OPEN CHANNEL FLOW METER

HBMH-MF

KAIFENG HUABANG INSTURMENT CO.,LTD

CONTENT

I. Brief introduction

1.1 Prefaces

Open channel flow integrating instrument is a universal industry intelligent instrument. 4-20mA， 0-20mA， 1-5V and 0-5V linear signal output and RS485 serial output are optional. Integrating 2 line control module of signal input, this instrument separately control each line signal and do relative operating to display and output. Processing open channel flow integrating instrument function, it can be used as open channel flow meter. For flash disk to download data, it is flexible to use.

1.2 Characteristics

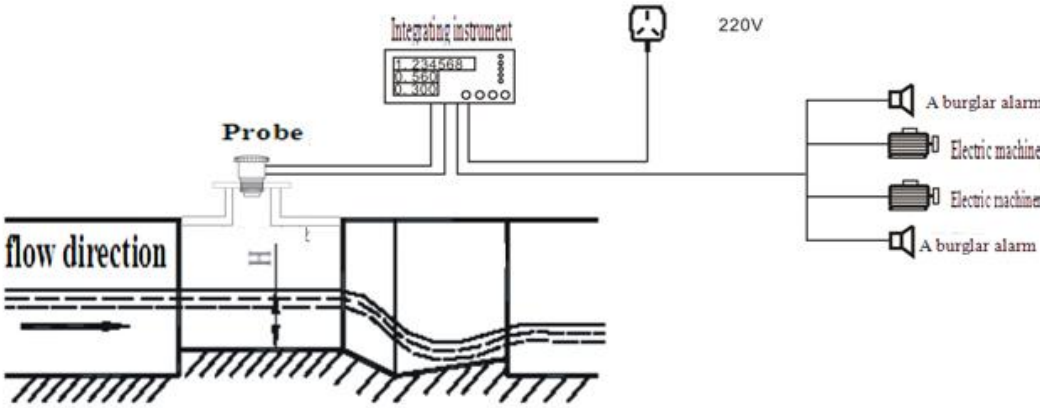
- □ High precise, non-touching level measurement. Without impact on flow velocity.
- □ Low sensor power consumption，easy installation and orientation，application wildly.
- □ Widely used in wall hanging right-angle rectangular weir, triangular weir, parshall flume and so on.
- □ Easy operation, no need to calibration the input signal, only few parameters should be set.
- □ Full functions, 2 line relays output, easy to connect actuating mechanism such as motor, Warner.
- □ Flow integrating instrument possess data storage. When power off it can save 10 years. Data can be also saved by SD card.
- □ According to condition ， sensor can choose anti-erosion, anti-explosion, small blind area，ultra low power consumption or wild range

□ Base on user's demand，it can attach flash disk、micro printer and storage battery .

1.3 Measuring principle

Ultrasonic open channel flow meter couple with flow measurement weir or flume to measure flux. The higher liquid level, the higher flux and vice versa

Measuring theory as follows:



Sensor is installed above the weir or flume. Sensor measured liquid level, and then according to flux formula (appendix), it can calculate flux. For different type of weir or flume has different parameter and formula. Make sure each parameter set correctly.

1.4 Specifications

（1）Flux range ：0~9999999 (Full eight cleared and the cumulative number plus 1)

（2）Instant flux: 10L/s～10m^3/s(based on wire type and size)

（3）Accuracy:5%

（4）Sensor range: 2m、5m、8m、10m(2m is standard, according condition　other range is optional)

（5）sensor blind area：0.3--0.5m（different for range）

（6）sensor precision ：±0.5%F.S

（7）display：Ｌ Ｃ Ｄ

（8）liquid level resolution：1mm

（9）keyboard：16

（10）signal input：transducer

（11）output(optional)：4-20mA / RS485/232(Modbus)/ 4 relays (AC:5A 250V　DC:10A 120V)

（12）work voltage：AC220V or DC12~24V

（13）consumption：<3W

（14）material：ABS for instrument、ABS for sensor

（15）main instrument size：180mm*160mm*76mm/168mm*130

（16）sensor size：Φ65mm×119mm×G1 1/2(3m)、
Φ74mm×137mm×M60(5-15m)、
Φ109mm×194mm×M30(20-30m)

（17）sensor installation size：G1 1/2(3m)、M60×2（5-15m）、M30X1.5（20-30m）

（18）sensor cable：10m shield cable

（19）work surrounding：normal

（20）protection degree：IP53 for main instrument

IP65 for sensor(higher degree optional）

（21）data scan：check hour, day, week, year flux record.

（22）optional item when order: MiniSD data collect、

GPRS/GPS、micro-printer.

Ⅱ Installation

Ultrasonic open channel flow meter installation is simple and convenient, only need to fix the host and the sensor is mounted in pre-reserve hole. When install the sensor, it should take note of the blind area of the sensor (generally 0.3-0.5m). According to the wire definition to connect then input correct installation height and flume or weir parameters. Please check the spare parts before installation. Such as: fixed plate and standard screws.

2.1 Input measurement parameter

Before measurement, please set the parameter first. Such as: installation height, weir or flume type selection and output...

measure interface.

2.1.2 Shortcuts definition

1：Check every hour history flux.

2：Check every day history flux.

3：Check every month history flux.

4：Check every year history flux.

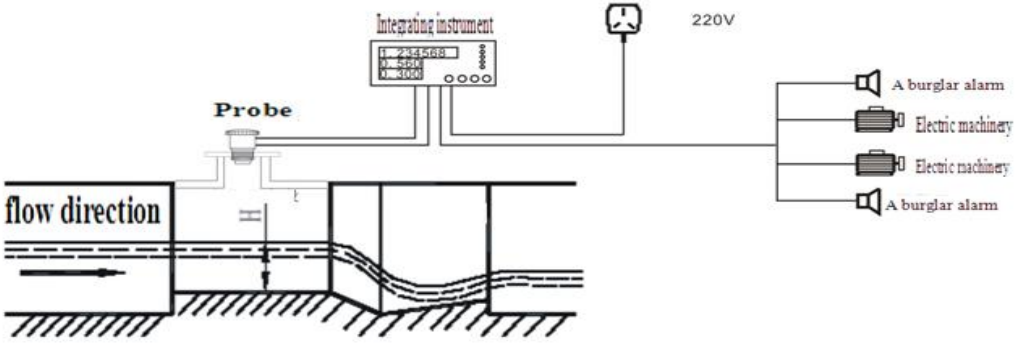
2.2 Installations precautions

The sensor is equipped with a fixed ring, pre-reserve a mounting hole in the installation place, put it in, and then tightens the screw ring.

Main instrument is wall mounting, with three fixation plates. Firstly fixed plates with screws to the bottom of the instrument, and then secure it to the pre-drilled mounting holes.

When it can't stable, we can use a wave guide as below: iii

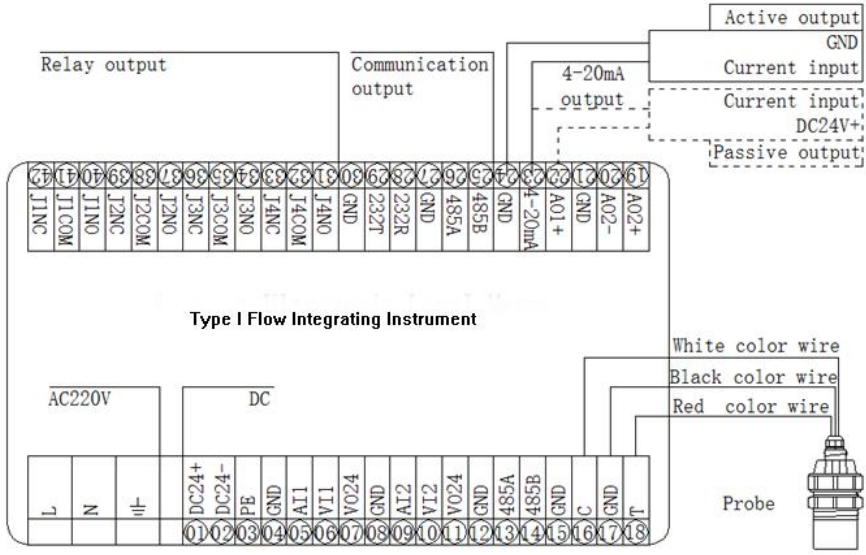
DN100, smooth inside wall and no joint water pipe is wonderful.

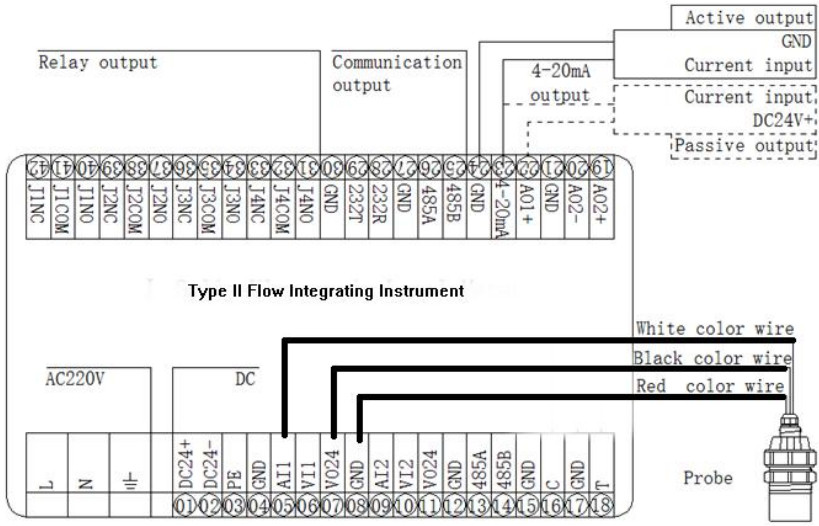


iii

2.2.2 Sensor connection

Wiring definition as below:

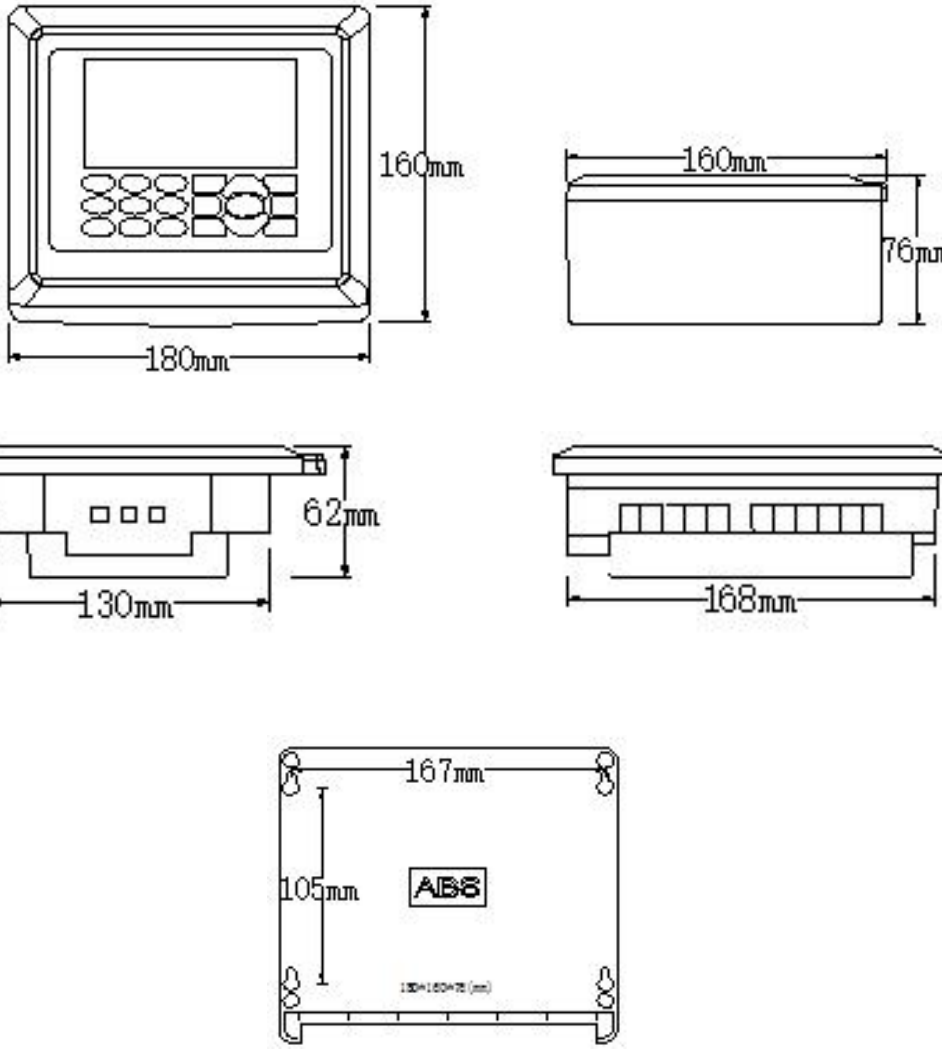




2.3 Main instrument installation

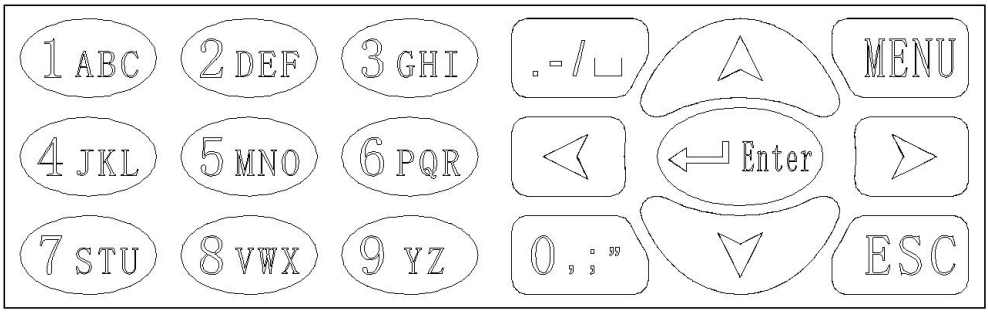
Main instrument is wall mounting, with three fixation plates. Firstly fixed plates with screws to the bottom of the instrument, and then secure it to the pre-drilled mounting holes.

Meter size and mounting sizes as picture above:



Ⅲ menu

Panel Instruction



MENU	Menu / Return	Input Password after pressing menu	ESC	Cancel	Back to the Previous Level
	Left Move Button	Cursor left	.-/␣	Symbol	Input symbol
	Right Move Button	Cursor right	0 , ; "	"0"	Input "0"
Enter	Confirm / Save	Confirm, Save Enter the Menu		Contextual Move	Select menu Up/Downwards

IType I

First class	Second class	Third class	Menu Meaning
Measure	Data Oper.	Ins. Ht	sensor install height
	Filter Set	Filter	
	sensor	PUL	
Flow Totalizer	Setting	Flume selection	Triangular, Parshall, Rectangular,
		Instant flux unit	km^3\m^3\L
		Total flux unit	km^3\m^3\L

		Zero Clearing	
		Custom Formula	
	Parshall Flume	Standard	
		Parameter C	
		Parameter N	
	Rectangular Weir	Weir Width	
		Channel Width	
		Weir Height	
	Conditions	Low	
		High	
	History flux	Hour	
		Day	
		Month	
		Year	
System	Password		
Output	Current	F0	
		FS	
	Serial	Add.	
		Bdr.	
	Switch	No.1 D.	
		No.1 H.	
		No.2 D.	
		No.2 H.	
		No.3 D.	
		No3 H.	
		No.4 D.	
		No.4 H.	

Type II

First class	Second class	Third class
Data	Value	Voltage
		Variable1~10
		01~02 Current output
		01 Percentage
	Flux Value	Second Flux
		Hour Flux
		Accumulative
		Accumulative Times
Input	I1 Analog Input	I1 Variable
		I1 Range Start
		I1 Range End
		I1 Ins. Ht
		I1 Filter
		I1 Calibration Start
		I1 Calibration End
	I2 Analog Input	I1 Variable
		I1 Range Start
		I1 Range End
		I1 Ins. Ht
		I1 Filter
		I1 Calibration Start
		I1 Calibration End
	Serial Input	Start of Variable
		Start Address
		Number
		Cycle
		Timeout

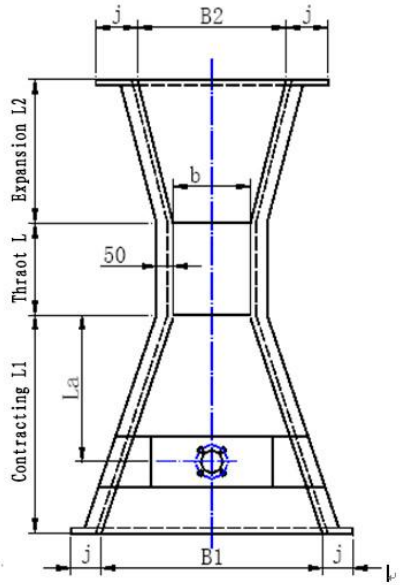
		Protocol
		Modbus Command
	Data Calculation	Input Custom Formula
	Settings	Input Variables
Flow	Flume Selection	Triangular, Parshall, Rectangular,
	S. Unit	L /㎞³ -H/㎥ -H
	A. Unit	L /㎞³ -H/㎥ -H
	Zero Clearing	
	Flow Custom Formula	
	Standard Number	1~25
	Parameter C	
	Parameter N	
	Weir Width	
	Channel Width	
	Weir Height	
	Low	
	High	
	Hour	
	Day	
	Month	
	Year	
Display	Contrast	
	Backlight Delay	
	Low Power Consumption	
	Main Display	
System	Password	0000
	Language	EASY/中文/English
	Admin Password	2006

	Menu Shielding	
	Clock	
	Clock Tuning	
	Safe Voltage	
	Backup	
	Restore	
Output	Current	01 F0
		01 FS
		01 L. Regul.
		01 H. Regul.
		02 F0
		02 FS
		02 L. Regul.
		02 H. Regul.
		Configuration
	Serial	Add.
		Bdr.
		Parity bit
		Custom Sinks 自定义接收
		Custom Send
	Switch	No.1 D.
		No.1 H.
		No.2 D.
		No.2 H.
		No.3 D.
		No3 H.
		No.4 D.
		No.4 H.
		Configuration
Data Collect	Timing	
	Collect L.	

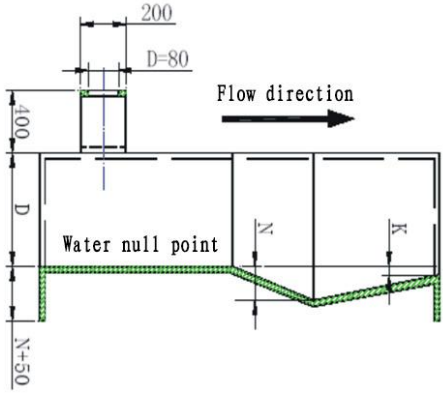
	Collect H.	
	File Name	
	Data Format	
	Check Item	
Telecommunication	Upload	Model/Timing/ Upper/Lower
	Message	Signal Quality/ Content/Phone1
	GPRS	Domain/IP/Port/ID/ Enrolment/Query Data/Query interval

Ⅳ Open channel flow meter application

4.1 *Standard Parshall Flume*



Plan



Vertical section

Explanation:

□ Symbol explanation: b for throat width,B1 for intake channel width,B2 for outtake channel width, L for throat length, L1 for contracting section, L2 for expansion section

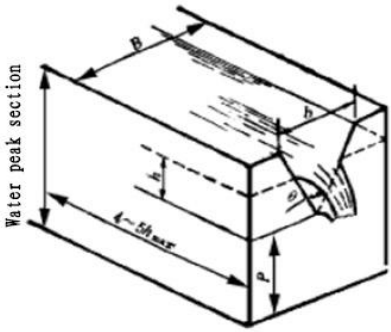
□ Weir notch construction and usage condition：B>=b，h/p<2.5，h>0.03m，p>0.1m

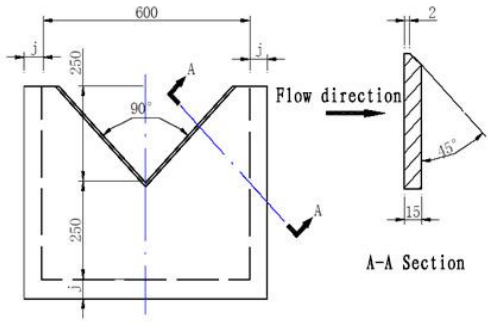
□ chart 6 is probe installation place diagram

□ When choose standard parshall flume, it can automatically load valid water level range. To manual revise flux operation parameter when submerge control is not used.

Choose flow weir type, look at appendix.

4.2 Right angle triangular weir setting





Elevation Longitudinal section

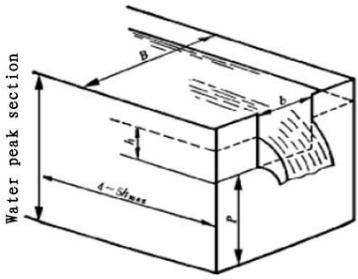
✧ Symbol explanation: b for crest of weir wide, θ for crest of weir angle, B for channel width, P for bottom of weir height, h for measured water level.

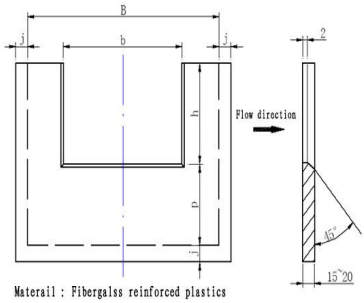
✧ Weir notch construction and usage condition: θ=90°， B>5h，h/p<1，0.06<h<0.65m

✧ chart 2 is suggestion size

Flux calculation formula: $Q=1.343h^{2.47}$, choose triangular weir.

4.3 *Rectangular setting*





Explanation：

✧ Symbol explanation: b for crest of weir wide, B for channel width, P for button of weir height, h for measured water level.

✧ Weir notch construction and usage condition: B>=b， h/p<2.5， h>0.03m， p>0.1m

Flux calculation formula：$Q=mb(2g)^{1/2}h^{1.5}$,m is flux coefficient，when b/B=1， m=0.407+0.0533h/p；when b/B<1，$m=(0.407+0.0027/h-0.03(B-b)/B)(1+0.55(h/(h+p))^2(b/p)^2)$； g=9.8;

Choose rectangular, then input crest of weir width, channel width and weir bottom height.

Ⅴ Relay output setting

This instrument has 4 relays output. When uses relay control, it must be set control point: D and H. D for relay start point, H for relay end point. X for display value. It works as follows:

When D < H

X < D close	D	D<X<H retain	H	X > H Disconnect

when D > H

X > D close	D	D>X>H retain	H	X < H Disconnect

Ⅵ Trouble shooting

No.	problem	Probable reason	Remedy
1	No display	Power is not connect or load of DC power output too high	Check power connector, check load. If there is reserve battery, check it has power or not.
2	With display but without measure data	Signal input not connect, measuring has been closed, wrong parameter	Check signal input cable and software setting, or system restore
3	Clock not correct	Clock crystal oscillator deviation	Clock speed regulation amendment
4	Power off, clock zero and flux not save	3V clock battery used up	Change 3V clock battery
5	No signal output or output abnormal	Relative parameter setting wrong, current load resistance too large	Check software setting, system restore, current load resistance <300Ω
6	Serial port communication abnormal	Wrong wiring or host and slave have different setting	Check RS485 connector or software setting
7	Display system wrong	Parameter lost	Reset parameter or contact with after service
8	Display wrong input	Mistake in input signal	Check data
9	Display USB wrong	Broken flash disk	Change flash disk

If fault still exist after handling with above methods, please contact with our service.

Appendix:

Appendix 1: Parshall Flume size

	No.	Throat					In			Out			H
		B	L	X	Y	N	B1	L1	LA	B2	L2	K	D
S	1	0.025	0.076	0.008	0.019	0.029	0.167	0.356	0.242	0.093	0.203	0.019	0.229
	2	0.051	0.114	0.016	0.022	0.043	0.214	0.406	0.276	0.135	0.254	0.022	0.254
	3	0.076	0.152	0.025	0.025	0.057	0.259	0.457	0.311	0.178	0.305	0.025	0.457
	4	0.152	0.305	0.050	0.075	0.114	0.400	0.610	0.415	0.394	0.610	0.076	0.61
M	5	0.25	0.60	0.05	0.075	0.23	0.78	1.325	0.90	0.55	0.92	0.08	0.80
	6	0.30	0.60	0.05	0.075	0.23	0.84	1.350	0.92	0.60	0.92	0.08	0.95
	7	0.45	0.60	0.05	0.075	0.23	1.02	1.425	0.967	0.75	0.92	0.08	0.95
	8	0.60	0.60	0.05	0.075	0.23	1.20	1.500	1.02	0.90	0.92	0.08	0.95
	9	0.75	0.60	0.05	0.075	0.23	1.38	1.575	1.074	1.05	0.92	0.08	0.95
	10	0.90	0.60	0.05	0.075	0.23	1.56	1.650	1.121	1.20	0.92	0.08	0.95
	11	1.00	0.60	0.05	0.075	0.23	1.68	1.705	1.161	1.30	0.92	0.08	1.0
	12	1.20	0.60	0.05	0.075	0.23	1.92	1.800	1.227	1.50	0.92	0.08	1.0
	13	1.50	0.60	0.05	0.075	0.23	2.28	1.95	1.329	1.80	0.92	0.08	1.0
	14	1.80	0.60	0.05	0.075	0.23	2.64	2.10	1.427	2.10	0.92	0.08	1.0
	15	2.10	0.60	0.05	0.075	0.23	3.00	2.25	1.534	2.40	0.92	0.08	1.0
	16	2.40	0.60	0.05	0.075	0.23	3.36	2.40	1.636	2.70	0.92	0.08	1.0
L	17	3.05	0.91	0.305	0.23	0.343	4.76	4.27	1.83	3.68	1.83	0.152	1.22
	18	3.66	0.91	0.305	0.23	0.343	5.61	4.88	2.03	4.47	2.44	0.152	1.52
	19	4.57	1.22	0.305	0.23	0.457	7.62	7.62	2.34	5.59	3.05	0.229	1.83
	20	6.10	1.83	0.305	0.23	0.686	9.14	7.62	2.84	7.32	3.66	0.305	2.13
	21	7.62	1.83	0.305	0.23	0.686	10.67	7.62	3.45	8.94	3.96	0.305	2.13
	22	9.14	1.83	0.305	0.23	0.686	12.31	7.93	3.86	10.57	4.27	0.305	2.13
	23	12.19	1.83	0.305	0.23	0.686	15.48	8.23	4.88	13.82	4.88	0.305	2.13
	24	15.24	1.83	0.305	0.23	0.686	18.53	8.23	5.89	17.27	6.10	0.305	2.13

Appendix 2 ： Parshall flow characteristic（JJG711-1990）

	No	throat b/m	Formula $Q=Ah_a^p/(m^3s^{-1})$	Water peak h/m		Flux range L/S		Flux range m^3/s		淹没临界度（%）
				Min	Max					
1		2	3	4	5	6	7	8	9	10
S	1	0.025	$0.0604\ h_a^{1.55}$	0.015	0.21	0.09	5.4	0.324	19.44	0.5
	2	0.051	$0.1207\ h_a^{1.55}$	0.015	0.24	0.18	13.2	0.648	47.52	0.5
	3	0.076	$0.1771\ h_a^{1.55}$	0.030	0.33	0.77	32.1	2.772	115.56	0.5
	4	0.152	$0.3812\ h_a^{1.58}$	0.03	0.45	1.50	111.0	5.400	399.60	0.6
M	5	0.25	$0.561\ h_a^{1.53}$	0.03	0.60	3.0	250	10.80	900.0	0.6
	6	0.30	$0.679\ h_a^{1.521}$	0.03	0.75	3.5	400	12.60	1440.0	0.6
	7	0.45	$1.038\ h_a^{1.537}$	0.03	0.75	4.5	630	16.20	2268.0	0.6
	8	0.60	$1.403\ h_a^{1.548}$	0.05	0.75	12.5	850	45.0	3060.0	0.6
	9	0.75	$1.772\ h_a^{1.557}$	0.06	0.75	25.0	1100	90.0	3960.0	0.6
	10	0.90	$2.147\ h_a^{1.565}$	0.06	0.75	30.0	1250	108.0	4500.0	0.6
	11	1.00	$2.397\ h_a^{1.569}$	0.06	0.80	30.0	1500	108.0	5400.0	0.7
	12	1.20	$2.904\ h_a^{1.577}$	0.06	0.80	35.0	2000	126.0	7200.0	0.7
	13	1.50	$3.668\ h_a^{1.586}$	0.06	0.80	45.0	2500	162.0	9000.0	0.7
	14	1.80	$4.440\ h_a^{1.593}$	0.08	0.80	80.0	3000	288.0	10800.0	0.7
	15	2.10	$5.222\ h_a^{1.599}$	0.08	0.80	95.0	3600	342.0	12960.0	0.7
	16	2.40	$6.004\ h_a^{1.605}$	0.08	0.80	100.0	4000	360.0	14400.0	0.7
L	17	3.05	$7.463\ h_a^{1.6}$	0.09	1.07	160.0	8280	576.0	29808	0.8
	18	3.66	$8.859\ h_a^{1.6}$	0.09	1.37	190.0	14680	684.0	52848	0.8
	19	4.57	$10.96\ h_a^{1.6}$	0.09	1.67	230.0	25040	828.0	90144	0.8
	20	6.10	$14.45\ h_a^{1.6}$	0.09	1.83	310.0	37970	1116.0	136692	0.8
	21	7.62	$17.94\ h_a^{1.6}$	0.09	1.83	380.0	47160	1368.0	139776	0.8
	22	9.14	$21.44\ h_a^{1.6}$	0.09	1.83	460.0	56330	1656.0	202788	0.8
	23	12.19	$28.43\ h_a^{1.6}$	0.09	1.83	600.0	74700	2160.0	268920	08
	24	15.24	$35.41\ h_a^{1.6}$	0.09	1.83	750.0	93040	2700.0	334944	0.8

Appendix3: Right angle triangular weir level and flux relevant table:

Level unit：m Flux unit: L/S

Level	**0.000**	**0.010**	**0.020**	**0.030**	**0.040**	**0.050**	**0.060**	**0.070**	**0.080**	**0.090**
Flux	**0.0000**	**0.0136**	**0.0772**	**0.2127**	**0.4367**	**0.7581**	**1.2035**	**1.7693**	**2.4705**	**3.3164**
Level	**0.100**	**0.110**	**0.120**	**0.130**	**0.140**	**0.150**	**0.160**	**0.170**	**0.180**	**0.190**
Flux	**4.3157**	**5.4769**	**6.8137**	**8.3304**	**10.043**	**11.954**	**14.072**	**16.417**	**18.987**	**21.798**
Level	**0.200**	**0.210**	**0.220**	**0.230**	**0.240**	**0.250**	**0.260**	**0.270**	**0.280**	**0.290**
Flux	**24.836**	**28.201**	**31.786**	**35.612**	**39.777**	**44.124**	-	-	-	-

Main specification

Sense range: FS= ____m

Unusable area: ≤■300mm; □600mm; □≤60mm; □other

Accuracy: ■±0.3％×max range; □±2mm; □other

Display Resolution: 1mm

Output: □0-20mA; ■4-20mA; □0-5V; □1-5V;

□0-10V; □1-10V; ■RS485; □ Relays

Working temperature: ■normal; □-10-60℃; □other

Working pressure: ■normal; □other

Working humidity: ≤80%RH

Storage temperature: -40-85 Deg. C

Storage humidity: ≤70%RH

Working voltage: 220V AC ro 24V DC

Normal power consumption: <1.5W

Warranty card

purchaser		Telephone	
Address		Post code	
Product		Type	
Item No.		Delivery date	
Repair record			
Notes	1. According to **THREE GUARANTEES,** When there are problems with the product under correct operation, it can be refunded, changed and repaired free of charge within one week, three months and one year respectively from the day it was bought. 2. For the problems caused by improper use, only the cost of material will be charged. 3. The product can not be dismantled or unsealed without manufacturer's agreement; otherwise the repair service is not available. 4. The freight out and home in relation to repair will be paid by customer.		