 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 Shuttle level transmitter 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 four function keys:

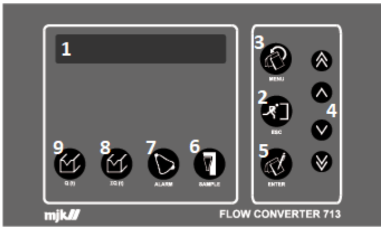
1. **the flow key**
2. **the summation key**
3. **the alarm key**
4. **the sample key.**

When one of these keys are pressed once, the selected function menus appear. By repeatedly pressing the same key, the various function menus associated with this function appear. Which menus appear depends on the Flow converter's configuration. A complete overview of the function menus can be found under Function indications (see page 46).

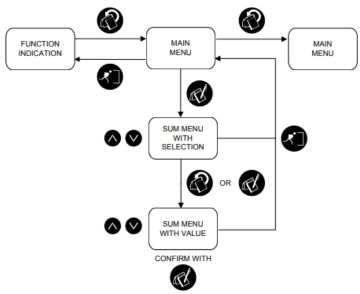
The flow meter setup is divided into a number of configuration menus. For each configuration menu, there are a number of sub-menus in which the arrow keys can be used to select or enter values. A complete overview of the configuration menus can be found under Configuration menus (see page 47).

The following is a description of the individual menu items.

1	Display	2 x 24 character text display for menus and measurement values. The display has back-light.
2	ESC	(ESCape = Undo): The key returns to the main menu or cancels a selection. At 2-3 key-presses, **ESC** key always returns to function indication.
3	MENU	By activating the **MENU** key, the next main menu in the menu overview is shown.
4	Arrow keys	The arrow keys are used to change a current setting. In a sub-menu with choices, the top line will show the current setup, the bottom line, in parentheses, will show the alternate setup. You switch between current and non-current settings by pressing an arrow key. Activating arrow keys also changes values. By activating the up arrow key, the number in the display will increase. Activating the down arrow key decreases the value.
5	ENTER	A switch from the main menu to the sub-menu, as well as between sub-menus, is done by activating the **ENTER** key. Also, a selection in a sub-menu must be confirmed with the **ENTER** key.
6	SAMP-LER	Registration of: - Total number of samples - Number of samples today - Number of samples 24 hours
7	ALARM	Alarm protocol with the last 9 alarms with date and time. As well as the time of voltage connection.



The figure below shows the general function of the keys in the configuration menus:



8	Σ Q(t)	Register for either: - Summed flow in total - Summarised flow 1 hour - Summarised flow today - Summarised flow for 24 hours - Log 99 days or: - Number of overflows - Overflow time - Total overflow amount - Overflow amount of last overflow - Start / End time last overflow - Log 99 overflows	
9	Q(t)	Register for flow: - Current value - Average flow 1 hour - Average flow today - Average flow 24 hours	

Function keys

Flow key Q(t)

This button displays the current flow value, as well as various average values.

F1	**Flow**
1. press results in:	24/12/96 13:34:12 FLOW: 3196 m^3/h
Specifies the current flow of the moment. The flow is calculated according to the selected Q(h) formula. Measured value with time and date is indicated.	
F2	**Average flow 1 hour**
2. press results in:	AVERAGE FLOW: 1 HR FLOW: 3120 m^3/h
Specifies the average flow for the last full hour.	
F3	**Average flow today**
3. press results in:	AVERAGE FLOW: TODAY FLOW: 3120 m^3/h
Specifies the average flow at 00:00:00 to the present time.	
F4	**Average flow 24 HR**
4. press results in:	AVERAGE FLOW: 24 HR FLOW: 3120 m^3/h
Specifies the average flow for the last 24 hours (00:00:00 til 23:59:59).	

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**

1. press results in:	21/06/95 13:34:12 Σ VOLUME 223196 m^3
Specifies the total amount from the last time the value was reset or since the start up.	
F6	**Σ volume 1 HR**
2. press results in:	1 HR 11:00 - 12:00 Σ VOLUME: 127 m^3
Specifies the sum of the previous full hour.	
F7	**Σ volume today**
3. press results in:	TODAY: 00:00 - 13:51 Σ VOLUME: 776 m^3
Specifies the sum of the amounts for today.	
F8	**Σ volume 24 HR - 99-days log**
4. press results in:	24 HR: 23/12/96 Σ VOLUME: 3120 m^3
Specifies the summed volume of the previous 99 days. The daily amount is logged every day (at 00:00:00). Using the arrow keys, you can scroll between the volumes of the last 99 days. Volume values can be reset by pressing **ENTER**, see menu F19.	

Stormflow measuring

F9	**No. of stormflows**
1. press results in:	21/06/95 13:34:12 NO. OF STORMFLOWS 21
Specifies the total number of overflows. The value is calculated from the last time the value is reset or from system startup.	
F10	**Stormflow time**
2. press results in:	21/06/95 13:34:12 STORMFLOW TIME: 00:21
Specifies the total time (hours:minutes) of stormflow	
F11	**Stormflow volume total**
3. press results in:	STORMFLOW VOLUME TOTAL: 1084 m^3
Specifies the total volume of stormflows. The volume is calculated from the last time the value was reset or the system was restarted.	
F12	**Volume last stormflow**
4. press results in:	VOLUME LAST STORMFLOW: 1084 m^3

Specifies the volume of the last stormflow.

F13	**Stormflow start/stop**
5. press results in:	START 25/12 12:32 STOP 25/12 13:01 00:29

Specifies the start and stop times as well as how long the last overflow lasted. All number, volume and time values can be reset by pressing **ENTER**, see menu F19.

F14	**99 days log**
6. press results in:	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.

Alarm key ALARM

The digital outputs can be configured as alarms of one of the following alarmtypes:

- high flow
- low flow
- 24 hour volume
- one hour volume
- sensor error
- voltage failure.

When there has been an alarm on one or more of the digital outputs, pressing the alarm button will display the last 9 alarms. A new alarm is registered as alarm # 1, the other alarms are cleared and the alarm previously registered as alarm # 9 is deleted.

F15	**Alarm display**
1. press of the button shows alarm # 1 which is the latest alarm. Following presses show alarm # 2 to 9. By using the arrow keys it is possible to travel back and forth through the alarms. As soon as an alarm is detected, the display shows alarmtype, digital output and time:	ALARM 1: HIGH FLOW D# 13/03 23:33

Alarm key ALARM

When the alarm is no longer active, the time of cancellation is recorded. Note, that in the meantime, other alarms may be activated so that the alarm is no longer # 1:	ALARM 2: HIGHE 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 occurs, the display will switch from the selected menu display to menu F15 alarm display, alarm # 1. Start time of voltage failure is detected at 5 min interval and stop time is detected immediately after the voltage is reconnected.	

Sample key SAMPLER

If one or more of the digital outputs is configured to control a sampler, pressing this button will give the following indications:

F16	**Number of samples**
1. press results in:	22/02/95 04:39:12 NUMBER OF SAMPLES: 34245
Specifies the total number of samples taken since the last reset or system startup. Resetting is done by pressing **ENTER**, menu F19.	
F17	**Number of samlples today**
2. press results in:	TODAY 00:00 - 17:22 NUMBER OF SAMPLES: 45
Specifies how many samples have been taken during the current day (00: 00: 00 - now).	
F18	**Number of samples 24 HR**
3. press results in:	24 HR: 30/06/95 NUMBER OF SAMPLES: 11
Specifies how many samples have been taken yesterday. The value and the date of the last day are indicated.	
F19	**Reset value**

Sample key SAMPLER

The following menus can be reset: F5, F6, F7, F9, F10, F11.

When viewing one of these menus, pressing **ENTER** will bring up the following menu;	RESET type: YES: Enter NO: Menu

Where the type can be quantity, time or number depending on the input to the conversion.

Menu key MENU

This key provides access to the menus with readings and programming of the flowmeter's measurements and functions. In menus where there are options, the options are displayed above each other, where the upper one is the current value. Pressing an arrow (up or down) will change the selection. Selections are confirmed with enter. Unconfirmed selections flash in the display, while valid/ confirmed selections appear fixed.

0.1	**Level**
1. press results in:	LEVEL= 43.2 I= 12.30 mA D1=0 D2=0 D4=1 D5=0

Specifies the measured level (**LEVEL**) and the value for the analog output (I). The position of the digital outputs is displayed (D1-D5). A 0 indicates a non-activated output, a 1 indicates an activated output, outputs selected for "not in use" are not displayed.

0.2	**Lenguage**
2. press results in:	LANGUAGE DANISH ENGLISH

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**
3. press results in:	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.

Menu key MENU

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 **MENU** to access configuration menus

1.1 Set date and time
Set time and date with the arrow keys followed by **ENTER**. If no changes are wanted, press **MENU**.

1.2 Access code enabled/disabled
Choose whether or not access code is wanted. The code blocks access to configuration menus, but allows reading and operation of flow meter. Use arrow keys to switch between choices and confirm with **ENTER**.

1.3 Enter new access code
This menu shows a chosen access code (4 digits) of the configuration menus. The arrow keys are used both to enter the code and configure it. Double arrow switches the first 2 digits, single arrow switches the last 2 digits. Press **ENTER** to confirm the choice of password.

1.4 Measurement storm flow/Continuous
This menu selects whether the flow converter measures a continuous flow or a storm flow. Use arrow keys to switch between choices and confirm with **ENTER**.

1.5 Calc. for storm flow delayed
In this menu, a level measurement delay is selected so that the level must be above the set point for a certain time before the calculation starts. This time interval is entered with the arrow keys. Double arrow changes value quickly with jumps of 10 sec. Single arrow slowly changes value with 1 second jump. The scale is in seconds (0-999).

1.6 Storm flow counter delayed
Enter the time interval where the storm flow must be 0 (zero) before a new storm flow can be registered in the storm flow counter. Use the arrow keys. Double arrow quickly changes value with jumps of 1 hour. Single arrow slowly changes value with jumps of 1 minute. The format is hours:minutes. Maximum time interval is 99 hours and 59 minutes.

2.0 Sensor, mounting data
The flow converter comes with one of two measurement principles; hydrostatic measurement or ultrasonic measurement. In menu 2.0, this setting is displayed.

2.1 Sensor and area
Here, if the hydrostatic measurement principle is used, you can enter which

sensor is used. Use the arrow keys to switch between choices, and confirm with **ENTER**. If the ultrasonic measurement principle is applied, the sensor is preprogrammed and can also be read here.

2.2A Sensor optional range
This menu is only available for hydrostatic measurement. If optional range is selected, the sensor area is set here. Double arrow changes the value with 10.0 cm jumps, single arrow changes the value with 0.1 cm jumps. Confirm with **ENTER**.

2.2B Sensor level
This menu is only available for ultrasonic measurement. Enter the height of the sensor above real zero. Use the arrow keys to set the value and confirm with **ENTER**.

2.3 Flow measurement 0-point level
Enter the level at which the flow measurement should start. At measurements 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 5.4 cm from the bottom due to the "bulge" at the bottom. Therefor, 5.4 cm is entered as a zero point for flow measurement. It is also possible that a pressure sensor is placed under a sharp-edged plate. Meaning that the flow does not start until, for example, 10.4 cm. Enter this height with the arrow keys. Double arrow changes value quickly with jumps of 10 cm. Single arrow changes value slowly with jumps of 0.1 cm.

2.4 Mine. level of flow calculations
Enter a level above 0-point for flow calculation, for starting flow measurement. This function is used e.g. where measuring is done directly on a weir. Flow calculation is only done when the level is above min. level, while the actual calculation is made from 0-point for flow measurement.

2.5 Level for max. flow
Enter the span of the flow measurement. This is the level at the maximum flow. Enter this level with the arrow keys. Double arrow changes the value quickly with jumps of 10 cm. Single arrow changes value slowly with jumps of 0.1 cm. When the desired level is confirmed with **ENTER**, the flow converter calculates the chosen weir/type of storm flow. By choosing the linearization point, this menu does not appear, as the highest level automatically gives the span.

2.6 Averaging of level over time
Here, the time for which the level measurement is to be averaged before Q(h), is calculated. The interval is optional between 1 and 60 seconds. Entering is done with the arrow keys. Double arrow changes value quickly with jumps of 10

sec. Single arrow slowly changes value with 1 second jump. The format is seconds.

3.0 Programming of flow calculation
Select the type and size of the flume/weir used for the flow measurement.

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 seven options for calculation of flow: Venturi-flume, Parshall-flume, Palmer/Bowlus-flume, V-notch weird, rectangular weir, linearization and optional flow formula. Select the desired parameter with arrow keys and confirm 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' and 3'. Change between the various sizes with the arrow keys. Confirm choice with ENTER.

3.5 Palmer/Bowlus flumes
If a Parshall-flume has been selected, there is a choice between various sizes: 1", 2", 3", 6", 9", 1', 2' and 3'. 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. 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 storm flow. This is why the width of the weir (menu 3.6.3) and depth under the weir (menu 3.6.4) must be keyed in. It is provided that there is a straight inflow of 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 choose, key in the angle with the arrow keys. The angle can be choose between 10° and 89°, confirm selection with **ENTER**.

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 quickly change value with 10 cm steps, single arrow slowly change value 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 triangular weir is keyed in with the arrow keys. Double arrow quickly changes value with 10 cm steps, single arrow slowly changes value 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 quickly changes value with 10 cm steps, single arrow slowly changes value 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 quickly changes value with 10 cm steps, single arrow slowly changes value with 0,1 cm steps.

3.7.3 Rectangular weir depth below edge
Here the depth of the channel upstream below the bottom of the rectangular weir is keyed in with the arrow keys. Double arrow quickly changes value with 10 cm steps, single arrow slowly changes value 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 the arrow keys. The number of points decides how many times you run through the menus 3.8.2 and 3.8.3. Always start with the lowest value, then the next and so on until the largest value is reached. It is assumed that h=0 equals Q(h) =0.

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 quickly changes value with 10 cm steps, single arrow slowly changes value 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.

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 quickly changes value with 100 m^3 steps, single arrow slowly changes value with 1 m^3 steps. The flow **MUST** be greater than

previously keyed in flow. The flow can only be set in whole numbered m^3/h or l/s. The highest Q(h) point 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, It is keyed in with the arrow keys. Double arrow quickly changes value with 0.1 steps, single arrow slowly changes value 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. K must be scaled in such a way that the result Q(h) gets the unit m^3/h. It is keyed in with the arrow keys. Double arrow quickly changes value with 100 steps, single arrow slowly changes value with 1 step. 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 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 nine different functions, confirm 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
- **Flow>0%**: Signal to indicate that flow is greater than 0. Is applied i.e. when measuring emergency storm flow
- **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 if 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. The range is 10% to 100% of maximum flow.

4.4 Alarm flow low
The limit for flow low is keyed in with the arrow keys. The range is 0% to 90% of maximum flow.

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 change 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, 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
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 in menu 2.5 generated 20 mA.

Specifications, Flow converter 713

Ultrasonic sensor	200570	200580
Measuring range:	3 m	100 cm
Frequency:	30 kHz	125 kHz
Spreading:	3°	6°
Temperature compensation:	Built-in	
Temperature:	-20 - +60° C	
Dimensions:	ø103 x 94 mm	
Materials:	PP Green / POM Black	
Cable:	Screened oil resistant PVC, length 12 m	
Can be extended to:	100 m	50 m
Housing:	IP 68, waterproof, withstands immersion, max. 1 bar	

Pressure Transmitter	Expert 3400	Expert 3400	Expert 3400
Measuring ranges:	0-30 cm	0-1 m	0-3 m
Function:	2-wire, 4-20 mA		
Accuracy:	±0,1% FS (10-30 degree Celcius)		
Temperature:	-10 - +60° C		
Dimensions:	ø60 x 132 mm		
Materials:	House: PPS		
Membrane	Ceramic		
Cable	2x0,5mm², length 12 m, can bee extended		
Mounting:	1" thread. Mounted on pipe		
Housing:	IP 68, waterproof, max. 0,5-2 bar		

Flow converter 713	
Measuring ranges:	0 - 1 m, 0 - 3 m
Supply:	220-240, 110-120 or 24V AC, app.10 VA
Temperature:	-20 - +60° C.
Input signal:	From ultrasonic sensor or pressure transmitter, 4-20 mA
Accuracy:	Max ±1% (min. ±1 mm)
Outputs:	• Plug 6 -17: Relay 1 to 4, max. load 250V, 4A ohmic max. 100VA inductive load. Can be selected as alarm, counter, flow>0 or sampler outputs. • Plug 19 - 20: Relay 5 (as 1-4) or pulse (optocoupler) max. 36 V, 50 mA, one shot, 100 msec-10 sec programmable. • Plug 21, 22: Analogue: 0-20 / 4-20 mA max. 500Ω galvanic isolation.
Facultative formula:	$Q = k \cdot h^x$; Q=flow, h=height, k=factor, x=exponent (ISO1438) or point linearization.
Indication:	2x24 characters LCD display for reading and programming
Dimensions:	185 x 240 x 115mm (h x b x d)
CE:	EN61000-6-4 2007, EN61000-2 2005
Housing:	IP 65

Order numbers

Part no:	Specification	
201455	713U-1121	Ultrasonic Flow converter 713U-1121 w/ sensor 200580, range 0-1m
201460	713U-1131	Ultrasonic Flow converter 713U-1131 w/ sensor 200570, range 0-3m
202600	713-1104	Flow converter 713P-1104 230VAC, 4-20mA
202655	713P-1124	Flow converter 713P-1124 w/sensor 203962, range 0-1m
202660	713P-1134	Flow converter 713P-1134 w/sensor 203963, range 0-3m

Accessories	Flow Converter 713
200205	Universal bracket

Accessories	Expert 3400
202922	Transmitter connection box

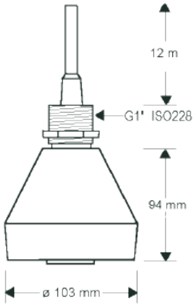
Accessories	Expert 3400
200205	Universal bracket
200220	Sensor bracket, Standard, 325mm
200590	MJK Connection box IP67/NEMA4X for Shuttle/SuSix/ Oxix sensors
690010	Ultrasonic sensor Cable, per m. 4x0,5mm2 green

Sensors	
200570	Shuttle® sensor 30 KHz, 0-15/6m 0-45/15ft. 12m/39ft. cable. ISO
200580	Shuttle® sensor 125 KHz, 0-1m, 12m/39ft cable
203962	Hydrostatic transmitter 3400 range 0-1,0m w/thread
203963	Hydrostatic transmitter 3400 range 0-3,0m w/thread

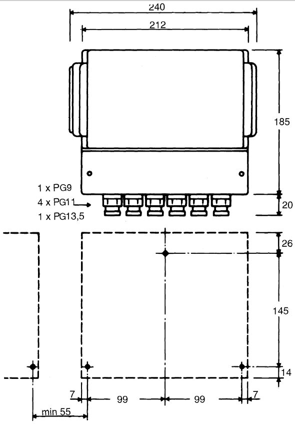
Sensors
For a more detailed specification, please see datasheet 2.77 Expert 3400

Dimensions

Ultrasonic sensor 200570



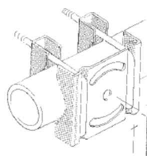
Flow Converter 713

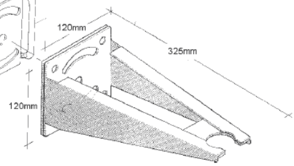


Pressure transmitter Expert 3400

Accessories for mounting

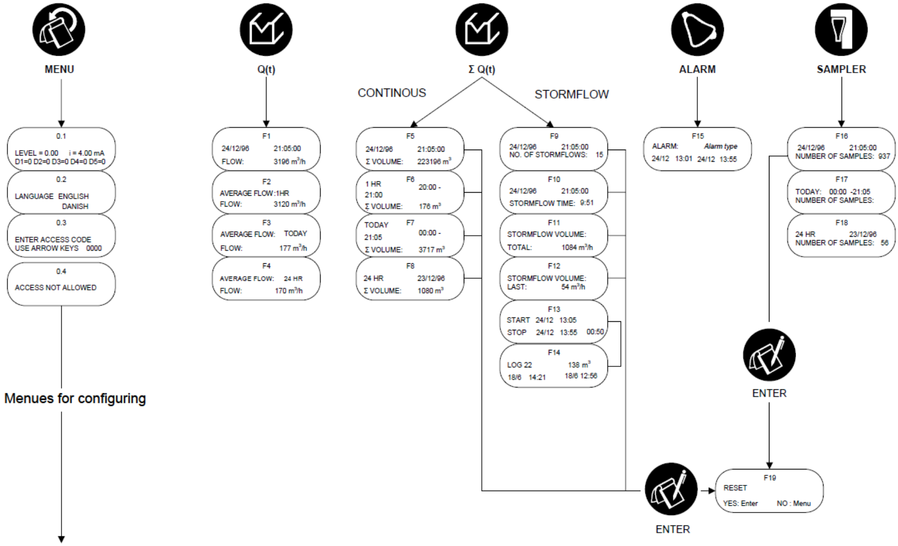
Universal bracket



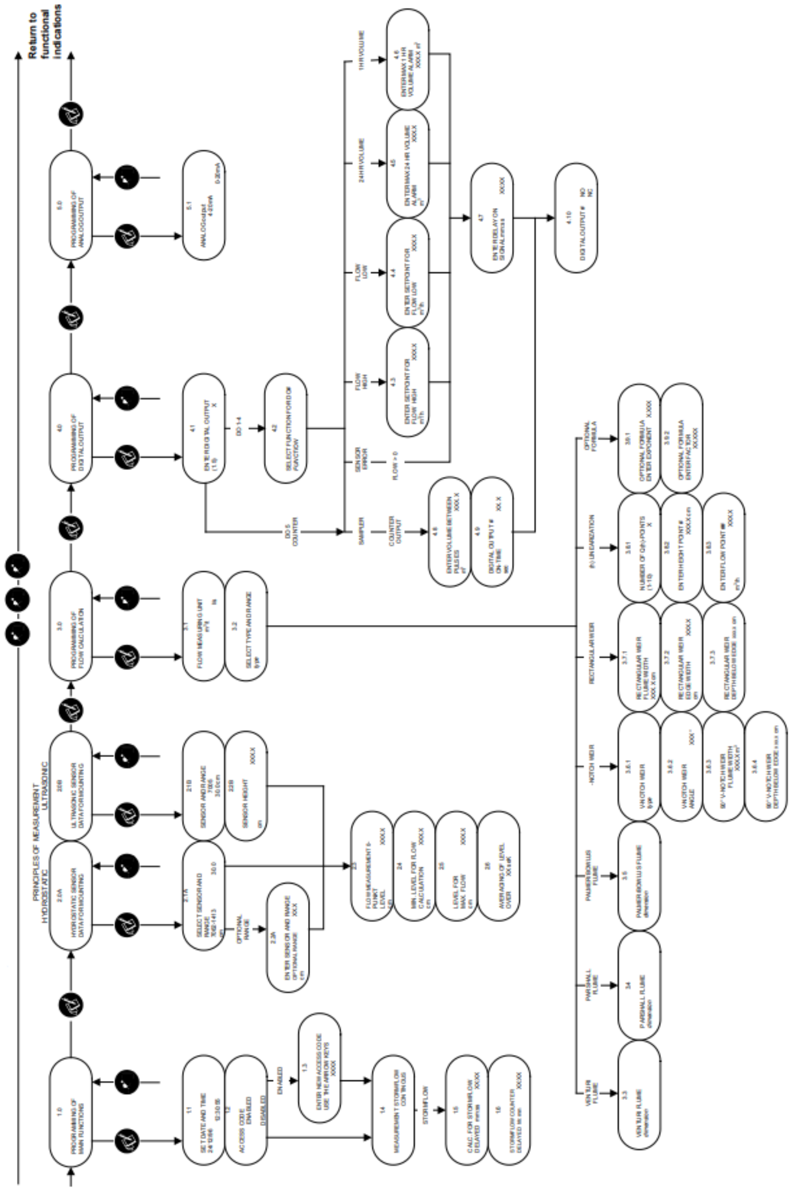


Bracket for ultrasonic sensor 7005

Function indications



Configuration menu



Setting of MJK 713 Open Channel Flow Converter

Measuring range:	Series no:
	Date:
Measuring station:	

Programming of main functions		
Access key	Unwanted / Wanted	Access key:
Measuring	Continuously / 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 fume / Palmer & Bowlus fume 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 formula	Expo-nent:	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 analogue outputs	
Analogue output	4-20mA / 0-20mA

Xylem |ˈzīləm|

1) The tissue in plants that brings water upward from the roots;

2) a leading global water technology company.

We're 12,700 people unified in a common purpose:

creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work.

We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xyleminc.com

mjk a xylem brand

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