enelsan

We Measure

Electromagnetic Flowmeter Converter

User's Manual
(V1.4)

CONTENTS

Electromagnetic Flow meter Converter User's Manual

1. Overview

1.1 Basic Function

- Low-frequency square-wave exciting，exciting frequency：5.000Hz（1/10）、4.167Hz（1/12）、3.125Hz（1/16）；
- Exciting current:125mA;
- No need to add additional electrode for empty pipeline measurement;
- Current speed range：0.1 --- 15m/s，current speed resolution：1mm/s;
- AC liner power, range of voltage：220VAC(±10%);
- DC power:DC24V(±10%);
- Communication function: MODBUS RTU protocol (RS-232 or RS-485) standard;
- Or HART communication option;
- Support Turkish、English、Portugues、Korean displaying mode;
- Analog output:0-10mA or 4-20 mA;
- Frequency output can be set;
- Equivalent pulse output can be set;
- Alarm functions: support excitation, pipes empty, Upper and lower alarm;
- Upper and lower alarm objects can be set: Flow volume、Flow percentage、Forward integrated flow, reverse integrated flow, difference integrated flow;
- Three integrator gross inside, respective register：Forward integrated flow, reverse integrated flow, difference integrated flow.
- Small flow linear correction functions: Support small flow four-point liner correction;
- Data back up and restore: manufacturer original information backup and restore;
- Data export and import: use of external EEPROM can import, export the instrument parameters (except converter parameters)and accumulation.

1.2 Basic parameters and performance

- Operating temperature: －20℃ ～+70℃
- Relative Humidity：5%～90%
- Dissipation power：< 10 W(with sensor)
- Analog current output

  Load resistor: 0~1200Ω for 0~10mA

0~600Ω for 4~20mA,

Accuracy: 0.1%±10μA

- Digital frequency output

Frequency output range: 1～5000Hz

Output electric isolate: Photoelectric isolate. Isolate voltage: > 1000VDC;

Frequency output: Internal pull Up resistor of 1500Ω, the drive current 16mA.

The highest voltage is 24VDC for external power supply, and the maximum load current is 100mA.

- Digital pulse output

The equivalent pulse: 0.001～1.000 m^3 / cp,

0.001～1.000 Ltr / cp

Pulse output width: Square wave output, and the maximum high level is 50ms.

Pulse output isolate: Photoelectric isolate. Isolate voltage: > 1000VDC;

Pulse output: Internal pull Up resistor of 1500Ω, the drive current 16mA.

The highest voltage is 24VDC for external power supply, and the Maximum load current is 100mA.

- Measure precision for assembly

Diameter(mm)	Range(m/s)	Accuracy
3 ～ 20	〈0.3	±0.25%FS
	0.3～1	±1.0R
	1～15	±0.5%R
25 ～600	0.1～0.3	±0.25%FS
	0.3～1	±0.5%R
	1～15	±0.3%R
700～3000	〈0.3	±0.25%FS
	0.3～1	±1.0%R
	1～15	±0.5%R

%FS：for relative ranges；

%R：for relative value of measurement

1.3 Digital Communication Port and Protocol

1.3.1 MODBUS Protocol

Physical interface RS-485, 1000V electric isolate, format of RTU.

You can use Modbus-Config-Tool software to set parameters, or read real-time flow, totalized flow value, etc.

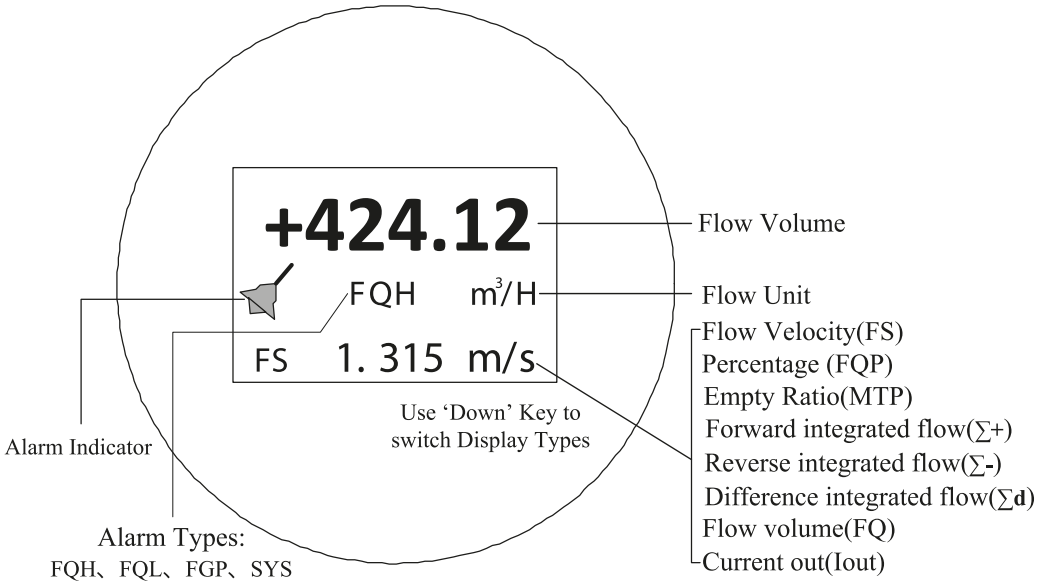
1.3.2 HART protocol

The standard HART of communication protocol, you can use the HART-Config-Tool software, or HART handheld, to set parameters, or read real-time flow, totalized flow value, etc.

2. Converter display and keys operation

2.1 Measurement State Display

The measuring data and status display as flows:



Note: When there more than one alarm, the alarm status display cycle.

FQH --- Flow high limit alarm FQL---Flow low limit alarm

FGP --- Flow empty pipe alarm SYS --- System exciting alarm

The converter contains four key: Esc key, Up key, Down key and Enter key

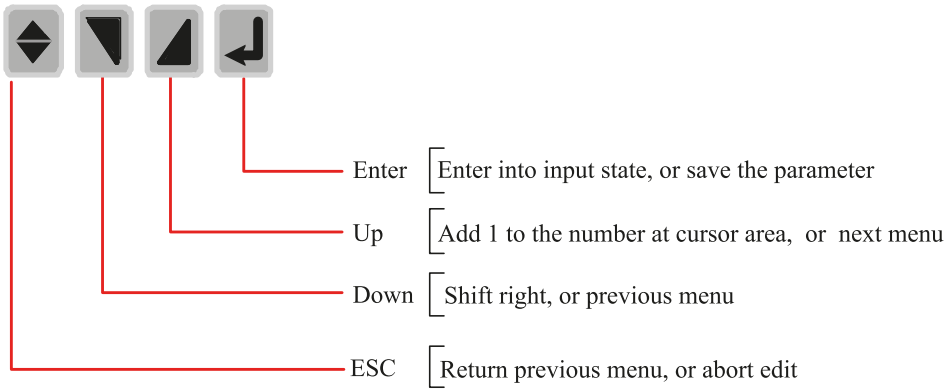
On measuring state display, the keys functions are:

- Push“Down key”to change line3 displaying value. Cycle display flow rate, percentage flow, empty ratio, forward integrated flow, reverse integrated flow and difference integrated flow, flow volume, current out.
- Long push “Enter” 3 seconds, enter into ‘Password‘ interface.
- Push“Esc key + Up key”, LCD screen contrast increases
- Push“Esc key + Down key”,LCD screen contrast decrease

2.2 Keys And Display

2.2.1 Key Function

The basic function of keys as follow:



2.2.2 Keys Operation Method

1) Single Key Operation

Operation method: Push the key, then lift. The single keys operation function as follow:

- ESC Key:Return previous menu,or abort edit.
- Down key:Shit right, or previous menu.
- Up key: Add 1 to the number at cursor area, or next menu.
- Enter key: Enter,enter into input state, or save the parameter.

2) Combination Key Operation

Use the ESC Key and other keys perform the operation. Operation method: Hold down the ESC Key, then push another key.

a) Measurement state (Normal Display State)

- Push“Esc key + Up key”, LCD screen contrast increases
- Push“Esc key + Down key”,LCD screen contrast decrease

b) Param edit state

- ESC Key + Down Key: Cursor shift left.
- ESC Key + Up Key : Subtract 1 to the number at cursor area.
- ESC Key + Enter Key: Return previous menu,or abort edit.

2.2.3 Enter Password

To enter the password for example, illustrate the keys operation process:

1） When the display on measurement state (Normal Display State), push “Enter key” for 3 seconds, will enter into ‘Set Param 0000’ Input the passwords (The password and the level, please refer the “parameter set” part, the second level password of 03210)

2） Then push “Up key” to add 1 to the number at cursor area .

3） Push “Down Key” cursor shift left.

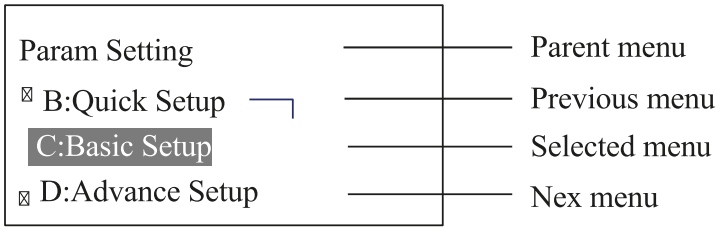
4） To finish input, push “Enter key”, if password is correct, then enter into the parameter setting.

Note: Press “Enter key”,for three seconds under any state and will return to automate measure way.

2.2.4 Menu browse state

1） Menu browse State Display

Menu browse state is used to view, select parameter , LCD displays up to four lines, as shown below:



2） Key Operation on Browse State

Esc key: Return parent menu;

Down key: Previous menu

Up key: Next menu

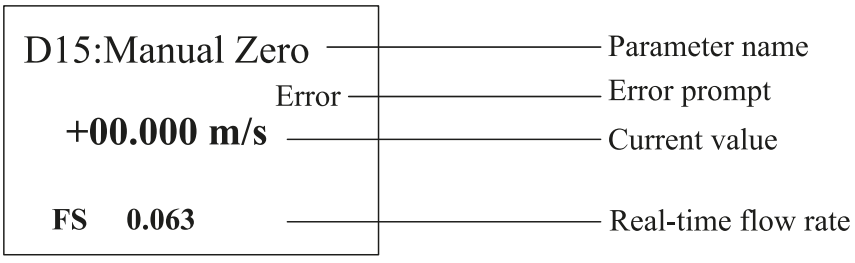
Enter key: Enter into menu browsestate, or parameter browse state.

More than 10 minutes without push any key, or push 3 seconds the “Enter Key”, direct return to automate measurement state.

2.2.5 Parameters Browse State

1） Browse state display

Parameter browse state is used to view various types of parameter values, LCD displays up to four lines, as shown below:



Error: When the parameter value error display;

The fourth line real-time flow rate: Flow rate value displayed when browser zero flow

correction coefficient, the factory calibration coefficients, flow correction coefficient 1, flow correction coefficient 2, flow correction coefficient 3, flow correction coefficient 4.

2） Key Operation on Browse State

Enter key: Enter into parameter editing state if have rights, otherwise, prompt error.

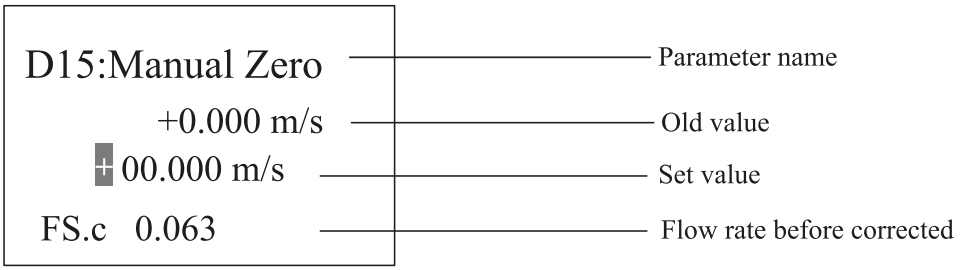
ESC key: Return parent menu.

More than 10 minutes without push any key, or push 3 seconds the “Enter Key”, direct return to automate measurement state.

2.2.6 Edit State

1） Edit State Display

Users can modify the parameter values in edit mode, the LCD displays:



The fourth line real-time flow rate: Flow rate value displayed when browser zero flow correction coefficient, the factory calibration coefficients, flow correction coefficient 1, flow correction coefficient 2, flow correction coefficient 3, flow correction coefficient 4.

2） Key Operation on Edit State

ESC key: Abort edit, return param browse state.

Down key : The cursor moves to the right (data input) or upward selection (select input)..

Up key : Add 1 to the number at cursor area(data input) or downward selection (select input).

ESC key + Down key: Cursor shift left.

ESC key + Up key: Subtract 1 to the number at cursor area(data input).

Enter key：Save the new parameter and return to browse state. If the parameter unreasonable, will prompt “fault”.

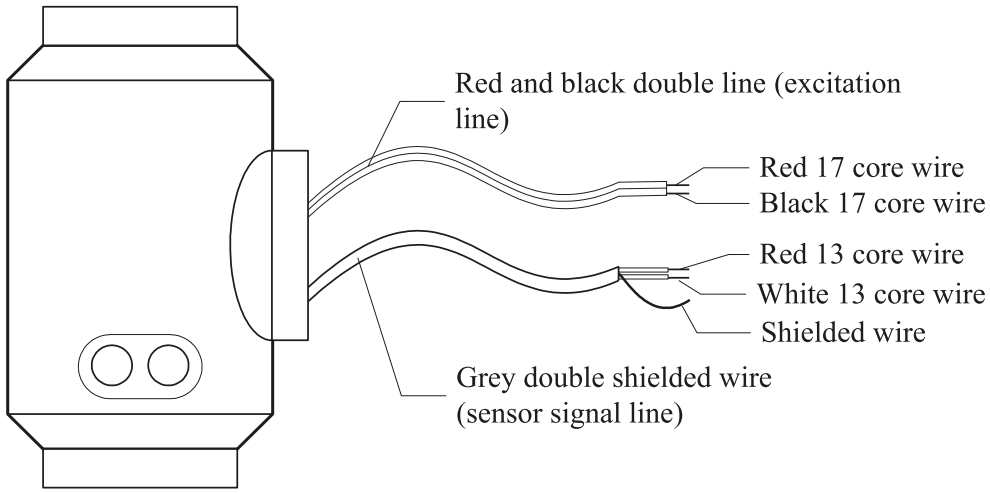
More than 10 minutes without push the key, or push 3 seconds the “Enter Key”, direct return to automatic measure state. Black 17 core wire

3. Connections of sensor and output

3.1 Compact meter

3.1.1 Sensor wiring

The sensor wiring(signal line and excitation line) of compact meter is shown below:



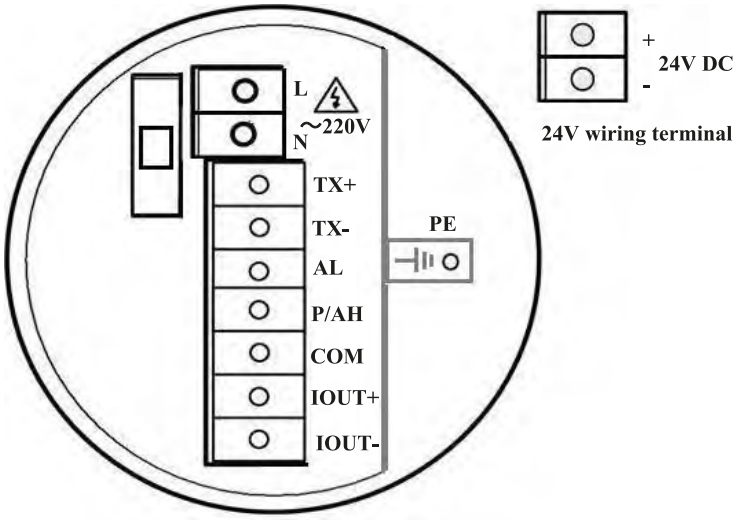
Illustrate：

Excitation line：Red 17 core wire
Black 17 core wire
] Connecting excitation current

Sensor signal line：Red 13 core wire“Signal 1”
White 13 core “Signal 2”
Shielded wire“Signal ground”
] Connection sensor signal

3.1.2 Wiring Terminal

Remove the bottom cover of the converter, and you can see the terminal board.

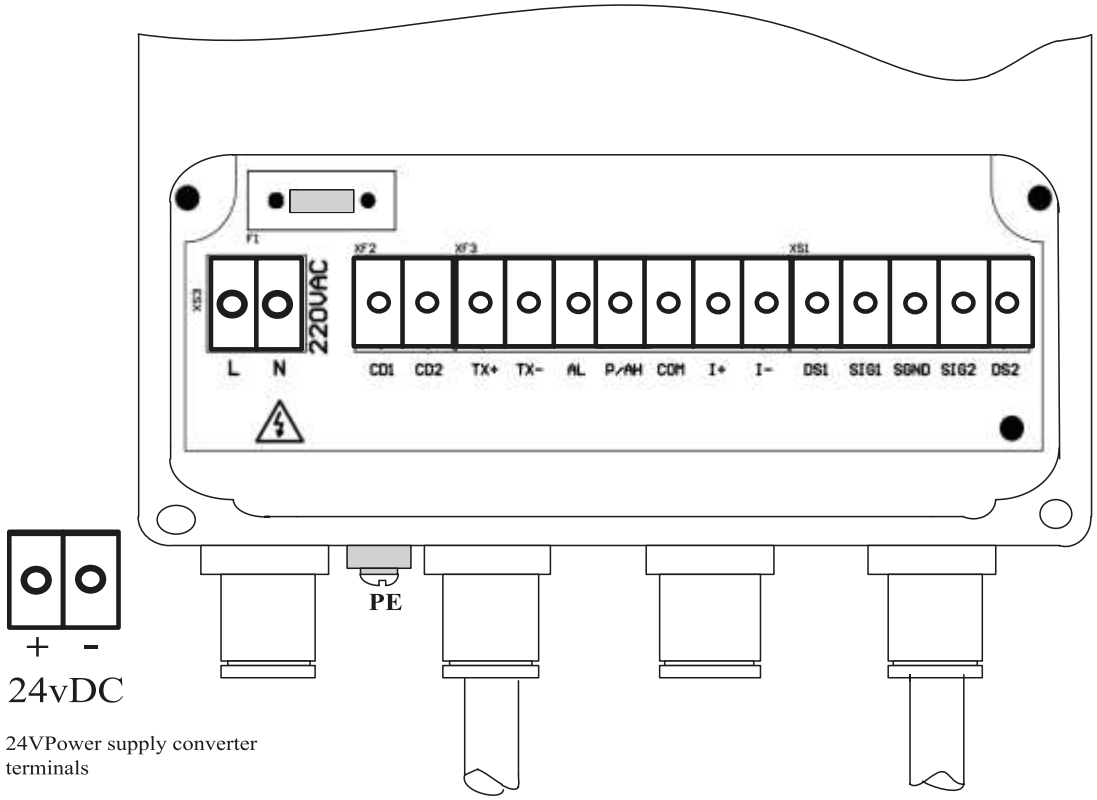


Symbols and description of connectors:

L：(+)	220V Power Supply L.（24V Power Supply +）
N：(-)	220V Power Supply N.（24V Power Supply -）
TX＋：	Communication Input Signal, RS485 A
TX－：	Communication Input Signal, RS485 B
AL：	Alarm Output for Low Limit / Flow Direction Output
P/AH：	Frequency (Pulse) Output Ground /Upper Alarm Output
PCOM：	Frequency (Pulse) Output Ground/Upper And Lower Alarm Ground
IOUT+：	4~20mA/0~10mA Output Current Positive
IOUT-：	4~20mA/0~10mA Output Current Ground

3.2 Remote meter

3.2.1 Wiring Terminal



220V/24V power Supply terminals:

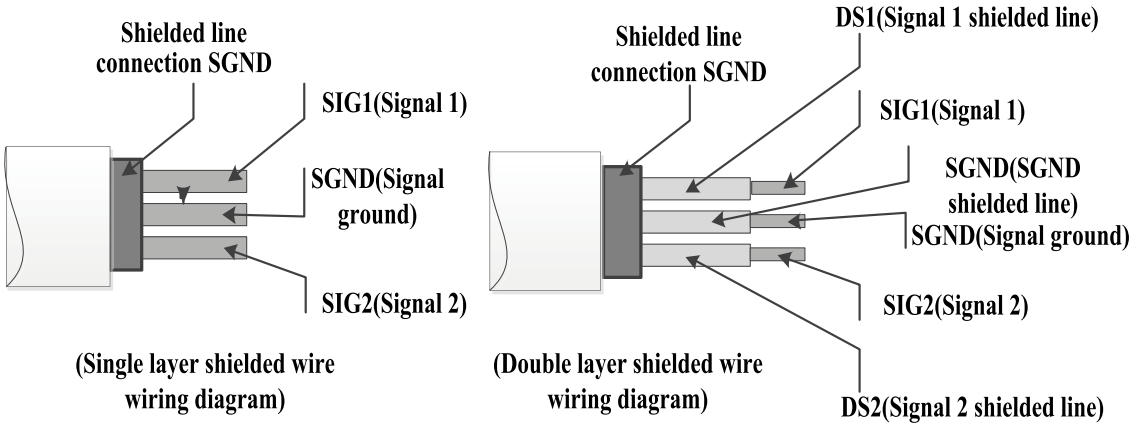
L：(+)	220V Power Supply L.（24V Power Supply +）
N：(-)	220V Power Supply N.（24V Power Supply -）

The other terminals symbols and description:

CD1	Excitation Output1
CD2	Excitation Output2
DS1：	Single 1 Shield
SIG1：	Single 1
SGND：	Single Ground
SIG2：	Single 2
DS2	Single 2 shield

TX＋：	Communication Input Signal, RS485 A
TX－：	Communication Input Signal, RS485 B
AL：	Alarm Output for Low Limit / Flow Direction Output
P/AH：	Frequency (Pulse) Output Ground /Upper Alarm Output
COM：	Frequency (Pulse) Output Ground/Upper And Lower Alarm Ground
I+：	4~20mA/0~10mA current output positive
I-：	4~20mA/0~10mA current output ground

Sensor signal wiring is shown below：



3.3G rounding

Contacta reao f copper ConnectorP Eo nC onverter Cabinet forg rounding shouldb el arger than 1.6mm^2. Contact resistance should be less than1 0Ω.

3.4F requency Output,P ulse Output, Upper Limit Alarm

The frequencyo utput, pulseo utput and upper limita larm output sharet he same wiring terminal of P/AH. Set as follow:

P/AH Function	Function Description	P/AH Output
Frequency Output	Frequency Mode	Frequency Output Range is0 ～5000HZ,a nd corresponding the percent of flow
PulseO utputP	ulse Mode	Equivalent Pulse
Upper AlarmU	pper AlarmO utput	**Upper alarmm ode (Always open):** P/AH Output Low: UpperA larm Limit P/AH Output High:N oU pper AlarmL imit
		Upper alarmm ode (Always Close): P/AH Output Low: No Upper AlarmL imit P/AH Output High:U pper AlarmL imit

Frequencyo utputm ode general can be used inc ontrol application,b ecause it responses the percent of flow. Users can choice pulse output when the equipment is applied to count.

3.4.1 Frequency Output Mode

Frequency output range , 0～5000Hz, and corresponding the percent of flow.

$$F=\frac{\text{Measure value}}{\text{Full scale value}}\bullet \text{ frequency range}$$

The Up limit of frequency output can be adjusted, It can be choice from 0 ~ 5000HZ, and also can be choice low frequency: such as 0 ~ 2000HZ etc.

3.4.2 Pulse Output Mode

Pulse output mainly applies in count mode. For each output of a pulse, the corresponding volume or quality is determined by the pulse factor and the total unit..

Pulse factor refers to the number of pulses output per unit total. When setting pulse factor, the user should pay attention to match the flow range and the pulse factor of the flowmeter. Count formula as follows:

For volume flow : $Q(m^3/s)=0.0007854\times D^2\times V\times 10^{-3}$

For mass flow: $Q(kg/s)=0.0007854\times D^2\times V\times 10^{-3}\times \rho$

Note: D-nozzle (mm)

V-velocity of flow (m/s)

ρ— density （kg/m3）

The appropriate pulse factor should be selected according to the size of the sensor, and the frequency of the pulse output should be below 5000Hz.

3.4.3 P/AH for Frequency, Pulse, Upper Limit Alarm output Wiring

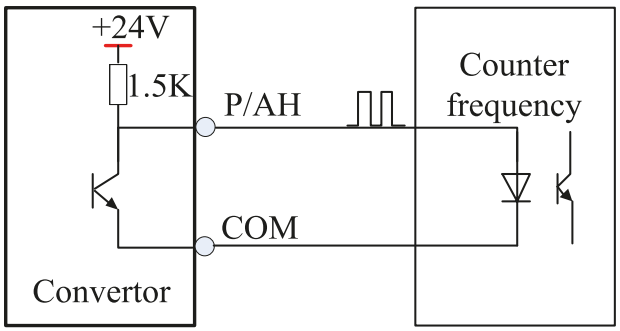
Frequency/pulse digital output has 2 connected points: output connected point, ground point, the symbols as follows

P/AH —— Output

PCOM —— Ground

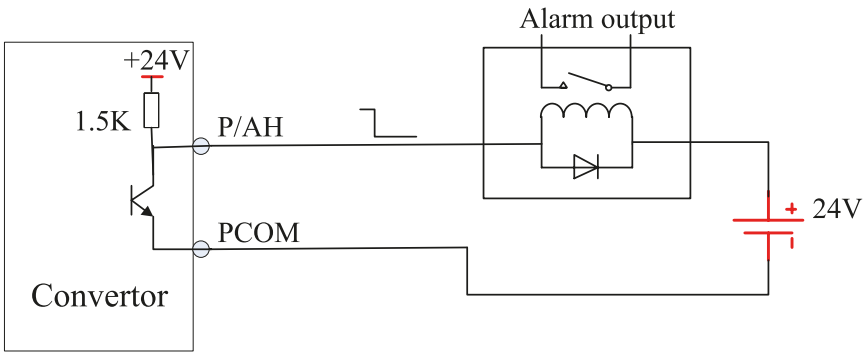
Frequency, equivalent pulse output wiring ways:

User equipment connected between P / AH and PCOM, The wiring can be referred to below. The pulse output voltage is 24V, and the converter is equipped with 1.5KΩ current limiting resistor, which can provide 16mA driving current for user equipment.



Alarm output mode of connection:

The load current is not more than 100mA, the wiring can be referred to below:



3.5 AL for Lower Limit Alarm output or Flow Direction Output

The lower limit alarm output and flow direction output share the same wiring terminal of AL. Set as follow:

AL function selection	Function Description	AL Output
flow direction	Flow direction output	AL output low: Flow is reverse
		AL output high: Flow is forward
Lower alarm	Lower limit alarm output	**Lower alarm mode (Always open):** AL output low: Lower Limit Alarm AL output high: No Lower Limit Alarm
		Lower alarm mode (Always Close): AL output low: No Lower Limit Alarm AL output high: Lower Limit Alarm

The lower alarm output and flow direction output wiring way is same to P/AH.

3.6 Current Output and Calculate Formula

3.6.1 Current Output

There are two analog output mode: 0～10mA and 4～20mA, the inner voltage is 24V. When select 4~20mA, it can drive 600Ω resistance.

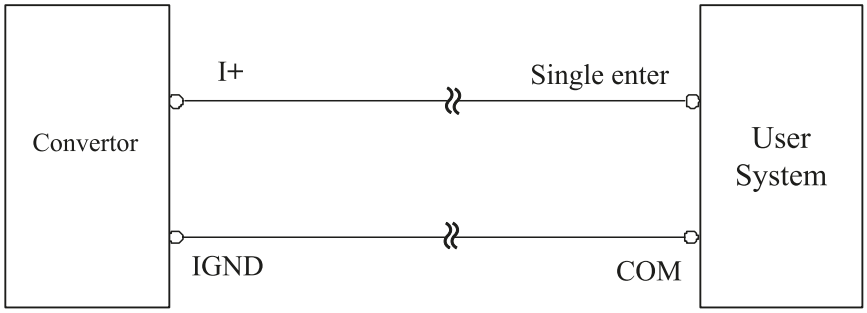
The percent flow of simulation current output:

$$I_0 = \frac{\text{Measure value}}{\text{Full scale value}} \times \text{the scale of current} + \text{the zero point of current}$$

The manufacture's parameter has been adjusted, and it need not adjust.

3.6.2 Connection of current output:

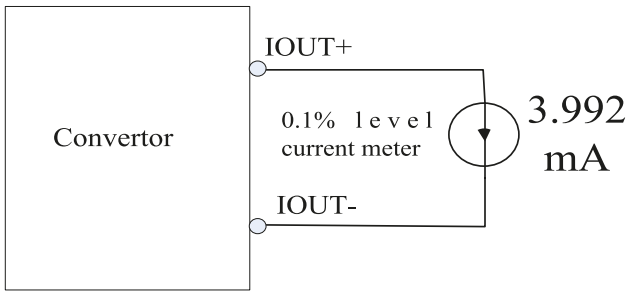
Connection of current output as follow:



3.6.3 Current output trim

1) Instrument timing prepare

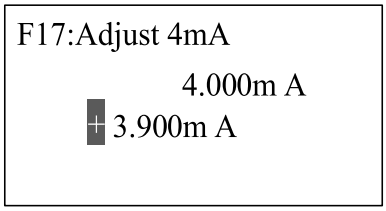
Preparative ampere meter. The accuracy shoud better than 0.1%.



2) Current Zero Correction

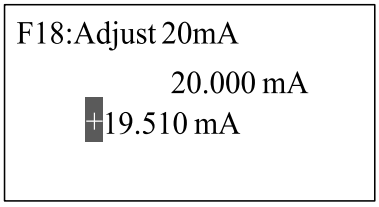
Through the key, Enter the "current zero correction" parameter edit mode, LCD display as shown below. At this point the converter outputs 4mA, the user only needs to input actual current

value measured by the current meter, then push the "EnterK ey"t o complete 4mA corrected.



3) CurrentF ull correction

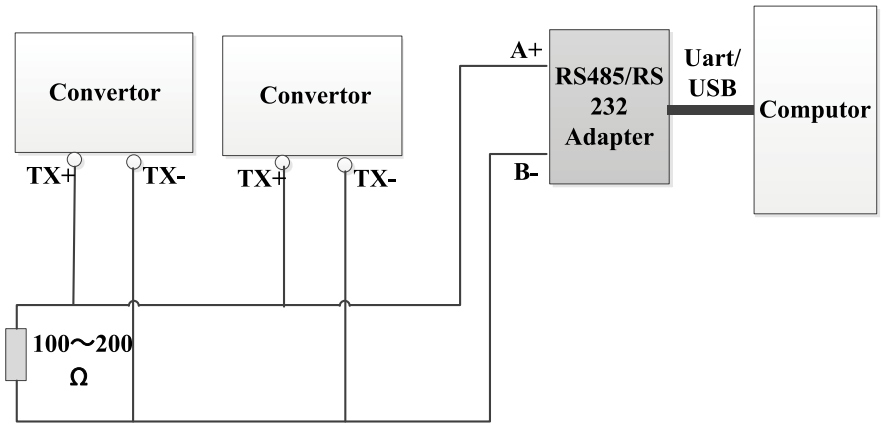
Through thek ey,E nter the “Currentf ullc orrection” parametere ditm ode,Att hisp oint the converter outputs2 0mA, theu ser onlyn eedt o input actual currentv alue measured by thec urrent meter , then push the “EnterK ey” to complete 20mA corrected.



3.7 Digital communication wiring

3.7.1M odbusc ommunication wiring

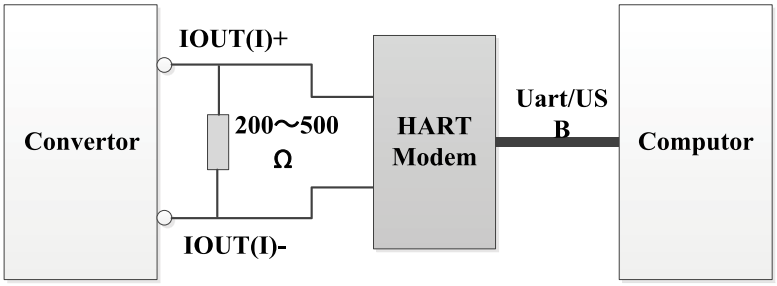
Modbusc ommunication adopts standardR S485 connection mode, andt he wiring iss hown below:



m

3.7.2H ARTc ommunicationw iring

TheH ART communication wiring is shown below:



4. Parameter setting and configuration

4.1 Parameter setting

Converter parameters are shown in table 4-1. Before use the instrument, the user should be setting the parameters according to the particular cases. Make sure the parameters running status, data processing algorithms, output ways as well as work ways

In order to prevent parameters are free to modify, there are 4 grades of passwords for setting parameters function, Corresponding 4-levels permissions user. Grades 1 to grade 3 of passwords are for users and grade 4 of password is for manufacturer. The 4th level permission can modify the 1~3 level permissions password.. The following table lists the permissions of users at all levels, and the default password of the factory..

Table 4-1

User grade	access authority	Password attribute	Default password
1	Users can only view the instrument parameters under the menu of B, C, D, F, G, K, and do not have the right to modify.	correctable	00521
2	Users can view and modify the instrument parameters under the menu of B, C, D, F, G and K.	correctable	03210
3	Users can view and modify the instrument parameters under the menu of B, C, D, F, G, H and K.	correctable	06108
4	The manufacturer's special password can view and modify all parameters.	uncorrectable	

It is suggested that higher-level personnel master the level 4 password. Grade 3 is mainly used for resetting total volume in password. Grades 1~2 can be set by any one who can be

chosen by users.

Table 4-1

Code	Parameter name	Setting Way	Parameter Range	Default value	Grades
B	**Quick Setup**				2
B10	Language	Select	Turkish/English	English	2
B11	Flow Rspns	Set count	1.0～50.0S, damping	4.0	2
B12	Flow unit	Select	m^3/s、m^3/min、m^3/h、L/s、L/min、L/h、gal/s、gal/min、gal/h、Ugal/s、Ugal/min、Ugal/h、kg/s、kg/min、kg/h、t/s、t/min、t/h、ft^3/s、ft^3/min、ft^3/h、lb/s、lb/min、lb/h	m^3/h	2
B13	Decpoint	Select	0～5, set the decimal point of instantaneous flow.	1 DecPt	2
B14	Flow Range	Set count	0.0～9999999.0	424.2	2
C	**Basic Setup**				2
C10	Sensor Size	Select	3～3000mm	100	2
C11	Meter Factor	Set count	0.0001～9.9999	1.0	2
C12	Total Unit	Select	$0.001m^3$ ～ $1m^3$ 、 0.001L ～ 1L 、$0.001ft^3$ ～ 1 ft^3 、 0.001gal ～ 1gal 、0.001Ugal～1Ugal、 0.001kg～1kg、0.001t～1t、0.001Lb～1Lb、	$1m^3$	2
C13	Flow Direct	Select	Normal/Reverse	Normal	2
C14	Flow Cutoff	Set count	0.0～99.0%	1.0%	2
C15	CutOff En.	Select	Enable/Disable	Enable	2
C16	1nd Line	Select	Q[Unit]、Q[%]、V[m/s]、mA	Q[Unit]	2
C17	2nd Line	Select	V[m/s]、Q[Unit]、Q[%]、MTP[%]、Totalizer Net 、 Totalizer->F 、 Totalizer<-R、mA	V[m/s]	2
C18	Version	Read nly	\	\	2
D	**Advance Setup**				2
D10	Modbus Addr.	Set count	1～247	1	2
D11	Modbus Baud.	Select	1200～38400bps	9600	2

D12	Modbus Pari.	Select	None、Odd、Even	None	2
D13	Modbus SBL	Select	1 、2 Stop Bit	1	2
D14	Manual Zero	Set count	-9999～+9999	0.0	2
D15	Autom. Zero	Select	YES / NO	NO	2
D16	Density Unit	Select	g/cm3、kg/m3、lb/gal、lb/Ugal、lb/ft3	kg/m3	2
D17	Density	Set count	0.1～5.0	1	2
D18	Pls.Lmt En.	Select	Enable/Disable	Disable	2
D19	Pls.Lmt Val.	Select	0～100%	10%	2
D20	Plsnt Delay	Set count	0～60000 ms	3000	2
D21	Browse PSWD	Set count	00000～65535, Bowse PassWord	00521	2
D22	Set PassWord	Set count	00000～65535	03210	2
D23	Reset	Select	YES / NO	NO	2
D24	Outport Param	Select	Enable/Disable	Enable	2
D25	Import Param	Select	Enable/Disable	Enable	2
F	**Output**				
F10	Measure Mode	Select	Forward、Forward/Reverse、Reverse	Forward/ Reverse	2
F11	Iout Mode	Select	0～10mA /4～20mA	4～20mA	2
F12	P/AH FC Sel.	Select	Pulse , Frequency , Upper limit alarm , Lower alarm, flow direction	Freque	2
F13	AL FC Select	Select	Lower alarm, flow direction	L_Alarm	2
F14	Pluse Factor	Set count	0.001～1000.0	10	2
F15	Pluse Width	Set count	0.1～250.0ms	0.5	2
F16	Max Frequency	Set count	2～5000 Hz	5000	2
F17	Adjust 20mA	Set count	18.000～22.000mA	20.0	2
F18	Adjust 4mA	Set count	3.500～4.500mA	4.0	2
G	**Alarm**				2
G10	MtSensor En.	Select	Enable / Disable	Enable	2
G11	Mtsnsr Trip	Set count	1～65535	50	2
G12	Alm High En.	Select	Enable / Disable	Disable	2
G13	Alm High Obj	Select	Q[%] 、 Q[Unit] 、 Totalizer Net 、 Totalizer->F、 Totalizer<-R	Q[Unit]	2

G14	Alm High Mod	Select	Always Open / Always Close	AlwaysOpen	2
G15	Alm High Val	Set count	-200.0～ +200.0 %	200.0	2
G16	Alm Low En.	Select	Enable / Disable	允☒	2
G17	Alm Low Obj	Select	Q[%] 、 Q[Unit] 、 Totalizer Net 、 Totalizer->F、 Totalizer<-R	Q[Unit]	2
G18	Alm Low Mod	Select	Always Open / Always Close	AlwaysOpen	2
G19	Alm Low Val	Set count	-200.0～ +200.0 %	-200.0	2
G20	Sys Alm En.	Select	Enable/Disable	Enable	2
G21	Alm Iout En.	Select	Enable/Disable	Disable	2
G22	LAlarm Iout	Set count	3.0～3.8mA	3.8 mA	2
G23	HAlarm Iout	Set count	21.5～23.0mA	22 mA	2
H	**Total Set**				3
H10	TOT Reset	Select	YES / NO	NO	3
H11	TOT->F	Set count	000000000～999999999	0.0	3
H12	TOT<-R	Set count	000000000～999999999	0.0	3
H13	Tot PassWord	Set count	0～65535	6108	3
K	**Test**				2
K10	Iout Test	Set count	0.01～23.0mA	12.0	2
K11	Pulse Test	Set count	2～5000 Hz	1000	2
K12	Display Test	Read Only			2
V	**Factory Set**				4
V10	Field Type	Select	Type 1(1/10)、 Type 2(1/12)、 Type 3(1/16) , Excitation type	Type 1	4
V11	Sensor Fact	Set count	0.0001～5.9999	1.0	4
V12	Line CRC En.	Select	Enable/Disable	Disable	4
V13	Line CRC1	Set count	0.0～15.0	0.3	4
V14	Line Fact1	Set count	0.0000～1.9999	1.0	4
V15	Line CRC2	Set count	0.0～15.0	0.225	4
V16	Line Fact2	Set count	0.0000～1.9999	1.0	4
V17	Line CRC3	Set count	0.0～15.0	0.15	4
V18	Line Fact3	Set count	0.0000～1.9999	1.0	4

V19	Line CRC4	Set count	0.0～15.0	0.075	4
V20	Line Fact4	Set count	0.0000～1.9999	1.0	4
V21	Work Mode	Select	Mode 1、Mode 10	Mode 1	4
V22	Backup Param	Select	YES / NO	NO	4
R	**Inter Set**				4
R10	LOGO Enable	Select	Enable/Disable	Enable	4
R11	Sensor Code	Set count	0～4294967296	0	4
R12	Meter Code	Set count	0～4294967296	0	4
R13	Language En	Select	Enable/Disable	Enable	4
R14	Language	Select	English/Turkish	English	4
R15	Line Frequency	Select	50Hz/60Hz	50Hz	4

4.2 Quick Setup Parameters

4.2.1 Language

Convertor supports 2 languages, Turkish and English, and other languages can be customized..

Note: vendors can open or prohibit language selection by " Language En " param.

4.2.2 Flow Rspns(Damping time)

It means time of filter measure value. The values range from 1 to 50 seconds. The long one can enhance the stability of flow display and output digital, and fits for gross add up of pulse flow; the short one means fast respond rate, and fits for production control.

4.2.3 Flow Unit

Instant flow unit has 24 options : m^3/s、m^3/min、m^3/h、L/s、L/min、L/h、gal/s、gal/min、gal/h、Ugal/s、Ugal/min、Ugal/h、kg/s、kg/min、kg/h、t/s、t/min、t/h、ft^3/s、ft^3/min、ft^3/h、lb/s、lb/min、lb/h.

4.2.4 Decpoint

The display precision is used to set the decimal display digit of the main display variable,

and the 0~5 bits after the decimal point are optional.

4.2.5 Flow Range

Flow range means upper limit value, and lower limit value is set “0” automatically. So, it makes the range, and makes the relation of percent display, frequency output and current output with flow:

percent display = (flow measure / measure range) * 100 %;

frequency output = (flow measure / measure range) * frequency full;

current output = (flow measure / measure range) * current full + current zero

Note: pulse output will not affect.

4.3 Basic Setup Parameters

4.3.1 Sensor Zize

Converter optional sensor diameter range: 3、6、10、15、20、25、32、40、50、65、80、100、125、150、200、250、300、350、400、450、500、600、700、800、900、1000、1200、1400、1600、1800、2000、2200、2400、2500、2600、2800、3000mm.

4.3.2 Meter factor

The meter coefficient is set up for the field users according to the actual use.

4.3.3 Total Unit

Converter display is counter with 9 bits, and the max is 999999999.

Total units are 0.001L, 0.010L, 0.100L, 1.000L, 0.001m^3, 0.010m^3, 0.100m^3, 1.000m^3 and so on. Users should select the appropriate unit based on the actual flow.Total units for display are L or m^3. The display unit and the decimal digits represent the real total unit.

Example: The forward integrated flow is 1000.12345, and total unit is 0.001m^3, the third line will display:

∑+ 1000.123 m³

4.3.4 Flow Direct

If users think the direct and design are differ, just change the direct parameter is OK, and do

not need to change exciting or signal

4.3.5 Flow Cutoff

Flow cutoff is set in percentage of Upper Limit Range of flow, and users can delete all negligible small signals of flow volume. If the flow lower than flow cutoff setting, then it will be set to 0, and the corresponding percentages, the current output signal frequency (pulse) output signal is also 0.

Note: Flow cutoff does not affect flow rate value.

4.3.6 CutOff En.

Open or close flow cutoff function.

4.3.7 1nd Line

“1nd line” is used to select the variables displayed by the first principal variable (variable displayed in large font on the first line) in the automatic measurement state. The variables available are: flow volume, flow percentage, flow rate and current.

4.3.8 2nd Line

“2nd line” is used to select the variables displayed by the second principal variable (the variable shown in small font on the third line) in the automatic measurement state. The variables available are: flow rate, flow volume, flow percentage, empty pipe ratio, forward totalize, reverse totalize, differential totalize and current.

4.4 Advance Setup parameters

4.4.1 Modbus Addr.

Electromagnetic flow converter supports RS-232/RS-485 serial communication of Modbus RTU protocol.

1) **Modbus Addr**.: optional range 01 to 247, and the default address is 1.
2) **Modbus Baud.**: 1200, 2400, 4800, 9600, 19200, 38400bps, and the default baud rate is 9600bps.

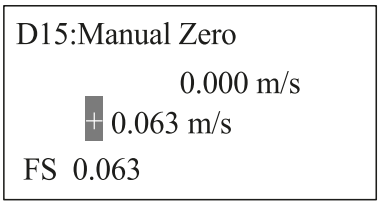
3) **Modbus Pari.**: For setting the check bits of serial ports in Modbus communication, you can choose: None (no check), Odd (odd check), Even (even check), default is None (no check).

4) **Modbus SBL**: used to set the stop bit of the serial port when Modbus communicates, can choose: 1 or 2 bits, default choice is 1 bit.

4.4.2 Manual Zero

Make sure the sensor is full of flow, and the flow is 0 (stillness). If the measurement value is not zero, users can set the flow rate to 0 through the flow zero correction.

Flow zero is shown as flow rate, m/s. Converter's zero-flow correction displays like this:



The fourth line displays the flow rate which without adjustment, the unit is m/s.

Correction method: Input the value behind FS.c to line 3.

Note: Flow zero correction value is a signed value, it should have same sign with line 4.

4.4.3 Autom. Zero

Under the same condition of manual zero correction, if the automatic zero correction function is implemented, the converter directly completes zero correction (no need to input zero correction value), and the current flow rate is modified to zero point flow rate.

4.4.4 Density

Density is used to set the density of the tested liquid, and mass flow measurement will be used to this parameter.

4.4.5 Variation restrain

Such as pulp or mud liquids, solid particles in the fluid shock measuring electrode will form

a "peak noise", in order to overcome such interference, converter using the rate of change suppression algorithm, converter design has three parameters : spike suppression allowed, spike suppression coefficient, spike suppression time, the rate of change suppression characteristics for selection.

1) Pls.Lmt En.

Set it "enable", then start variation restrain arithmetic.

2) Pls.Lmt Val.

This coefficient setting the rate of change of peak interference suppression, its value is flow rate and the unit is m/s. There are ten grades: 0.010m/s, 0.020m/s, 0030m/s, 0.050m/s, 0.080m/s, 0.100m/s, 0.200m/s, 0.300m/s, 0.500m/s, 0.800m/s. The smaller grade, the higher sensitivity of interference suppression.

Note: In the practical application, you can based on the actual situation try to multiple choices, the higher sensitivity not means the better you choose.

3) Plsnt Delay

This coefficient can select the width of time of restrain cuspidal disturb and the unit is ms. If the duration is shorter than flow change in some time, converters will think it is cuspidal disturb, and if it is longer, converters will think it is natural. It also needs to select parameter in fact.

4.4.6 Browse PSWD

" Browse PSWD " is the first level user password, the first level user can only view the instrument parameters under the menu of B, C, D, F, G, K level, and can not modify the parameter values. Only users with level 2 and above can modify the "view password".

4.4.7 Set PassWord

Set PassWord is the second level user password. The second level user can modify the instrument parameters under the menu of B, C, D, F, G and K. Only users with level 2 and above can modify the password.

4.4.8 Reset

Restore the factory settings restore the parameters in Table 4-1 to the previous backup state except current output test, pulse output test, display output test, forward total settings and reverse total settings.

4.4.9 Export param

Convertor provides pluggable external EEPROM for the import and export of instrument parameters.

Export instrument parameters refer to the parameters in Table 41 except current zero correction value, current fullness correction value, instrument coding, current output test, pulse output test and display output test, and positive and negative totalize and totalize overflow value are exported to external EEPROM. When the converter is damaged, the user only needs to replace the new converter and import the instrument parameters from the external EEPROM into the new converter, so that the instrument can resume to the user's original setting state and continue to run. At the same time, positive and negative totalize will continue to accumulate.

Note: External EEPROM needs customization.

4.4.10 Inport param

Refer to “export instrument parameters”.

4.5 Output parameters

4.5.1 Measure Mode

The measurement mode is used to select the measurement direction allowed by the converter.

1) **Forward**: only measure the positive flow (flow > 0.0); if the flow is negative, the positive and negative cumulants are not accumulated, the frequency (or pulse) output is 0, and the current output is 4 mA (or 0 mA).

2) **Reverse**: only reverse flow (flow < 0.0) is allowed; if flow is positive, the positive and

negative cumulants are not accumulated, the frequency (or pulse) output is 0, and the current output is 4 mA (or 0 mA).

3) **Forward/Reverse**: allowed forward and reverse flow measurement.

4.5.2 Iout Mode

Converter output current can be chosen by 0~10mA or 4~20mA.

4.5.3 P/AH Function Select

Upper limit alarm output, frequency output and pulse output share the same wiring terminal of P/AH, you can choose the type of the current output signal by setting the output mode.

For more details, please check the 3rd section.

4.5.4 AL function Select

Lower limit alarm output and flow direction output share the same wiring terminal of AL, you can choose the type of the current output signal by setting the output mode.

For more details, please check the 3rd section

4.5.5 Pluse Factor

Pulse factor refers to the number of pulses output corresponding to the flow of one cumulant unit, ranging from 0.001 to 1000.0.

4.5.6 Pluse Width

Pluse width refers to the width of the high level of the pulse output square wave, which ranges from 0.1 to 250.0ms.

4.5.7 Max Frequency

The frequency output range refers to the maximum value of frequency or pulse output. The unit is Hz.

4.5.8 Adjust 20mA/4mA

The current output of the converter has been corrected when it leaves the factory. If the user finds that the error is large in the process of using, it can be calibrated again. The calibration

method is referred to in the third part.

Note: the current type of 0 ~ 10mA does not need to be corrected separately.

4.6 Alarm parameters

4.6.1 Empty Pipe Alarm

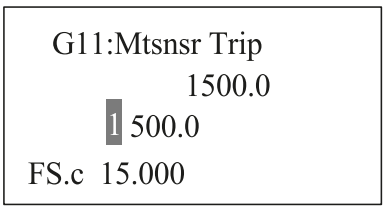
1) MtSensor En.

The state of empty pipe can be detected with the function of converter. In the case of Empty Pipe Alarm, if the pipe was empty, the signals of analog output and digital output would be zero and displayed flow would be zero, too. The flow empty pipe alarm signal FGP and  will be displayed.

2) Mtsnsr Trip

When empty pipe alarm is not accurate, the user can reset the empty pipe alarm thresholds to achieve the empty pipe alarm recalibration. Please ensure full pipe before calibration (with or without the flow rate may be), otherwise the calibration will be inaccurate.

Enter into 'Mtsnsr Trip', the LCD will display empty ratio in line 4 behind FS.c. The line 3 is empty ratio threshold setting by user. Please wait the pipes alarm threshold is stable , can set the empty pipes alarm threshold, otherwise pipes alarm correction will be not accurate. Empty pipes alarm threshold set is actual empty pipes value 10 times higher than FS.c, the recommended minimum is set to 1500. If the threshold setting is too small, it may be lead to misinformation.



Third line: the user input empty pipes alarm threshold.

Fourth line: FS.c indicate the current pipe sampling value.

4.6.2 Upper and Lower Limit Alarm

1) Alm High/Low Enable

The user selects the upper and lower limits of the alarm, or prohibits the upper and lower

limits of the alarm.

2) Alm High/Low Object

'Alm High/Low Object' are used to specify the corresponding variables of upper and lower alarm. The optional variables are: flow percentage, flow volum, differential totalize, forward totalize and reverse totalize.

3) Alm High/Low Mode

'Alm High/Low Mode' are used to specify the output levels of upper and lower alarm output terminals P/AH and AL when they are not alarmed.A detailed description can be found in the third part.

4) Alm High/Low Value

The parameter of Upper limit alarm is percentage of flow range and can be set in the way of setting one numerical value between -200.0%~200.0%.When the value of flow percentage is larger than the value of setting value, the converter outputs the alarm signal and alarm instruction **FQH/FQL**.

If P/AH and AL set the alarm output, then output corresponding alarm status.

4.6.3 Sys Alm Enable

When the converter is not contacted the excitation coil, or when the excitation coil is open, will lead to excitation alarm. The excitation alarm signal SYS and will be displayed, and the output flow is 0.

Excitation alarm function can be "Enable" or "Disable".

4.6.4 Alm Iout Enable

The current output of alarm is used to prohibit or allow the upper and lower alarm limits to fix the current output on the upper and lower alarm current values.

4.6.5 LAlarm/HAlarm Iout

'LAlarm/HAlarm Iout' is used to specify the output value of the alarm current when the alarm is on the upper and lower limits.

4.7 Total Set

4.7.1 TOT Reset

Clean up positive totalize, reverse totalize, differential totalize and totalize overflow counter, and make all values return to zero.

4.7.2 Preset positive/ reverse totalize

'TOT->F / TOT<-R' can change the positive /reverse total value, mainly for instrument maintenance and instrument replacement.

Users can modify the forward total （Σ+）and the reverse total（Σ-）by entering with a level 3 password. The total setting should not exceed the maximum value displayed by the liquid crystal (999999999).

4.7.3 Tot PassWord

The tot password corresponds to the protection password of the "Total Set" menu, and is also the password of level 3 privileges. Users with level 3 privileges and above can modify this password.

4.8 Test

4.8.1 Iout Test

Current output test is used to test whether the current output is normal or not. Iout current terminal will output the specified test value at the time of current output test.

4.8.2 Pulse Test

Pulse output test is used to test whether the pulse output is normal or not. When the pulse output test is performed, the P/AH output terminal will output the specified test value.

4.8.3 Display Test

Display output test is used to test whether the LCD display is normal or not. When performing the display output test, the LCD screen will display four lines of "1234567890ABCDEF" string.

Users can see if there is any problem with the display output.

4.9 Factory Set

4.9.1 Field Type

Converter provides three exciting frequency types: 5Hz (type 1), 4.167Hz（type 2）,3.125Hz (type 3),. The small-bore one should use 1/10 frequency, and large-bore one should use 1/12 or 1/16 frequency.

Note: Demarcate on which exciting type, working on it only. You should demarcate the converter again when you modified the ways of excitation.

4.9.2 Sensor Fact

“Sensor Fact” is printed on the Label of the sensor when it is made in factory. The “Sensor Fact” has to be set into Sensor Coefficient Parameter when it runs with converter.Sensor factor calculate formula:

Sensor factor = actual flow (rate) / measured flow (rate)

Note: Please disable ‘Line CRC Ena ‘ to turn off the non-linear correction function before you calibrate the sensor parameter, otherwise the calibration will be inaccurate.

4.9.3 Work Mode

The mode of work includes: mode 1, mode 10, choice. Mode 1 is used in most cases. Mode 10 is recommended only when the measured liquid contains particulate matter which leads to instability of measurement.

4.9.4 Sensor Code

It is referred to the produced date of sensor and the serial number of product that can keep the sensors coefficient right and accurate.

4.9.5 Backup Param

preset reverse total are backed up to the internal EEPROM. The 4 level users have backup function.

Suggestion: Make instrument parameter backup before flowmeter leaving the factory. If the user mistakenly modifies the parameters, it can be restored to the backup state by performing the "Reset" function.

4.9.6 Nonlinear correction function

1) Line CRC1,Line CRC2,Line CRC3,Line CRC1: four Correction point;
2) Line Fact1, Line Fact2, Line Fact3, Line Fact4: corresponds to the coefficient of Line CRC1,Line CRC2,Line CRC3,Line CRC1.

Nonlinear correction function is used for line regulation of flow which under 0.3m/s. This function is designed to four segments, and includes four flow velocity points and four correction factors. Nonlinear correction coefficient works on the basis of the original transducer calibration coefficient, so please turn off nonlinear correction function before calibrating the coefficient.

Flow correction coefficient calculated as:

Correction coefficient = actual flow / measured flow

Correction coefficient > 1.0 is positive correction (increase flow), correction coefficient <1.0 is negative correction (decrease flow). The correction points should keep the following relationship:

15.0m/s>= Correction point1> Correction point2> Correction point3> Correction point4> 0

Nonlinear correction points (flow rate) and correction coefficient corresponding relationship as shown in the following table:

Original flow velocity	coefficient
15.0m/s ≥ Flow rate ≥ Correction point 1	Correction coefficient 1
Correction point 1 > Flow rate ≥ Correction point 2	Correction coefficient 1 and 2 linear interpolation
Correction point 2 > Flow rate≥Correction point 3	Correction coefficient 2 and 3 linear interpolation
Correction point 3 > Flow rate≥Correction point 4	Correction coefficient 3 and 4 linear interpolation
Correction point 4 > Flow rate≥ 0.00m/s	Correction coefficient 4

Note:

In order to ensure that the flow between the correction point 1 and 15m /s is not effect by the

correction coefficient, the correction coefficient must is 1.000!!!

Application example:

Assuming the meters test the four small flow points when the nonlinear correction function is not turned on, the data is in the table below, you can see the flow rate of 4 points has bias:

Actual flow （m/s）	measured flow （m/s）
0.225	0.221
0.150	0.145
0.075	0.069

We can enable nonlinear correction function to achieve higher accuracy. Selects four points correction, and the correction points and coefficient is calculated in the following table:

	Correction point (m/s)	correction flow velocity
1	0.300	1.0 (must 1.0 ！！！)
2	0.225	1.018 (0.225 / 0.221 = 1.018)
3	0.150	1.034 (0.150 / 0.145 = 1.034)
4	0.075	1.087 (0.075 / 0.069 = 1.087)

4.10 Inter Set

4.10.1 LOGO Enable

Logo display can choose " Enable " or " Disable ", when set to " Enable ", the converter will display logo information when powered on; otherwise, the logo information will not be displayed.

4.10.2 Sensor Code

Sensor Code can be used to mark the time and number of the sensor leaving the factory matching with the converter, so as to coordinate the setting of sensor coefficients.

4.10.3 Meter Code

Meter code records the date of manufacturing and serial number of converter.

4.10.4 Language Enable

‘Language En’ allows the choice of " Enable " or " Disable ". When set to " Enable ", level 1-3

users can select the language through the "B10: Language" menu, otherwise level 1-3 users can not modify the language.

4.10.5 Language

Supports two languages in Turkish and English. When the "language En" option is set to " Enable ", the manufacturer (level 4 privileges) can change the language option through this menu, and ordinary users (level 1-3 privileges) will not be able to change the language option.

4.10.6 Line Frequency

‘Line Frequency’ is the power supply frequency (or city frequency), power frequency parameters are set to be consistent with the power supply frequency to reduce power frequency interference.

5. Troubleshooting

5.1 No display

1) Check the power supply connection;

2) Check the power fuse;

3) Check the power voltage;

5.2 Empty pipe alarm

1) Check if the signal cable is OK

2) If measured fluid full of testing pipe of sensor

3) Short circuit SIG 1, SIG 2, SGND of converter, if no “Empty Alarm” displayed then the converter works OK. In this case, it is possible that conductivity of measured fluid may be small or empty threshold of empty pipe are set wrongly. Then increases the empty pipe threshold until the empty pipe alarm disappear.

4) Check if the electrode-poles are OK or not. Resistances of SIG1 to SIGGND and SIG2 to SIGGND are all less than 50kΩ (conductivity of water) during measurement operation.

5) The DC voltage should be less than 1V between DS1 and DS2. Test the voltage by voltmeter. If DC voltage is larger than 1V, the electro poles of sensor were polluted that have to be cleaned.

5.3 Exciting alarm

1) Check if exciting cables is ok.

2) Check if the sensor electrode wiring is ok

3) If 1,2,are OK, the converter is failed

5.4 Measure flow disallow

1) Check if the ground is OK;

2) Check if the signal cable is OK；
3) If measured fluid full of testing pipe of sensor
4) Check the sensor fact coefficient and sensor zero coefficient whether set as the sensor scutcheon.

6. Appendix: The flow and the flow rate corresponding table

Flow rate (m/s) / flow(m^3/h) / caliber(mm)	0.1	1	10	15
DN10	0.02827	0.28274	2.82743	4.24114
DN15	0.06362	0.63617	6.36171	9.54257
DN20	0.11310	1.13097	11.3097	16.9645
DN25	0.17671	1.76714	17.6714	26.5071
DN32	0.28953	2.89528	28.9528	43.4293
DN40	0.45239	4.52388	45.2388	67.8583
DN50	0.70686	7.06857	70.6857	106.028
DN65	1.19459	11.9458	119.458	179.188
DN80	1.80956	18.0955	180.955	271.433
DN100	2.82743	28.2743	282.743	424.114
DN125	4.41786	44.1786	441.786	662.679
DN150	6.36172	63.6171	636.171	954.257
DN200	11.3097	113.097	1130.97	1696.45
DN250	17.6714	176.714	1767.14	2650.71
DN300	25.4468	254.468	2544.68	3817.03
DN600	101.787	1017.87	10178.7	15268.1
DN1000	282.743	2827.43	28274.3	42411.5
DN2000	1130.97	11309.7	113097	169645
DN3000	2544.69	25446.9	254468	381703

enelsan

We Measure

ModBus Protocol Manual
V1.0

Electromagnetic Flowmeter Converter

Communication Protocol (ModBus)

Electromagnetic Flowmeter Converter

Communication Protocol (Ver 1.0)

1. Overview

1.1 Protocol Overview

Electromagnetic Flowmeter Converter Communication protocol is the standard MOD-BUS-RTU mode.

Communication interface：RS-485.

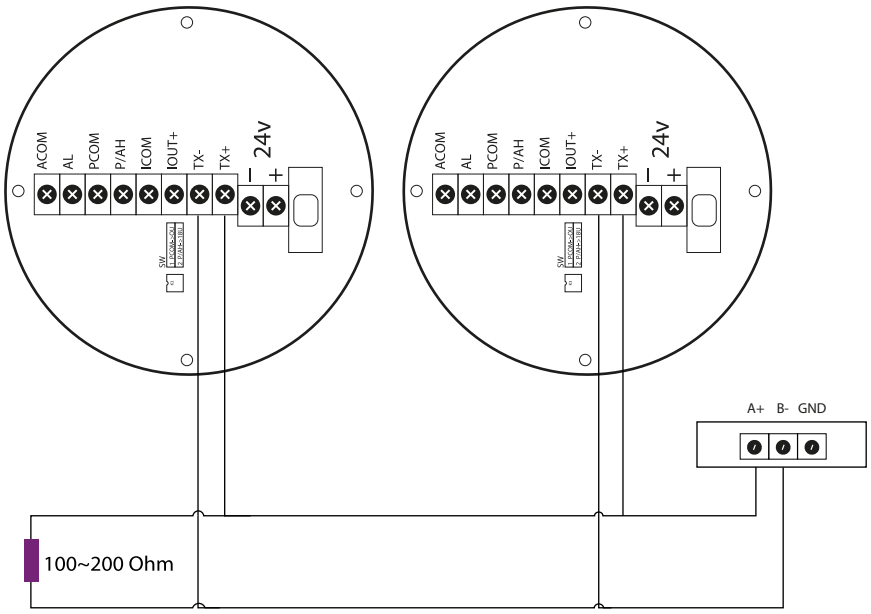
Support standard Modbus-RTU ：**Support functions codes** 03, 04, 06, 16.

Register length limit：**Functions code** 03 and 04 supports max 64 registers.

Register length limit：**Functions code** 16 support max 2 registers.

1.2 RS-485 Wiring

TX+ and TX- terminal are RS485 converter A+ and B-.



1-1

1.3 Serial Communication Parameters

The length of data bits：8

Parity check：None

Stop bits：1

Baud rate：600, 1200, 2400, 4800, 9600, 19200 bps

Address: 1 - 247。

Note: Communication address and baud rate can be changed via local adjustment.

	16			short	
Alm Low Obj	03、06、16	344	0x0158	Unsigned short	1 -- Q[%]、 3 -- Totalizer->F、 4 -- Totalizer<-R、 6 -- Q[Unit]、 5 -- Totalizer Net
AL Alm Mod	03、06、16	345	0x0159	Unsigned short	0 -- “ Active High” 1 -- “ Active Low”
Language En	03、06、16	346	0x015A	Unsigned short	0 -- Disable 1 -- Enable
LOGO Enable	03、06、16	347	0x015B	Unsigned short	0 -- Disable 1 -- Enable
Conduct En.	03、06、16	351	0x015F	Unsigned short	0 -- Disable 1 -- Enable
Worktime En.	03、06、16	352	0x0160	Unsigned short	0 -- Disable 1 -- Enable

	16			short	9 -- Mode 2、
2nd Line	03、06、16	325	0x0145	Unsigned short	0 -- V[m/s]、 1 -- Q[%], 2 -- MTP[%], 3 -- Totalizer->F, 4 -- Totalizer<-R, 5 -- Totalizer Net, 6 -- Q[Unit], 7 – mA, 9 – Cond.、
LCD Contrast	03、06、16	326	0x0146	Unsigned short	0 ～ 5
Pluse Factor	03、06、16	327	0x0147	Float	0.001～1000.0
Pluse Width	03、06、16	329	0x0149	Float	0.1～250.0ms
Density	03、06、16	331	0x014B	Float	0.1～5.0
Density Unit	03、06、16	333	0x014D	Unsigned short	0 -- “g/cm3”、 1 -- “kg/m3”、 2 -- “lb/gal”、 3 -- “lb/cf”、
Alm Iout En.	03、06、16	334	0x014E	Unsigned short	0 -- Disable 1 -- Enable
HAlarm Iout	03、06、16	335	0x014F	Float	21.5～23.0mA
LAlarm Iout	03、06、16	337	0x0151	Float	3.0～3.8mA
Write Protect	03、06、16	339	0x0153	Unsigned short	0 -- Disable 1 -- Enable
Modbus Pari.	03、06、16	340	0x0154	Unsigned short	0 -- “ None” 1 -- “ Odd” 2 -- “ Even”
Modbus SBL	03、06、16	341	0x0155	Unsigned short	1 ～ 2
Alm High Object	03、06、16	342	0x0156	Unsigned short	1 -- Q[%]、 3 -- Totalizer->F、 4 -- Totalizer<-R、 6 -- Q[Unit]、 5 -- Totalizer Net
P/AH Alm Mode	03、06、	343	0x0157	Unsigned	0 -- “ Active High” 1 -- “ Active Low”

Sys Alm Ena	03,06,16	286	0x011E	Unsigned short	0: Disable 1: Enable
Clr Sum Key	06,16	287	0x011F	Unsigned short	Total Flow Clear Password (Default 6108)
Sensor code 1	03,16	288	0x0120	Unsigned Integer	0 – 999999
Meter Factor	03,16	290	0x0122	Float	0.00 01 ～ 9.9999
Excitation type	03,06,16	292	0x0124	Unsigned short	0 -- Type 1(1/10), 1 -- Type 2(1/12, 2 -- Type 3(1/16)
Sensor Fact	03,16	293	0x0125	Float	0.0000 - 5.9999
Line CRC En.	03,06,16	295	0x0127	Unsigned short	0: Disable 1: Enable
Line CRC1	03,16	297	0x0129	Float	-15.0 - 15.0
Line Fact1	03,16	299	0x012B	Float	-15.0 - 15.0
Line CRC2	03,16	301	0x012D	Float	-15.0 - 15.0
Line Fact2	03,16	303	0x012F	Float	-15.0 - 15.0
Line CRC3	03,16	305	0x0131	Float	0.0000 - 1.9999
Line Fact3	03,16	307	0x0133	Float	0.0000 - 1.9999
Line CRC4	03,16	309	0x0135	Float	0.0000 - 1.9999
Line Fact4	03,16	311	0x0137	Float	0.0000 - 1.9999
Pls.Lmt En.	03,06,16	313	0x0139	Unsigned short	0: Disable 1: Enable
Pls.Lmt Val.	03,06,16	314	0x013A	Unsigned short	0 ～ 100%
Plsnt Delay	03,06,16	315	0x013B	Unsigned short	0 ～ 60000
Flow Display Decpoint	03,06,16	322	0x0142	Unsigned short	1 -- 1 Decpoint , 2 -- 2 Decpoint , 3 -- 3 Decpoint, 4 -- 4 Decpoint , 5 -- 5 Decpoint , 0 -- 0 Decpoint ,
AL FC Select	03,06,16	323	0x0143	Unsigned short	0 -- Lower Alarm, 1 -- Flow Firection, 2 -- Upper limit alarm , 3 -- Mtsensor Alm, 4 -- Sys Alm
Work Mode	03、 06、	324	0x0144	Unsigned	0 -- Mode 1、

					18 -- “ 0.1Ugal ”、 19 -- “ Ugal”、 20 -- “ 0.001kg ”、 21 -- “ 0.01kg ”、 22 -- “ 0.1kg ”、 23 -- “ kg”、 24 -- “ 0.001t ”、 25 -- “ 0.01t ”、 26 -- “ 0.1t ”、 27 -- “ t”、 28 -- “ 0.001Lb ”、 29 -- “ 0.01Lb ”、 30 -- “ 0.1Lb ”、 31 -- “ Lb”。
Measure Mode.	03,06,16	272	0x0110	Unsigned short	0 -- "forward"、 1 -- "forward/reverse" 2 -- "reverse"
Analog Type	03,06,16	273	0x0111	Unsigned short	0 -- 0-10mA, 1 -- 4-20mA, 2 -- 4～12～20mA, 3 -- 0～20mA
P/AH FC Sel.	03,06,16	274	0x0112	Unsigned short	0 -- Frequency, 1 -- Pulse, 2 -- Upper limit alarm , 3 -- Low limit alarm, 4 -- Direct, 5 -- Mtsensor Alm, 6 -- Sys Alm
1nd Line	03,06,16	275	0x0113	Unsigned short	0 -- Q[Unit]、 1 -- Q[%]、 6 -- V[m/s]、 7 -- mA。
Frequency Max	03,06,16	276	0x0114	Unsigned short	1 - 5000
Mtsensor Ena	03,06,16	277	0x0115	Unsigned short	0: Disable 1: Enable
Mtsnsr Trip	03,16	278	0x0116	Float	1 ～ 65535.0
Alm High Ena	03,06,16	280	0x0118	Unsigned short	0: Disable 1: Enable
Alm High Val	03,16	281	0x0119	Float	-200.0 - 200.0
Alm Low Ena	03,06,16	283	0x011B	Unsigned short	0: Disable 1: Enable
Alm Low Val	03,16	284	0x011C	Float	-200.0 - 200.0

					7 -- “ ft3/min ”、 8 -- “ ft3/h ”、 9 -- “ gal/s ”、 10 -- “ gal/min ”、 11 -- “ gal/h ”、 12 -- “ Ugal/s ”、 13 -- “ Ugal/min”、 14 -- “ Ugal/h”、 15 -- “ kg/s”、 16 -- “ kg/min”、 17 -- “ kg/h”、 18 -- “ t/s ”、 19 -- “ t/min ”、 20 -- “ t/h ”、 21 -- “ lb/s ”、 22 -- “ lb /min”、 23 -- “ lb/h ”。
Flow Range	03,16	261	0x0105	Float	0.00001 - 99999
Damping	03,16	263	0x0107	Float	0.0～50.0S, damping
Flow	03,06,16	265	0x0109	Unsigned short	0 -- Forward 1 -- Reverse
Flow	03,16	266	0x010A	Float	-9999 - 9999
Flow Cutoff	03,16	268	0x010C	Float	0 - 99
Cut Disp Ena	03,06,16	270	0x010E	Unsigned short	0: Disable 1: Enable
Total Unit	03,06,16	271	0x010F	Unsigned short	0 -- “ 0.001m3” 1 -- “ 0.01m3” 2 -- “ 0.1m3” 3 -- “ m3” 4 -- “ 0.001L” 5 -- “ 0.01L” 6 -- “ 0.1L” 7 -- “ L” 8 -- “ 0.001ft3 ” 9 -- “ 0.01ft3 ” 10 -- “ 0.1ft3 ” 11 -- “ ft3 ” 12 -- “ 0.001gal ” 13 -- “ 0.01gal ” 14 -- “ 0.1gal ” 15 -- “ gal” 16 -- “ 0.001Ugal ”、 17 -- “ 0.01Ugal ” 18 -- “ 0.1Ugal ” 19 -- “ Ugal ” 20 -- “ 0.001lb ” 21 -- “ 0.01lb ” 22 -- “ 0.1lb ” 23 -- “ lb ”

				short	State Bit1: Excitation alarm State Bit2: High Flow Limit Alarm State Bit3: Low Flow Limit Alarm State Bit4-Bit15: Reserve。 Bits define： 1 -- Alarm 0 – No Alarm
Flow rate	04	778	0x030A	float	＼
Flow percent	04	780	0x030C	float	＼
Empty Pipe Ratio	04	782	0x030E	float	＼
Reverse Total Overflow Count	04	784	0x0310	Unsigned Integer	0 - 65535
Forward Total Overflow Count	04	786	0x0312	Unsigned Integer	0 - 65535
Differential Total Overflow Count	04	788	0x0314	Integer	0 - 65535
Conductivity	04	812	0x032C	float	＼
WorkTime	04	814	0x032E	float	＼

3.4 Holding Register

Note: Uses the Modbus RTU standard protocol addressing mode, register address begin from 0x0000.

Parameter name	Funcion Code	Register Address		Data Type	Value Range
		Dec	Hex		
Language	03,06,16	256	0x0100	Unsigned short	0 -- English, 1 -- Chinese
Slave MODBUS Address	03,06,16	257	0x0101	Unsigned short	1 - 247
Baud Rate	03,06,16	258	0x0102	Unsigned short	1200、2400、4800、9600、19200、38400
Sensor Size	03,06,16	259	0x0103	Unsigned short	3 ～ 3000mm
Flow unit	03,06,16	260	0x0104	Unsigned short	0 -- “ m³/s ” 、 1 -- “ m³/m” 、 2 -- “ m³/h ” 、 3 -- “ L/s ” 、 4 -- “ L/m” 、 5 -- “ L/h ” 、 6 -- “ ft3/s ”、

					14 -- “ 0.1gal ” 15 -- “ gal ”、 16 -- “ 0.001Ugal ”、 17 -- “ 0.01Ugal ” 18 -- “ 0.1Ugal ” 19 -- “ Ugal” 20 -- “ 0.001kg ” 21 -- “ 0.01kg ” 22 -- “ 0.1kg ” 23 -- “ kg” 24 -- “ 0.001t ” 25 -- “ 0.01t ” 26 -- “ 0.1t ” 27 -- “ t” 28 -- “ 0.001Lb ” 29 -- “ 0.01Lb ” 30 -- “ 0.1Lb ” 31 -- “ Lb”; Low Byte：Flow Unit 0 -- “ m³/s ” 、 1 -- “ m³/m” 、 2 -- “ m³/h ” 、 3 -- “ L/s ” 、 4 -- “ L/m” 、 5 -- “ L/h ” 、 6 -- “ ft3/s ”、 7 -- “ ft3/min ”、 8 -- “ ft3/h ”、 9 -- “ gal/s ”、 10 -- “ gal/min ”、 11 -- “ gal/h ”、 12 -- “ Ugal/s ”、 13 -- “ Ugal/min”、 14 -- “ Ugal/h ”、 15 -- “ kg/s ”、 16 -- “ kg/min”、 17 -- “ kg/h”、 18 -- “ t/s ”、 19 -- “ t/min ”、 20 -- “ t/h ”、 21 -- “ lb/s ”、 22 -- “ lb/min ”、 23 -- “ lb/h ”。
Flow	04	775	0x0307	float	＼
Alarm Flag	04	777	0x0309	Unsigned	Bit0: Empty Pipe Alarm

Bits sequence	Bit15…Bit8	Bit7…Bit0

5) Unsigned short Type (2 Bytes Unsigned Integer)

Transmission sequence	**Data1**	**Data2**
Bits sequence	Bit15…Bit8	Bit7…Bit0

3.2 Register Address Instructions

Modbus register address coding is generally divided into two types: Modbus RTU standard protocol addressing mode, PLC addressing mode (such as: Modicon company, GE companies).

Uses the Modbus RTU standard protocol addressing mode, register address begin from 0x0000. If the PC software uses the PLC addressing mode (register address begin from 0x0001), the input register address should plus 1. This kind of equipment in the transmitting message before the register address of minus 1, such as: access to the 0x0001 register, the sent message register address 0x0000.

3.3 Input Register

Note: Uses the Modbus RTU standard protocol addressing mode, register address begin from 0x0000.

Parameter name	**Function Code**	**Register Address**		**Data Type**	**Value Range**
		Dec	**Hex**		
Differential Total Flow	04	768	0x0300	Integer	-999999999 - 999999999
Reverse Total Flow	04	770	0x0302	Unsigned Integer	0 - 999999999
Forward Total Flow	04	772	0x0304	Unsigned Integer	0 - 999999999
Unit (Total unit and Flow unit)	04	774	0x0306	Unsigned short	High Byte：Total Unit 0 – “ 0.001m3” 1 -- “ 0.01m3” 2 -- “ 0.1m3” 3 -- “ m3” 4 -- “ 0.001L” 5 -- “ 0.01L” 6 -- “ 0.1L” 7 -- “ L” 8 -- “ 0.001ft3 ” 9 -- “ 0.01ft3 ” 10 -- “ 0.1ft3 ” 11 -- “ ft3” 12 -- “ 0.001gal ” 13 -- “ 0.01gal ”

Example：

If you want to set the converter range to 424.00, the register start address is 261 (0x0105). The float format is 4 bytes IEEE-754. Then 424.0 should be 0x43, 0xD4, 0x00, 0x00.

Request		Response	
Domain name	**Data (Hex)**	**Domain name**	**Data (Hex)**
Device Address	20	Device Address	20
Function Code	10	Function Code	10
Register Address High Byte	01	Register Address High Byte	01
Register Address Low Byte	05	Register Address Low Byte	05
Register Count High Byte	00	Register Count High Byte	00
Register Count Low Byte	02	Register Count Low Byte	02
Byte Count	04	CRC Check Code Byte0	56
Register(0x1005) Values High Byte	43	CRC Check Code Byte1	84
Register(0x1005) Values Low Byte			
Register(0x1006) Values High Byte			
Register(0x1006) Values Low Byte	00		
CRC Check Code Byte0	C4		
CRC Check Code Byte1	80		

3. Parameters

3.1 Data Type

1) Float Type (4 Bytes IEEE-754 Format Float)

Transmission sequence	**Data1**	**Data2**	**Data3**	**Data4**
Bits sequence	Bit31…Bit24	Bit23…Bit16	Bit15…Bit8	Bit7…Bit0

2) Integer Type (4 Bytes Signed Integer)

Transmission sequence	**Data1**	**Data2**	**Data3**	**Data4**
Bits sequence	Bit31…Bit24	Bit23…Bit16	Bit15…Bit8	Bit7…Bit0

3) Unsigned Integer Type (4 Bytes Unsigned Integer)

Transmission sequence	**Data1**	**Data2**	**Data3**	**Data4**
Bits sequence	Bit31…Bit24	Bit23…Bit16	Bit15…Bit8	Bit7…Bit0

4) Short Type (2 Bytes Signed Integer)

Transmission sequence	**Data1**	**Data2**

Device Address	20	Device Address	20
Function Code	6	Function Code	6
Start Register Address High Byte	01	Start Register Address High Byte	01
Start Register Address Low Byte	04	Start Register Address Low Byte	04
Register Values High Byte	00	Register Values High Byte	44
Register Values Low Byte	02	Register Values Low Byte	02
CRC Check Code Byte0	03	CRC Check Code Byte0	73
CRC Check Code Byte1	A6	CRC Check Code Byte1	A7

2.4 Write Holding Registers (Function Code 16)

Support function code 16 to write max 2 holding registers for 4 bytes format data. **Request frame:**

Device Address	1 Byte	1 - 247
Function Code	1 Byte	16
Start Register Address	2 Bytes	256 ～ 347
Register Count	2 Bytes	N* = 1-2
Byte Count	1 Byte	N* x 2
Register Values	N* x 2 Bytes	Data
CRC Check	2 Bytes	XX XX

***N** = Register Count

The correct response frame：

Device Address	1 Byte	1 - 247
Function Code	1 Byte	16
Start Register Address	2 Bytes	256 ～ 347
Register Count	2 Bytes	1-2
CRC Check	2 Bytes	XX XX

Error response frame:

Device Address	1 Byte	1-247
Function Code	1 Byte	**144**
Error Code	1 Byte	1 or 2 or 3 or 4
CRC Check	2 Bytes	XX XX

Register Address Low Byte	04	Register(0x0304) Values High Byte	00
Register Count High Byte	00	Register(0x0304) Values Low Byte	00
Register Count Low Byte	03	Register(0x0305) Values High Byte	04
CRC Check Code Byte0	F7	Register(0x0305) Values Low Byte	D2
CRC Check Code Byte1	3F	Register(0x0306) Values High Byte	04
		Register(0x0306) Values Low Byte	03
		CRC Check Code Byte0	17
		CRC Check Code Byte1	0A

2.3 Set Single Holding Registers (Function Code 06)

Request frame:

Device Address	1 Byte	1 - 247
Function Code	1 Byte	6
Start Register Address	2 Bytes	256 ～ 347
Register Values	2 Bytes	Data
CRC Check	2 Bytes	XX XX

The correct response frame：

Device Address	1 Byte	1 - 247
Function Code	1 Byte	6
Start Register Address	2 Bytes	256 ～ 347
Register Values	2 Bytes	Data
CRC Check	2 Bytes	XX XX

Error response frame:

Device Address	1 Byte	1-247
Function Code	1 Byte	**134**
Error Code	1 Byte	1 or 2 or 3 or 4
CRC Check	2 Bytes	XX XX

Example：

If you want to change the flow unit to m^3/h (unit code = 2) , the register start address is 260 (0x0104).

Request		**Response**	
Domain name	**Data (Hex)**	**Domain name**	**Data (Hex)**

CRC Check Code Byte0	D3	Register (0x0106) Values Low Byte	00
CRC Check Code Byte1	47	CRC Check Code Byte0	9E
		CRC Check Code Byte1	8D

2.2 Read Input Registers (Function Code 04)

Function 04 can access max 64 consecutive holding registers. The frame as follows:

Request frame:

Device Address	1 Byte	1 - 247
Function Code	1 Byte	4
Start Register Address	2 Bytes	768 ～ 788
Register Count	2 Bytes	1 - 64
CRC Check	2 Bytes	XX XX

The correct response frame：

Device Address	1 Byte	1- 247
Function Code	1 Byte	4
Bytes Count	1 Byte	N* x 2
Register Values	N* x 2 Bytes	Data
CRC Check	2 Bytes	XX XX

***N** = Register Count

Error response frame:

Device Address	1 Byte	1-247
Function Code	1 Byte	**132**
Error Code	1 Byte	1 or 2 or 3 or 4
CRC Check	2 Bytes	XX XX

Example：

If you want to read the positive total flow and unit, the register start address is 772 (0x0304), assume the positive total flow value is 1234. The data format is long. Then 1234 should be 0x00,0x00,0x04,0xD2. And assume total flow unit is 0.001L(unit code = 4), the flow unit is L/s (unit code = 3).

Request		**Response**	
Domain name	**Data (Hex)**	**Domain name**	**Data (Hex)**
Device Address	20	Device Address	20
Function Code	04	Function Code	04
Register Address High Byte	03	Bytes Count	06

2. Modbus RTU Protocol

2.1 Read Holding Registers (Function Code 03)

Function 03 can access max 64 consecutive holding registers. The frame as follows:

Request frame:

Device Address	1 Byte	1 - 247
Function Code	1 Byte	**3**
Start Register Address	2 Bytes	256 ～ 347
Register Count	2 Bytes	1 - 64
CRC Check	2 Bytes	XX XX

The correct response frame：

Device Address	1 Byte	1- 247
Function Code	1 Byte	**3**
Bytes Count	1 Byte	N* x 2
Register Values	N* x 2 Bytes	Data
CRC Check	2 Bytes	XX XX

***N** = Register Count

Error response frame:

Device Address	1 Byte	1-247
Function Code	1 Byte	**131**
Error Code	1 Byte	1 or 2 or 3 or 4
CRC Check	2 Bytes	XX XX

Example：

If you want to read the converter range, the register start address is 261 (0x0105), assume the range value is 424.00. The float format is 4 bytes IEEE-754. Then 424.0 should be 0x43, 0xD4, 0x00, 0x00.

Request		**Response**	
Domain name	**Data (Hex)**	**Domain name**	**Data (Hex)**
Device Address	20	Device Address	20
Function Code	03	Function Code	03
Register Address High Byte	01	Bytes Count	04
Register Address Low Byte	05	Register(0x0105) Values High Byte	43
Register Count High Byte	00	Register(0x0105) Values Low Byte	D4
Register Count Low Byte	02	Register(0x0106) Values High Byte	00