
Ultrasonic Open Channel Flow-meter

Installation Instruction Manual

V3.16

Measurement of flow within open, partially-filled and free flow channels

Table of Contents

Welcome, Application and Features	1
Technical Parameters	2
Installation Position.....	3
Installation Mode	4
Boot Display	5
Key Description.....	6
Basic Parameters(Password 1000)	
P02 20mA Settings.....	7
P03 Display.....	7
P04 Probe Height.....	8
P05 Response.....	9
P06 Dead Band.....	9
P07 Language	10
P08 Dist Unit.....	10
P10-P11 Relay Logic1-2	10
P16 Relay Buffer.....	10
P30 Weir.....	11
P31 C.....	11
P32 N.....	11
P33 Hv.....	11
P34 Lv.....	11
P35 Flow Unit.....	12
P36 Flow Record.....	12
P37 B.....	12
P38 b.....	13
P39 p.....	13
T35 Slope.....	13
T36 Roughness.....	13
T37 Top Width.....	13
T38 Bottom Width.....	13

Advanced Parameters(Password 0101)

P40 Damping Time.....	14
P41 Alarm Output.....	14
P42 Alarm Delay.....	14
P43 Threshold.....	15
P44 Output Power.....	15
P45 First Echo Coefficient.....	15
P50 ID.....	16
P51 Baud.....	16
P53 Float Order.....	16
P54 Comm Test.....	16
P55 Set Time.....	16
P56 ACC Clear.....	17
P57 Max Down Level.....	17
P58 Power Fail ACC.....	17
P60 Current Sim.....	17
P62 Pulse Width	18
P63 Pulse Equal	18
P66 Temp Delay.....	18
P99 Load Param.....	18
Appendix 1: Parshall Flume	19
Appendix 2: Triangular Weir	21
Appendix 3: Rectangular Weir	22
Appendix 4: Trapezoidal Weir	23
Appendix 5: PALMER-BOWLUS Flume	24
Appendix 6: Chezy Formulae	25
Appendix 7: HART Command	28
Appendix 8: ModBus-RTU Communication Protocol	29
Appendix 9, 10: Integral Meter Dimension Drawing, Wiring Diagram	30,31
Appendix 11, 12: Remote Meter Dimension Drawing, Wiring Diagram	32,33
Appendix 13: Pulse Output Interface.....	34
Packing List	35
Warranty Card	36

Welcome

Sincerely thank you for buying ultrasonic open channel flowmeter of this company!

Production and operation basis of this product is JJG 711-1990 “open channel weirsflowmeter”.

This manual introduces the application, feature, function, installation and setup of ultrasonic open channel flowmeter, so users can know, install, use and maintain this instrument.

This product must be used with the measuring weirs and is mainly used to measure sewage flow within the channel under an open, partially filled and free flow conditions.

Application

- Continuous, non-contact measurement of flow
- Can be used for factory sewage outfall, farmland irrigation, river flow and other circumstances.

Feature

- Can display instantaneous flow, cumulative flow, liquid level, echo waveform, history curve
- With data storage, automatic error correction function with data storage time of up to 8 years
- Can query cumulative flow for any period in the past 8 years and obtain daily, monthly and annual flow.
- 4~20mA current output instantaneous flow, RS485/ModBUS output instantaneous flow, total flow, liquid level
- Internally integrated temperature sensor provides real-time temperature compensation to sound speed.
- Internal integrated clock chip to display the current date and time
- With 4 ~ 20mA current simulation, RS485 diagnostic functions.
- On-site operation is available with liquid crystal display and keyboard.
- Chinese and English displays are available; the unit of flow can be selected
- Carry out automatic detection of on-site electrical disturbance and interference suppression.
- Non-contact measurement owns a long service life.

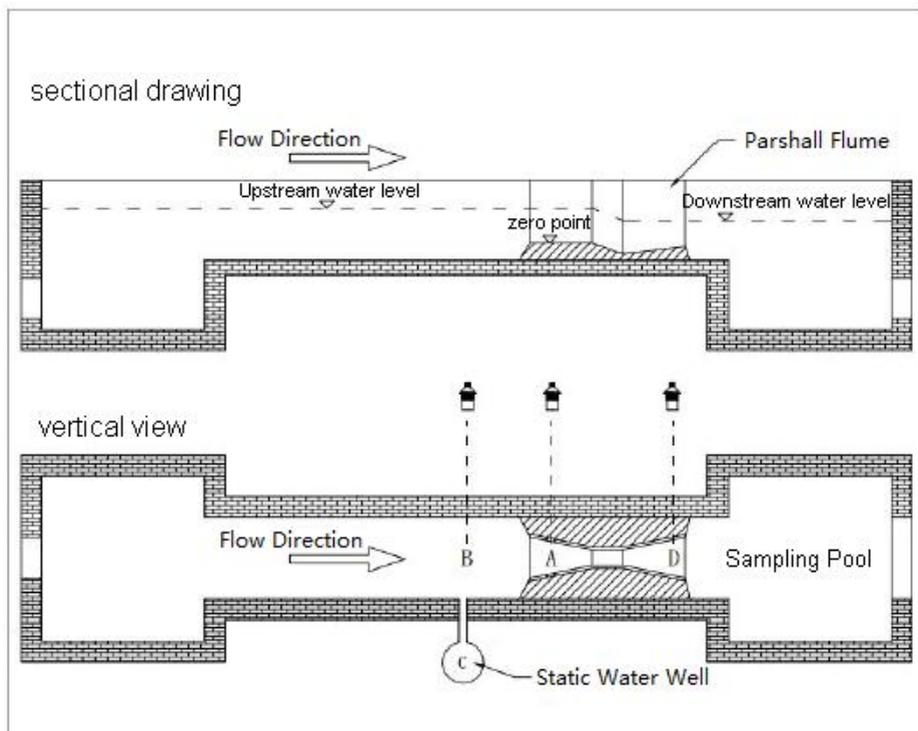
Technical Parameters

Items		Integral	Remote
Measuring range	Instantflow	1L/s~32000 m ³ /h	
	Cumulative flow	4000000000m ³	
	level	0.25m~3.000m(6.000m)	
Measuring accuracy	flow	Triangular weir 1 ~ 5% / rectangular weir 3 ~ 5% / Parshall flume 2 ~ 3%	
	level	±0.3%FS* (standard condition*)	
Meter display		instantaneous flow,cumulative flow, liquid level, echo	
Power supply		DC18~36V / 60mA or AC85~265V / 3W	
Flow recorder		Can query the cumulative flow of any time during the last 8 years	
Output	Analog current	12bit, with load of less than 500 Ohm	
	Digital signal	RS485/ModBus agreement / HART5.0	
	Switching value	Switching values of 2 circuits	
	Pulse Output	N/A	6~100ms Pulse
Temperature	Environment	-35℃ ~ +70℃*	
	Process	-40℃ ~ +80℃	
Interface	Electric	M20×1.5mm	PG11
	Process	G2"(NPT2")	
Materials	Transmitter	Aluminum alloy	ABS
	Probe	ABS / ETFE / PTFE	
waterproof level		IP67	IP65
Explosion protection class		Ex db ia[ia Ga] II BT4Gb	N/A

* Ex db ia[ia Ga] II BT4Gb is a composite intrinsic safe explosion proof certificate, with the intrinsic safe circuit plus explosion-proof enclosure and is more secure.

* When the ambient temperature is at -40℃ ~ -20℃, the LCD can not display properly, but the instrument can work. LCD can be restored.

Installation Position

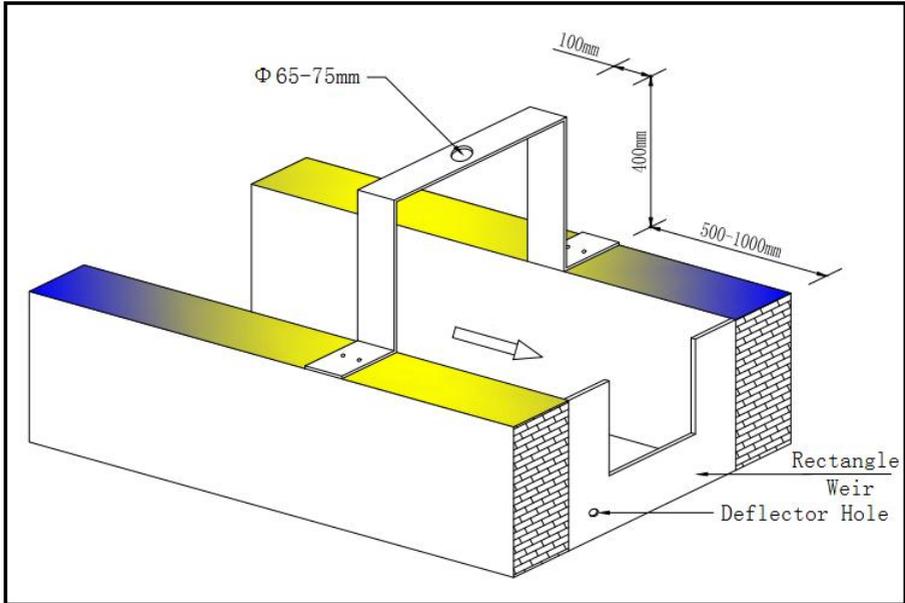


In general, the open channel flow monitor can be installed at the position A, B and C, as shown in the following figure.

Note:

- Liquid level is prohibited from entering block district of the instrument, bracket height shall be no less than 350mm.
- When there are bubbles or floating objects on the liquid surface, it can only be installed at the position C or in the upstream in order to block the foam.
- When Parshall flume No.1 or No.2 is used, it is recommended to mount the instrument at the position B, C due to the narrow throat.
- Downstream drainage capacity should be greater than the upstream water; otherwise, a submerge ratio shall be set up to correct the flow.

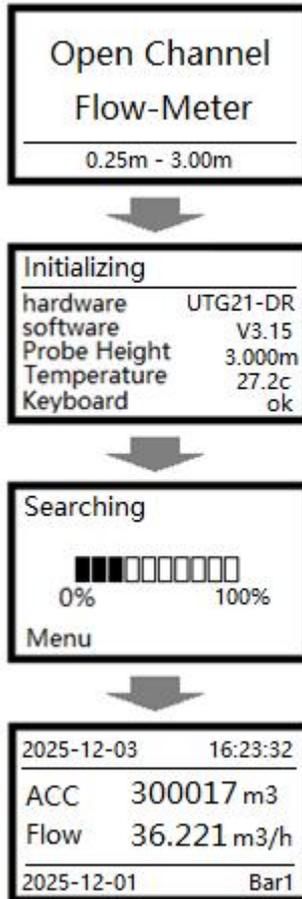
Installation Mode



Note:

- The open channel flowmeter must be used in conjunction with the weir groove and weir plate; This instrument supports Bachel groove, triangular weir, rectangular weir, trapezoidal weir, rectangular throatless measuring tank, and PALMER BOWLUS groove.
- The height of the bracket should be greater than 400mm, and liquid level is strictly prohibited from entering the blind area of the instrument.
- The channel width at the fixed position of the bracket should be greater than 200mm to prevent the instrument from receiving echoes from the ground.
- To ensure measurement accuracy, a sunshade needs to be installed above the back cover of the probe to avoid direct sunlight on the probe.
- If the instrument and probe are in a humid environment for a long time, glass adhesive should be applied to the inlet and outlet of the probe and the cover seam.

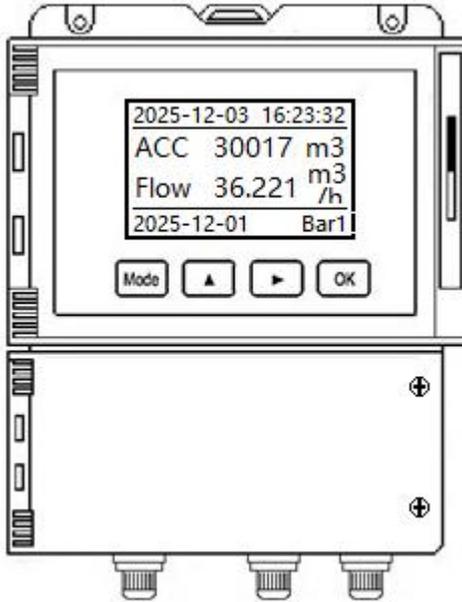
Boot Display



Note:

- The measurement range, hardware version and software version may be inconsistent with the above figure, the actual display of the meter shall prevail.
- The upper limit of the search progress bar depends on the transmit power of menu P44.
- If the keyboard is found to be error during the initialization, instrument will display which key is error. O indicates normal, x indicates errors.
- In case of keyboard error, the whole keyboard will be locked and no key responses when being pressed.

Key Description



[Mode] key

- ◇ Enter the menu
- ◇ quit the menu

[OK] key

- ◇ Enter editing
- ◇ quit editing

[▲] key

- ◇ Roll to the next menu
- ◇ Modify the number at cursor/list selection
- ◇ Under working condition, press this key for a long time, the instrument will switch display mode temporarily. 40 seconds after loosening this key, the instrument returns to previous display mode.

[→] key

- ◇ Move cursor
- ◇ Roll to the previous menu
- ◇ In echo display mode, the waveform can be enlarged.

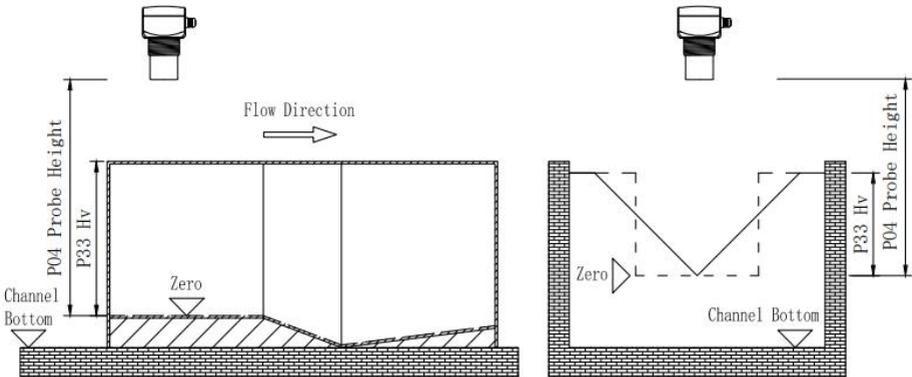
- "D" is the damping time, and the subsequent value represents seconds.
- "R" is for the relay state, X represents it is disconnected, O represents it is closed
- Working state, X indicates sending waves, O indicates having received echo sent from the surface of the liquid.

Note:

- Press and hold [▲] key to temporarily switch the display mode. Release [▲] for 40 seconds to return to the original display mode.
- Temporarily switch the display mode, 4-20mA current output remains unchanged.
- In echo display mode, press and hold [→] key to enlarge the waveform.

P04: Probe Height

Menu	P04: Input the distance between probe surface and zero point	
Value	Value range	0.350m~10.000m
	Default value	3.000m



The relationship of the probe height and zero point is as shown on the right figure:

Note:

- The zero point is not equal to the bottom of the channel.
- The zero point is the horizontal plane just when the flow turns zero.

P05: Response

Menu	P05: properly select the change rate according to rate of the liquid level/distance change		
Param	Fast		Default
	Normal		
	Slow	Slow (with level change of no more than 50cm/ min)	
	Slowest		

- The slower the reaction, the greater the damping, the better the stability of the data, but the corresponding data changes is slow.

P06: Dead Band

Menu	P06: Input here the distance from the nozzle, step, and beam to the probe surface	
Numerical value	Value range	0~10.000m
	Default value	0.000m

Deadband means the distance in which the instrument blocks the echo that may affect the normal measurement, By setting the block distance, it can reduce the influence of the extension tube nozzle, steps and beams on the instrument measurement.

Note:

- **When the dead band is smaller than the inherent dead band of the probe, the dead band is invalid. Refer to the meter label for the probe's inherent dead band.**
- **Liquid level shall not enter the instrument dead band !**
- **The distance from the liquid level to the probe surface shall be no less than the dead band.**
- **The manufacturer is not responsible for any accident caused by malfunction of the instrument due to liquid entering into dead band.**

P07: Language

Menu	P07	
Parameter	English	Default
	Chinese	

P08: Dist Unit

Menu	P08	
Parameter	Meter	Default
	Feet	

P10-P11: Relay Logic 1-2

Menu	P10-P11	
Parameter	Value range	-10.000m~+10.000m
	Default	<+0.00m
Relevant menu	P16 Relay Buffer	

Simple logic: if the level meets the logic, the relay is closed; if the level does not meet the logic, the relay is disconnected.

Illustration (relay buffer 0.030m):

Example 1: "> +03.00 m" means that the relay is closed when the liquid level is greater than 3.00m and is disconnected when the level is less than 2.97m.

Example 2: "<+02.00 m" means that the relay is closed when the liquid level is less than 2.00m pull, and is disconnected when the level is greater than 2.03m ,

P16: Relay Buffer

In order to reduce the frequent action of the critical level of the relay, the relay will not act until it exceeds / is below the liquid level by a certain amount . Such amount is the relay buffer.

Menu	P16: Relay Buffer	
Parameter	Value range	0.000m~1.000m
	Default	0.030m
Related menu	P10-P13 relay logic 1-4	

P30: Weir

Menu	P30 Select the weir / weir plate that matches with the instrument		
Parameters	Menu options	Description	Remark
	90Tri	90 degree triangular weir	Appendix 2
	Bar1 - Bar12	1# - 12# Parshall flume	Appendix 1
	Rec0 - Rec6	0# - 6# Rectangular weir	Appendix 3
	Rec9	user-defined Rectangular weir	
	Other	Other flume	
	Chezy	Chezy formula	Appendix 6
Related menu	P31 C; P32 N; P33 Hv; P34 Lv;		

Note:

- Different weir has different value C and N. After the selection of the weir, the value C and N value will be automatically modified;
- When P30 is Rec9, it is necessary to manually input P33/P37/P38/P39; See Appendix 3 for details;
- When P30 is other, it is necessary to manually input P31/P32/P33;
- When P30 is Chezy, it is necessary to manually input P33/T35/T36/T37/T38; See Appendix 6 for details;

P31: C

Menu	Flow coefficient (will change with P30)	
Parameters	Value range	0.000m~32.000m ³ /s

P32: N

Menu	Flow index (will change with P30)	
Parameter	Value range	0.000m~9.999

P33: Hv

Menu	Input the Weir depth	
Parameters	Value range	0.000m~3.000m
	Default	3.000m

P34: Lv

Menu	Minimum head of water
------	-----------------------

Parameters	Value range	0.000m~1.000m
	Default	0.005m

Note: when the liquid level is lower than Lv, the flow is ignored. Only when the liquid level is higher than Lv will the flow be calculated.

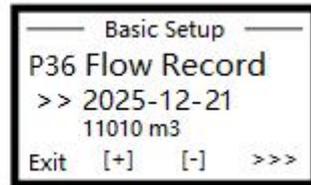
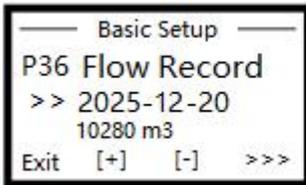
P35: Flow Unit

Menu	P35	
Parameter	m3/h	Default
	m3/s	
	L/s	
	gal/min	
	gal/hour	

P36: Flow Record

According to the input time, display the cumulative flow recorded at 15:00 of that day.

For example, to query the daily flow on December 20, 2025



a: first input the time 2025-12-20, it will display 10280m3

b: then input the time 2025-12-21, it will display 11010m3

c: Subtract the cumulative flow of the two successive days $11010 - 10280 = 730\text{m}^3$ to obtain the daily flow of 2025-12-20

P37: B (Only P30 = Rec9)

Menu	Input the width of the channel	
Parameters	Value range	0.150m ~ 9.999m3/s
	Default	1.000m
	Require	≥ P38 b

See Appendix 3 for details

P38: b (Only P30 = Rec9)

Menu	Input the width of the Weir	
Parameters	Value range	0.150m ~ 9.999m ³ /s
	Default	1.000m
	Require	≥ 0.15m

P39: p (Only P30 = Rec9)

Menu	Input the top height of the Weir	
Parameters	Value range	0.100m ~ 9.999m ³ /s
	Default	0.100m
	Require	≥ 0.100m

T35: Slope (Only P30 = Chezy)

Menu	Hydraulic slope = Difference in height/Spacing	
Parameter	Value Range	0.000m~9.999
	Default Value	0.002

Please see Appendix 6 for details on how to use Chezy formula to measure the flow.

T36: Roughness (Only P30 = Chezy)

Menu	Enter the roughness of the channel material	
Parameter	Value Range	0.000m~9.999
	Default Value	0.020

Please see Appendix 6 to obtain the approximate roughness based on the channel material, and then make fine adjustments according to the actual flow.

T37: Top Width (Only P30 = Chezy)

Menu	Input the top width of the channel	
Parameters	Value range	0.000m~20.000m ³ /s

T38: Bottom Width (Only P30 = Chezy)

Menu	Input the bottom width of the channel	
Parameter	Value range	0.000m~20.000m ³ /s

Advanced Parameters



To enter advanced parameter menu, the password is "0101".

Setting of advanced parameters shall be guided by the manufacturer!

P40: Damping Time

Menu	P40	
Value	Value range	0~30s
	Default value	12s

The less the damping is, the quicker the instrument response speed becomes; the more the damping is, the more stable the data becomes. Please choose this parameter reasonably.

P41: Alarm Output

Menu	P41		
Parameter	22mA	During alarm, current output is 22mA	
	3.8mA	During alarm, current output is 3.8mA	
	Hold	No alarm	Default
Relevant menu	P02: 20mA Setup P42: Alarm Time P48: Safety Dist.		

Note:

- When fault delay counter terminates, the instrument will report the fault to PLC through 4~20mA current.
- When liquid level enters within safe distance, the instrument will output an alarm.
- When the instrument has searched for a long time, the instrument will forcibly output 3.8mA current as an alarm.
- Closing the alarm output will increase the risk of tank boil-overs, the user is recommended to open the alarm output

P42: Alarm Time

Menu	P42	
Value	Value range	0~200s
	Default value	5s
Relevant menu	P41: Alarm Output	

When fault delay counter terminates, the instrument will report the fault to PLC through 4~20mA current.

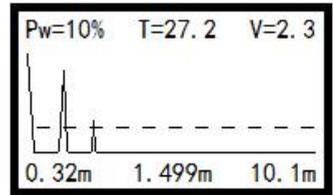
P43: Threshold

If instrument earthing cannot solve interference, set a threshold voltage to increase its immunity from interference.

Menu	P43		
Parameter	0.3v	Ignore echo below 0.3v	Default
	0.6v	Ignore echo below 0.6v	
	0.9v	Ignore echo below 0.9v	
	1.2v	Ignore echo below 1.2v	
	1.5v	Ignore echo below 1.5v	

Note:

- Dotted line in the right figure is threshold voltage.
- When threshold voltage is 0.3v, dotted line won't appear.
- Increase of threshold voltage will reduce instrument sensitivity.



P44: Output Power

Menu	P44		
Parameter	0~30%	Output power changes between 0~30%	
	0~60%	Output power changes between 0~60%	
	0~100%	Output power changes between 0~100%	Default
	100%	Output power is always 100%	

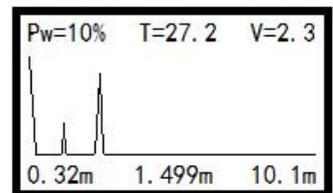
The less output power is, the smaller the block dist. and measurement range become. The more output power is, the more larger the block dist. and measurement range become.

P45: First Echo Coefficient

Menu	P45	
Value	Value range	1.0~5.0 times
	Default value	×1.0 time

There are 2 echoes as shown in the right figure.

If it is confirmed that the first echo is liquid reflection echo, rather than orifice echo, try to increase first wave coefficient, so that the first echo is higher than the second echo.



P50: ID

Menu	P50	
Numerical value	Value range	RS485:1~99# / HART:0~15#
	Default value	RS485: 1# / HART:0#

P51: Baud

Menu	P51		
Parameters	1200Bd	Baud Rate of 1200Bd	
	2400Bd	Baud Rate of 2400Bd	
	4800Bd	Baud Rate of 4800Bd	Default
	9600Bd	Baud Rate of 9600Bd	

P53: Float Order

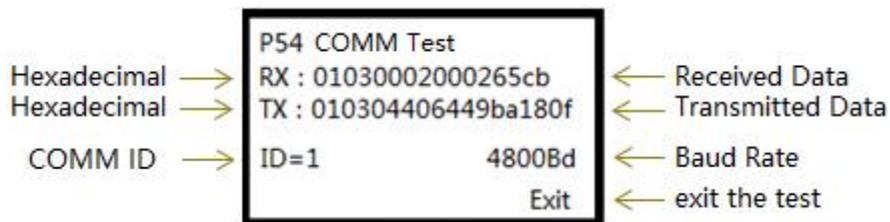
Menu	P53		
Parameters	1234	The sequence of 4-byte floating-point numbers is 1234	Default
	4321	The sequence of 4-byte floating-point numbers is 4321	
	3412	The sequence of 4-byte floating-point numbers is 3412	
	2143	The sequence of 4-byte floating-point numbers is 2143	

Note the requirement of DCS / PLC for the sequence of 4-byte floating point numbers. The sequence of floating point numbers of the instrument and DCS / PLC should be the same.

P54: COMM Test

This menu displays the host computer data received by the instrument and the data sent by the instrument to assist the host computer programmer to debug the communication.

Note:



When the RX data is incorrect, an error message is displayed and no TX data is sent.

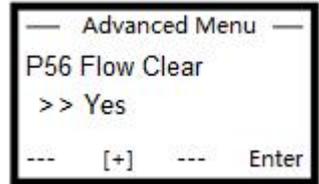
P55: Set Time

Value	Value Range	January 1, 2000 – December 31, 2099
-------	-------------	-------------------------------------

P56: ACC Clear

After the accumulated flow is cleared, the current time is regarded as the starting time of the accumulated flow, and all the records are cleared.

Note: It takes 2-3 minutes to clear, do not power off or operate the keyboard.



P57: Max Down Level

Menu	P57: Input the highest water level downstream	
Numerical value	Value range	0~10.000m
	Default value	0.000m
Related menu	N/A	

Notice:

- When the downstream drainage capacity is less than or equal to the upstream inflow, the submerged flow will occur. At this point, the instrument needs to use the downstream water level to correct the flow.
- After the instrument is installed in the downstream area, please connect the 4-20mA simulation current of the downstream instrument to the 4-20mA Input Port of the instrument, and then enter the 20mA setting value of the downstream instrument in P57. See Appendix 12 for details.
- At the time of P57 =0.000m, there is no downstream instrument.

P58: Power-Fail ACC

Menu	P58		
Parameter	No	Close power-fail add	Default
	Yes	Open power-fail add	

Note:After turning on the power-fail add, the instrument will count the accumulated flow according to the instantaneous flow and power-off interval before power-off every time it is rebooted.

P60: Sim. Current

Menu	P60: Simulate output the integer current	
Value	Value Range	4.000~20.000mA

P62: Pulse Width

The instrument can output the pulse signal, and upload the accumulated flow to the flow settlement instrument or PLC.

Menu	P62		
Parameter	Value Range	6~100ms	
	Default	6ms	
Relevant menu	P63		

Notice: Number of Pulses × Pulse Width ≤ 500ms (Otherwise, the pulse cannot be output; please reasonably select P63 Pulse Equal.)

P63: Pulse Equal

Menu	P63: When the flow adds one pulse equal, the instrument outputs one pulse.		
Parameter	Value Range	0.01~1000m3	
	Default	1m3	

Notice: Please reasonably select the pulse equal according to the instantaneous flow rate. (Number of Pulses × Pulse Width ≤ 500ms)

P66: Temp Delay

Menu	P66		
Parameters	12us	Probe cable is less than 30m	Default
	18us	Probe cable is 30~60m	
	24us	Probe cable is 60~100m	
	30us	Probe cable is 100~150m	

Cable length, wire diameter, temperature will affect the signal transmission delay time, delay / cable length relationship in the above table is for reference only.

P99: Load Param

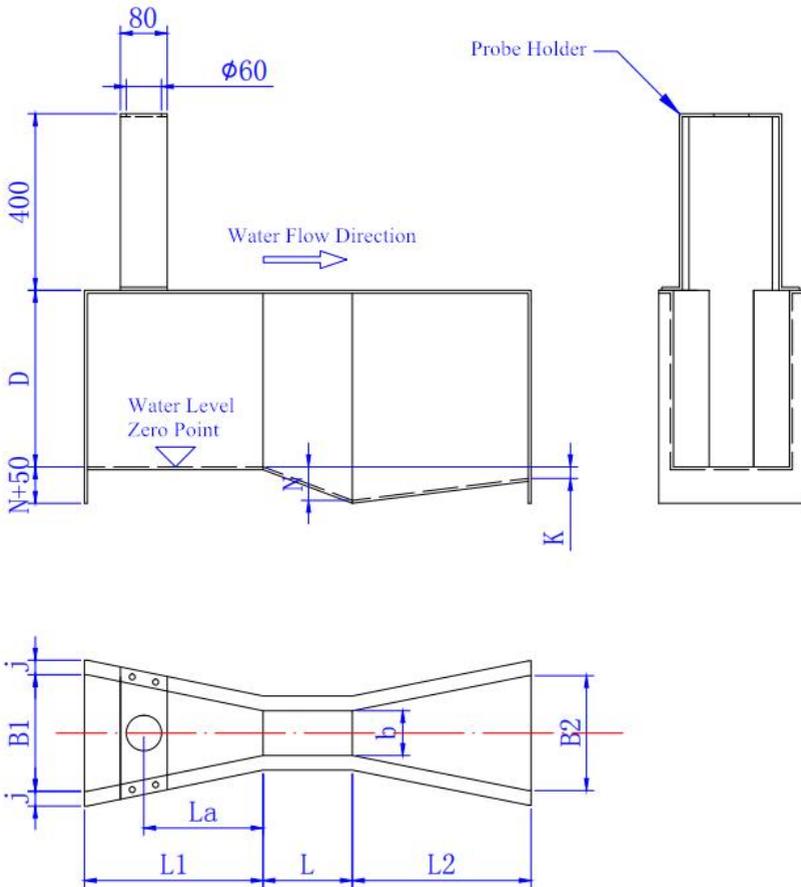
Menu	P99		
Parameter	No	Don't restore	Default
	Yes	Restore factory defaults	

Appendix 1: Parshall Flume

Material: 8mm-thick glass reinforced plastics/304 stainless steel

Attentions

- The size of j is related to channel installation, and shall be determined by the user according to the on-site conditions.
- The upstream area of Parshall flume shall have the flat section that is more than or equal to 3-5 times the channel width, so that the water can smoothly enter Parshall flume.
- After the water smoothly passes through Parshall flume, the water flow shall be free. The downstream drainage is unobstructed to avoid submerged flow.

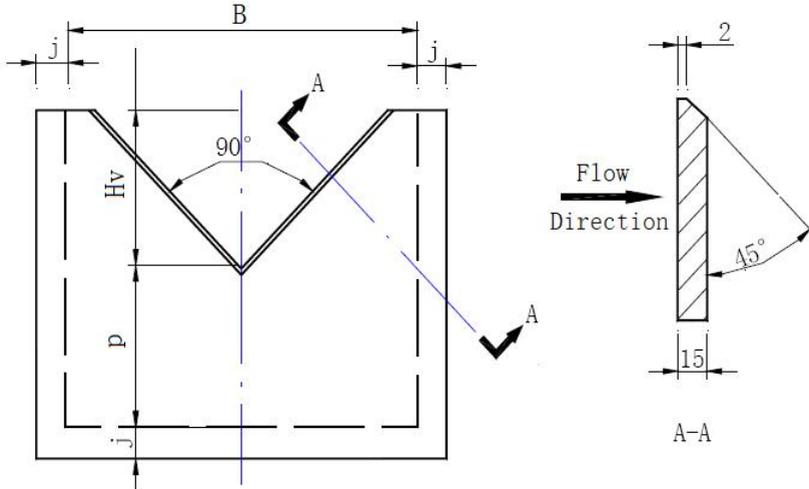


No.	Flow Range (m ³ /h)		Waterhead Range (mm)		Throat Section (mm)			Contraction Section (mm)			Diffusion Section (mm)			Wall Height (mm)	Degree of Submergence	Flow Parameter (m ² /s)	
	Q (min)	Q (max)	h (min)	h (max)	b	L	N	B1	L1	La	B2	L2	K	D	C	n	
b01	0.3	20	15	210	25	76	29	167	356	237	93	203	19	230	50%	0.0604	1.550
b02	0.6	48	15	240	51	114	43	214	406	271	135	254	22	260	50%	0.1207	1.550
b03	2.8	115	30	330	76	152	57	259	457	305	178	305	25	460	50%	0.1771	1.550
b04	5.4	400	30	450	152	305	114	400	610	407	394	610	76	610	60%	0.3812	1.580
b05	9.0	903	30	600	228	305	114	575	864	576	381	457	76	770	60%	0.5354	1.530
b06	10.8	900	30	600	250	600	230	780	1325	900	550	920	80	800	60%	0.561	1.513
b07	12.6	1440	30	750	300	600	230	780	1350	902	600	920	80	800	60%	0.679	1.521
b08	16.2	2268	30	750	450	600	230	840	1425	948	750	920	80	950	60%	1.038	1.537
b09	45.0	3060	50	750	600	600	230	1020	1500	1000	900	920	80	950	60%	1.403	1.548
b10	90.0	3960	60	750	750	600	230	1380	1575	1074	1050	920	80	950	60%	1.772	1.557
b11	108.0	4500	60	750	900	600	230	1560	1650	1121	1200	920	80	950	60%	2.147	1.565
b12	108.0	5400	60	800	1000	600	230	1680	1705	1161	1300	920	80	1000	70%	2.397	1.569
b13	126.0	7200	60	800	1200	600	230	1920	1800	1227	1500	920	80	1000	70%	2.904	1.577
b14	162.0	9000	60	800	1500	600	230	2280	1950	1329	1800	920	80	1000	70%	3.668	1.586
b15	288.0	10800	80	800	1800	600	230	2640	2100	1427	2100	920	80	1000	70%	4.440	1.593
b16	342.0	12960	80	800	2100	600	230	3000	2250	1534	2400	920	80	1000	70%	5.222	1.599
b17	360.0	14400	80	800	2400	600	230	3360	2400	1636	2700	920	80	1000	70%	6.004	1.605
b18	576.0	29800	90	1070	3050	910	343	4760	4270	1830	3680	1830	152	1220	80%	7.463	1.600

Appendix 2: Triangular Weir

Material: 15mm-thick glass reinforced plastics, or PVC (If the flow is larger, the wall thickness is increased accordingly.)

Attentions: j is the part of the weir plate embedded into the channel wall. The size shall be determined by the user according to the on-site conditions.



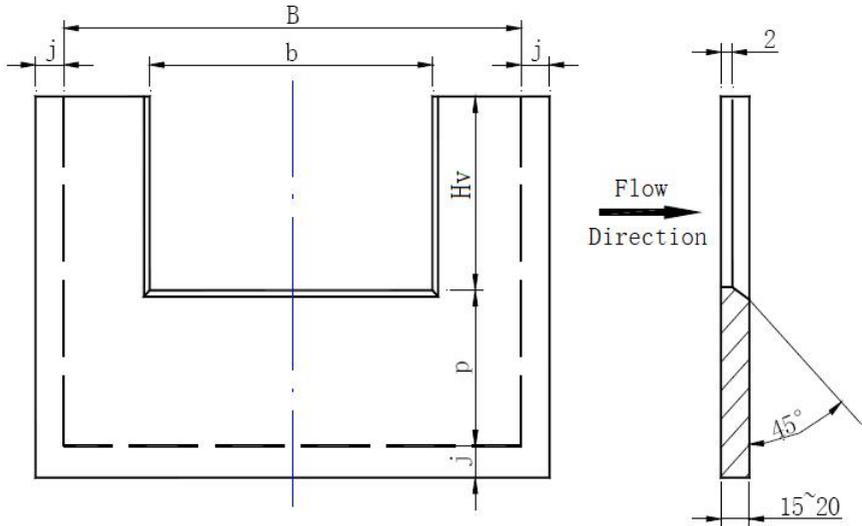
General Size and Flow Parameter of Triangular Weir (Unit: mm)

No.	Flow Range (m ³ /h)		Applicable Channel	B	Hv	P	Flow Parameter	
	Q(min)	Q(max)	Width × Height				C(m ² /s)	n
Tri0	0.3	20	275×220	275	110	110	1.343	2.5
Tri1	0.3	40	360×288	360	144	144		
Tri2	0.3	80	475×380	475	190	190		
Tri3	0.3	121	560×448	560	224	224		
Tri4	0.3	182	660×528	660	264	264		
Tri5	0.3	272	775×620	775	310	310		
Tri6	0.3	395	900×720	900	360	360		
Tri7	0.3	616	1075×860	1075	430	430		
Tri8	0.3	899	1250×1000	1250	500	500		
Tri9	0.3	1359	1475×1180	1475	590	590		

Appendix 3: Rectangular Weir

Material: 15mm-thick glass reinforced plastics, or PVC (If the flow is larger, the wall thickness is increased accordingly).

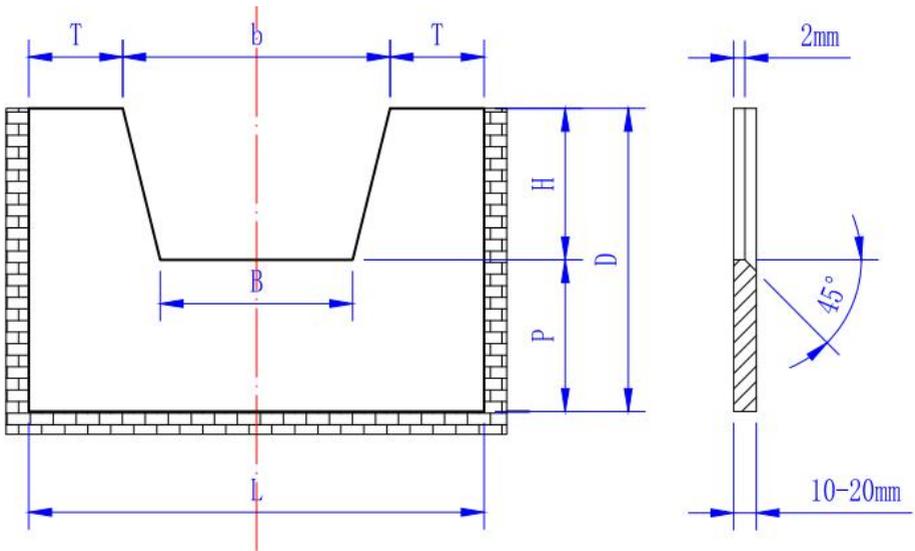
Attentions: j is the part of the weir plate embedded into the channel wall. The size shall be determined by the user according to the on-site conditions.



General Size and Flow Parameter of Rectangular Weir (Unit: mm)

No.	Flow Range (m ³ /h)		Applicable Channel Width × Height	B	b	Hv	p	Flow Parameter	
	Q (min)	Q (max)						C (m ² /s)	n
Rec0	1.3	85	500×500	500	200	163	337	0.356	1.5
Rec1	2.2	195	650×650	650	260	239	411	0.461	1.5
Rec2	4.6	414	750×750	750	375	308	442	0.668	1.5
Rec3	9.0	803	850×850	850	510	387	463	0.922	1.5
Rec4	18.5	1662	1000×1000	1000	700	501	499	1.297	1.5
Rec5	37.2	3332	1250×1250	1250	875	683	567	1.635	1.5
Rec6	72.6	6504	1450×1450	1450	1160	857	593	2.272	1.5
Rec9	user-defined			P37	P38	P33	P39	Auto	

Appendix 4: Trapezoidal Weir



General Size and Flow Parameters of Trapezoidal Weir

No.	Flow Range (m^3/h)	B (mm)	b (mm)	H (mm)	T (mm)	P (mm)	D (mm)	L (mm)	C (m^2/s)	n
Trap1	7.2~43	250	317	133	83	83	267	643	0.465	1.5
Trap2	36~226	500	608	217	167	167	433	1102	0.930	1.5
Trap3	108~178	750	900	300	250	250	600	1560	1.395	1.5
Trap4	61~640	1000	1192	383	333	333	767	2018	1.860	1.5
Trap5	367~2304	1250	1483	467	417	417	933	2477	2.325	1.5
Trap6	594~3632	1500	1775	550	500	500	1100	2935	2.790	1.5

Thereinto, D contains the skirt of 50mm; L contains the skirt of 80mm on each side. The skirt shall be embedded into the channel wall.

Appendix 5: PALMER-BOWLUS Flume

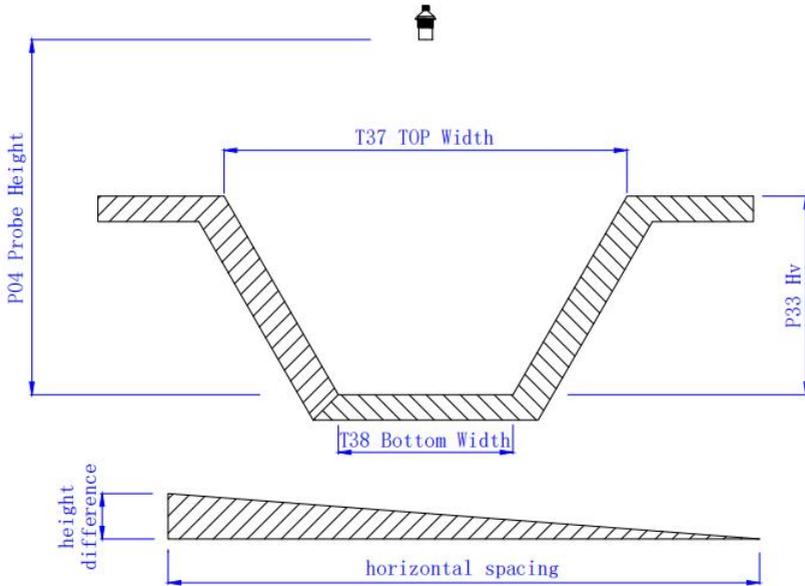


General Flow Parameters of PB Flume:

PALMER-BOWLUS Flume (PB Flume)					
No.	Caliber		Maximum Flow (m ³ /h)	C(m ² /s)	N
PB_01	4"	DN100	20	0.501	1.957
PB_02	6"	DN150	55	0.562	1.903
PB_03	8"	DN200	110	0.749	1.972
PB_04	10"	DN250	200	0.820	1.953
PB_05	12"	DN300	310	0.888	1.936
PB_06	15"	DN375	540	0.975	1.906
PB_07	18"	DN450	850	1.077	1.898

Appendix 6: Chezy Formulae

Chezy formula describes the relationship between water velocity and water depth.



Parameter Setting Steps:

1. Enter the probe installation height in Menu P04, exit from the menu, and check if the liquid level value displayed on the instrument is consistent with the actual conditions. If there is an error, it is required to repeat the step, and make fine adjustments for the data in Menu P04, so that the liquid level value displayed on the instrument is consistent with the actual conditions (the error is less than or equal to 3mm).
2. The weir is set to be “Chezy” in Menu P30.
3. Enter the depth of the channel in Menu P33 Hv
4. Enter the hydraulic slope in Menu T35. (Hydraulic slope = height Difference/Horizontal spacing)
5. Enter the roughness in Menu T36. (According to the channel material, check the following table to obtain the value, and then make fine adjustments based on the actual flow.)
6. Enter the top width of the channel in Menu T37.

7. Enter the bottom width of the channel in Menu T38. (If the channel is rectangular, T37 is equal to T38.)

Notice:

- P33, T37 and T38 are the cross-sectional dimensions of the narrowest channel within 100-200m downstream from below the instrument probe.

Roughness of Soil Channel

Channel Characteristics	Flow m ³ /s	Irrigation Channel	Drainage Channel
Flatness, smoothness, good maintenance	>20	0.0200	0.0225
Flatness, smoothness, general maintenance		0.0225	0.0250
Stony channel bed, poor maintenance		0.0250	0.0275
Flatness, smoothness, good maintenance	1-20	0.0225	0.0250
Flatness, smoothness, general maintenance		0.0250	0.0275
Stony channel bed, poor maintenance		0.0275	0.0330
Flatness, smoothness, good maintenance	<1	0.0250	0.0275
Flatness, smoothness, general maintenance		0.0275	0.0300
Stony channel bed, poor maintenance		0.0300	0.0350

Roughness of Stone Channel

Channel Surface Characteristics	Roughness
Good finishing	0.0250
Medium finishing without projecting portion	0.0300
Medium finishing with projecting portion	0.0330
No finishing, with projecting portion	0.0350-0.0450

Roughness of Anti-seepage Channel

Anti-seepage Channel Structure Class and Characteristics	Roughness	
Clay/clay and sand mixed soil/mixed bentonite	Flatness, smoothness, good maintenance	0.0225
	Flatness, smoothness, general maintenance	0.0250
	Flatness, smoothness, poor maintenance	0.0275

Stone masonry	Mortared masonry of stones and slab stones	0.0150-0.0230
	Mortared masonry of block stones	0.0200-0.0250
	Dry masonry of block stones	0.0250-0.0330
	Mortared masonry of pebbles	0.0230-0.0275
	Good dry masonry of pebbles	0.0250-0.0325
	General dry masonry of pebbles	0.0275-0.0375
	Rough dry masonry of pebbles	0.0325-0.0425
Concrete	Polished cement sand surface	0.0120-0.0130
	Metal formwork pouring, flatness,smooth surface	0.0120-0.0140
	Planed wood formwork pouring,general surface	0.0150
	Rough surface/uneven seam	0.0170
	Poor finishing and maintenance	0.0180
	Prefabricated slab masonry	0.0160-0.0150
	Precast channel	0.0120-0.0160
	Flat gunite surface	0.0150-0.0160
	Rough gunite surface	0.0170-0.0180
	Gunite surface with undulating section	0.0180-0.0250

Appendix 7: HART Command

For HART5.0 Protocol supported by the open channel flowmeter, the commands are shown below:

Command 0	Read identification code
Command 1	Read main variable—instantaneous flow
Command 2	Read instantaneous flow, current and percentage
Command 3	Read current, instantaneous flow, accumulated flow, level and distance
Command 6	Write HART ID
Command 11	Read labeled identification code
Command 12	Read information
Command 13	Read label, descriptor and date
Command 14	Read sensor information of main variable
Command 15	Read equipment information
Command 16	Read the final assembly number
Command 17	Write information
Command 18	Write label, descriptor and date
Command 19	Write the final assembly number
Command 33	Read transmitter variable
Command 34	Write damping value of main variable
Command 35	Write the upper limit and lower limit of measurement range of main variable
Command 36	Present value of main variable is set at the upper limit of measurement range of main variable
Command 37	Present value of main variable is set at the lower limit of measurement range of main variable
Command 40	Enter/quit fixed main variable current mode
Command 43	Present main variable of the equipment is set at zero point
Command 44	Define main variable unit
Command 45	Adjust DAC zero point of main variable current
Command 46	Adjust DAC gain of main variable current
Command 49	Write serial number of main variable sensor

Notice: HART sampling resistance is 250Ω~500Ω.

Appendix 8: Modbus-RTU Communication Protocol

Register Address	Data Content	Format	Unit
0000~0001H	Reserved		
0002~0003H	Level	Float	m
0004~0005H	Distance	Float	m
0006~0007H	Temperature	Float	°C
0008~0009H	Flow Rate	Float	P35
000A~000BH	Total Flow	Float	m ³
000C~000DH	Current	Float	mA
000EH	Liquid Level	Int	mm
000FH	Distance	Int	mm
0010H	Temperature	Int	0.1°C
0011H	Current	Int	uA
0012~0013H	Flow Rate	Long	P35/1000
0014~0015H	Total Flow	Long	m ³

Default setting of RS485 serial port: Baud rate: 9,600; 1 stop bit; no parity bit; ID: 01

Notice:

- 1: Menu **【P54 Communication Test】** displays incoming/outgoing data.
- 2: When the instantaneous flow is large and the accumulated flow is more than or equal to 8-digital number, it is recommended to read LONG accumulated flow in the register 0014H-0015H.

For example: Read the data on instantaneous flow and accumulated flow (Function Code: 03H)

Query data frames (8 bytes in total)

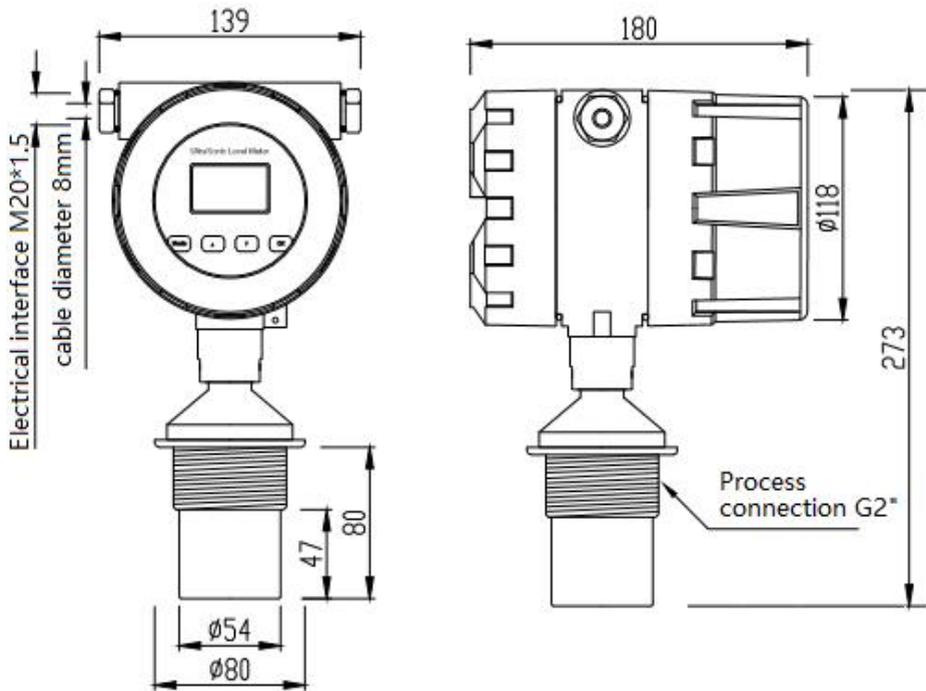
Data	01H	03H	00H	08H	00H	04H	C5H	CBH
------	-----	-----	-----	-----	-----	-----	-----	-----

Response data frames

Data	01H	03H	08H	42H	F1H	00H	00H	46H	B7H	41H	00H	65H	CFH
------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

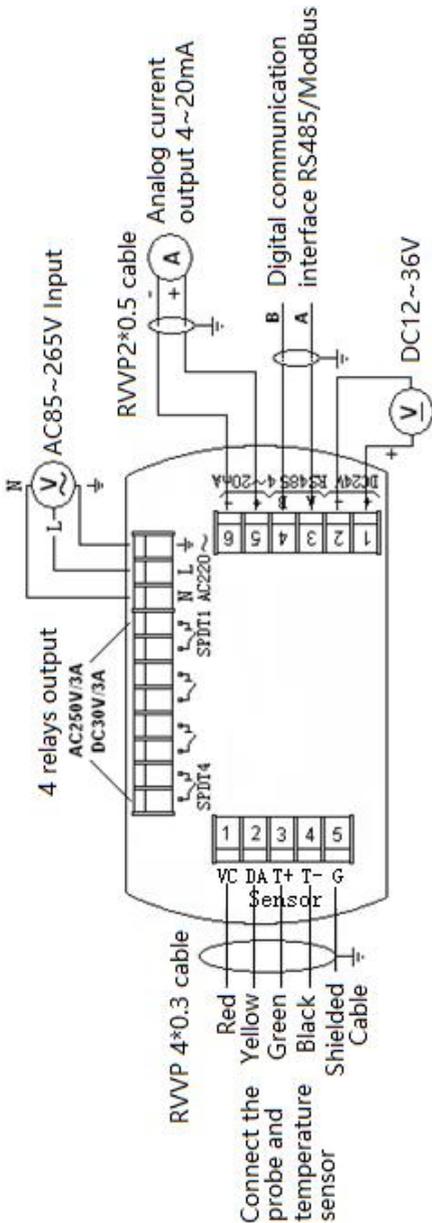
Thereinto, 0x42F10000 is the floating point number in IEEE754 format, indicating that the instantaneous flow is 120.5m³/h; 0x46B74100 indicates the accumulated flow of 23,456.5m³.

Appendix 9: Dimensional Drawings of Integral Instrument



Note: If the instrument is in humid environment all year round, it is recommended to coat the glass cement on the cable inlet port and the joint of the instrument or wrap the waterproof cover on the instrument (probe excluded).

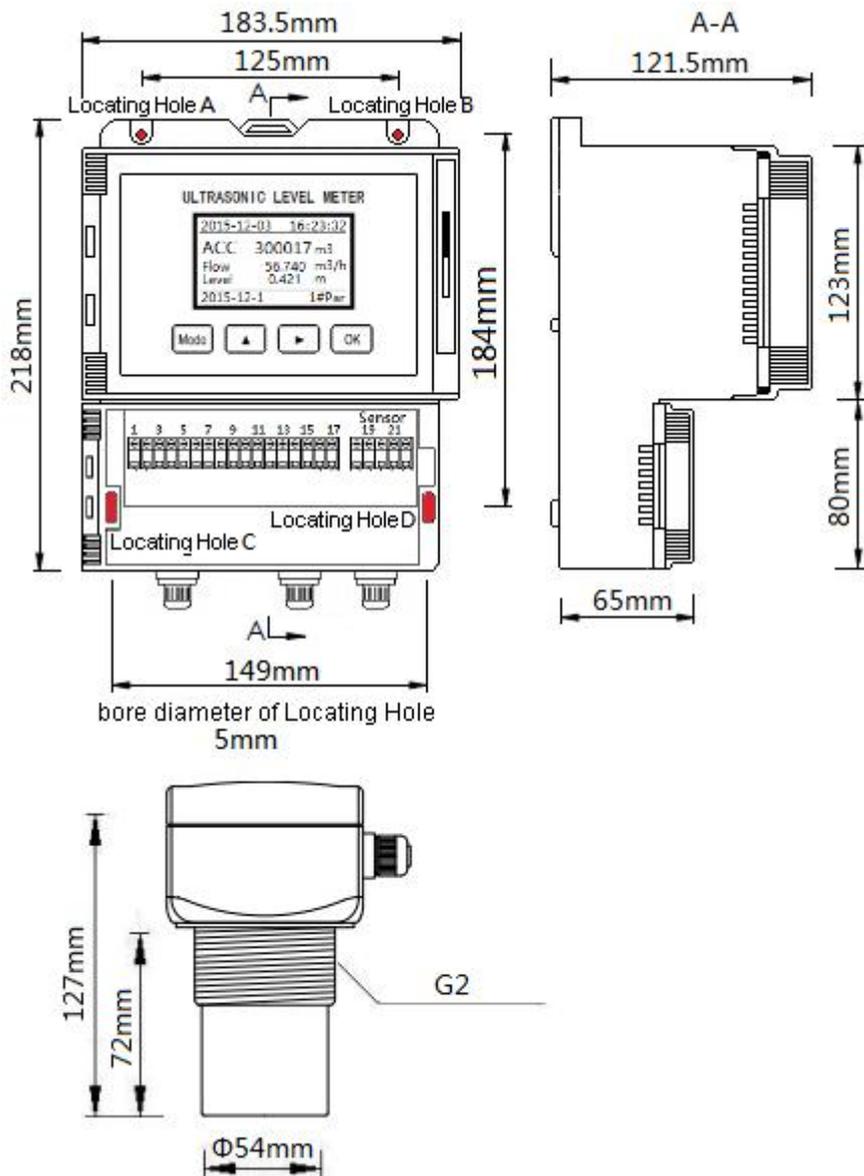
Appendix 10: IntegrallInstrument Wiring Diagram



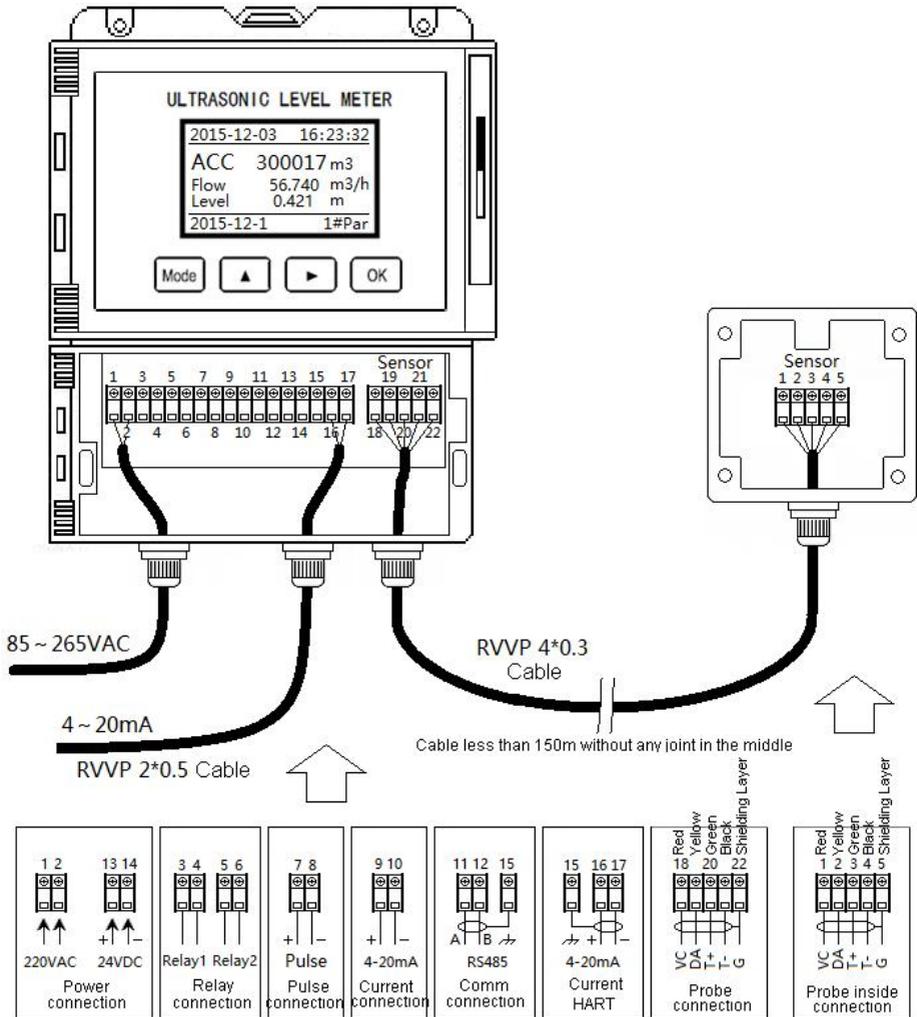
Note:

- As open channel flow monitor is a weak current instrument with high internal magnification, instrument ground is essential
- 4-20mA line should be RVVP2×0.5 shielded cable, and not parallel with the power line alignment .
- The probe line should be RVVP 4×0.3 shielded cable without any joint in the middle and shall not be in parallel with the power line alignment.
- PLC connected with the instrument should be far away from the inverter, motor, and not share power with the inverter. Otherwise, a 4-20mA isolator must be installed.
- If the instrument is in the humid environment , it is recommended to coat glass cement at the cable inlet port and the joint of the instrument cover or wrap the instrument with the waterproof cover (probe excluded).
- Digital meter wiring, please refer to the digital form instructions.

Appendix 11: Remote Instrument Dimensional Drawing



Appendix 12: Wiring Diagram of Remote Instrument

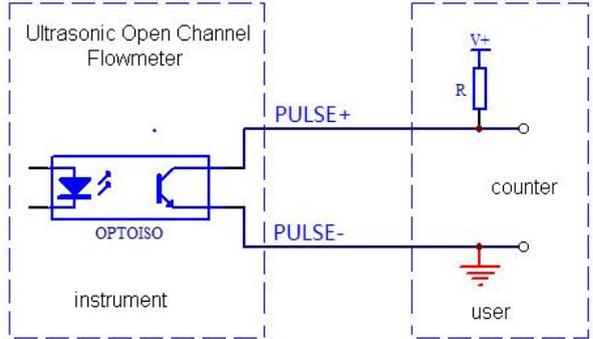


Appendix 13: Pulse Output Interface

【Output Mode A】

OC mode passive output (The pull-up resistor R needs to be added on the counter side.)

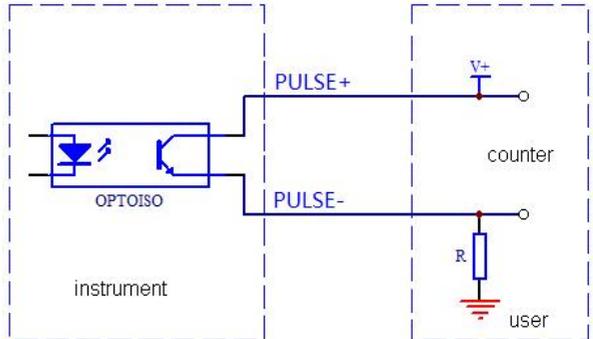
- The external power $V+$ can be 5V/12V/24V.
- The pull-up resistor R is 2K~10K.
- Turn the switch (1/2) to the "OFF" position.



【Output Mode B】

OC mode passive output (The pull-down resistor R needs to be added on the counter side.)

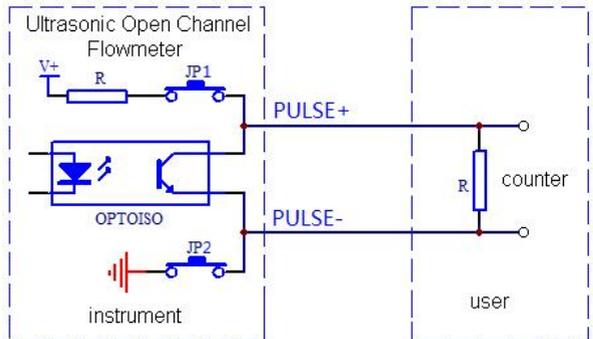
- PULSE+: Connect the external power supply $V+$.
- PULSE-: Output the pulse signal.
- Turn the switch (1/2) to the "OFF" position.



【Output Mode C】

Level mode active output, able to directly drive the load R

- The internal $V+$ is DC24V.
- Turn the switch (1/2) to the "ON" position.



Packing List

No.	Name of equipment or accessory	Unit	Quantity	Note
1	ultrasonic open channel flowmeter	Set	1	
2	Plastic screw nut (default) DN32 flange or bracket (optional)	Piece	1	
3	Operation Instruction	Book	1	
4	Product qualification certificate	Piece	1	

Points for attention

- Don't shake or collide the equipment intensively during use and transportation.
- During transportation and storage of the instrument, environment temperature shall not be lower than -40 °C or higher than +70 °C; relative humidity shall not exceed 85%; there shall be no corrosive gas or intense electromagnetic field around; original packing box shall be used during transportation.

All Rights Reserved

This company reserves all patents in the world. Without prior written permission of this company, any parts of this instrument, including source code, shall not be copied, transmitted, transcribed or translated into any language or computer language in any form or electronic, electromagnetic, optical, artificial or other ways.

Without prior written permission of this company, all or any parts of this manual shall not be copied, photocopied, reprinted, translated or transmitted to any electronic or machine readable media.

Name and mark on the product are registered trademark or trademark of this company. All other trademarks, trade names or company names referred to herein are only for the purpose of identification; they are assets of respective owners.

Warranty Card Receipt

User name			
Contact address			
Contact person		Contact telephone	
Product type		Product number	
Delivery date		Person responsible for installation	

.....

Description of Warranty Card

Product type		Product number	
Delivery date		Person responsible for installation	

Warranty policy:

- The user shall show Warranty Card during maintenance. With Warranty Card, faults arising from normal use during warranty period can be repaired for free as stipulated.
- Warranty period: warranty period of our products is 24 months from delivery date. This company provides paid extension of warranty period.

The following cases are beyond free warranty scope:

- The product or its components exceed free warranty period.
- Hardware faults result from operating environment which doesn't conform to product operating requirements.
- Bad power supply environment or foreign matters entering the equipment lead to faults or damages.
- Faults are caused because the user doesn't operate according to use methods and points for attention in operation manual.
- Faults are caused by force majeure, such as thunder, lightning, flood and fire. Arbitrary disassembly of the equipment, modification beyond authority or abuse of the equipment leads to faults or damages.
