4. Protocols

§4.1

TDS-100M has an non-isolated serial ports, RS485

TDS-100M can support three different communication protocols at the same time, that is MODBUS, the Fuji Extended Protocol and the Easy-to-Use Water Meter Protocol

MODBUS is a very commonly used industrial protocol. Both the RTU and the ASCII format of MODBUS can be supported

the Fuji Extended Protocol is developed based on the protocol used in a Japanese ultrasonic flow meter. The extended protocol is compatible with that of Version 7 flow meter made by Hipeak.

The Easy-to-Use Water Meter Protocol is compatible with the water meters made by Hipeak and the water meters made by Huizhong Instruments.

TDS-100M can even be used as a sample RTU terminal. The 4-20mA output in the TDS-100M can be used to open an analog proportional valve; The OCT output can be used to control the turn-on and turn-off of other devices such as a pump. The analog input can be used to input pressure or temperatures signals.

That the hardware allows a MODEM to be connected directly to the RS232 port will make it very easy to setup a flow SCADA by means of PTN. While with the RS485 port, TDS-100M can be directly connected to a network based on RS485 bus. By use of a GSM module, flow data can be obtained by use of a mobile phone.

There is a programmable device address (or ID number) located at window M46 to make the flow meter be easily used in a SCADA system. If there are more than two flow meters be used in a network, the prefix W should be used before every command.

The data link can be RS232C (0-15 meters) or RS485 (0-1000meters) when the distance is short. When the distance is over 1 km, the data link can be a kind of current loop, radio, MODEM, GSP or GPRS.

When TDS-100M is used in a network, all the parameters of the flow meter can be programmed through the network, except the device address that needs the keypad.

At most occasions, data should be obtained by polling the flow mete with a command, the flow meter will respond with what the master asks.

The TDS-100M has a special command sets to facilitate the use of the flow meter in a GSM network.

§4.2 The MODBUS protocol

Both the two formats of the MODBUS protocol can be supported.

A software switch located at the window number 63(shorted as M63 after) select

MODBUS-ASCII or MODBUS-RTU will be in functioning.

The default option is MODBUS-ASCII format.

TDS-100M can only support MODBUS functions code 3 and code 6, i.e. reading registers and writing a register.

For example, reading the registers from REG0001 to REG0010 in the unit #1 (ultrasonic flow meter) under the MODBUS-RTU format, the command could be as following

01 03 00 00 00 0A C5 CD （hex）

Unit Function start REG Numbers of REGs Check-sum

While under the MODBUS-ASCII format, the command could be

:01030000000AF2(CR and LF)

Details about the standard MODBUS protocol will not be studied in this manual, please the users find them on other related materials.

By default, the RS232/RS485 will be setup with 9600,none,8,1(9600bd，none parity，8 data bits， 1 stop bit)

§4.2.1 MODBUS REGISTERS TABLE

MODBUS REGISTERS TABLE for TDS-100M

（please take notice the difference with the water meter MODBUS table）

REGISTER	NUMBER	VARIABLE NAME	FORMAT	NOTE
0001-0002	2	Flow Rate	REAL4	REAL4 is a format of Singular IEEE-754 number, also called FLOAT
0003-0004	2	Energy Flow Rate	REAL4	
0005-0006	2	Velocity	REAL4	
0007-0008	2	Fluid sound speed	REAL4	
0009-0010	2	Positive accumulator	LONG	Long integer, lower byte first
0011-0012	2	Positive decimal fraction	REAL4	
0013-0014	2	Negative accumulator	LONG	
0015-0016	2	Negative decimal fraction	REAL4	
0017-0018	2	Positive energy accumulator	LONG	
0019-0020	2	Positive energy decimal fraction	REAL4	
0021-0022	2	Negative energy accumulator	LONG	
0023-0024	2	Negative energy decimal fraction	REAL4	
0025-0026	2	Net accumulator	LONG	
0027-0028	2	Net decimal fraction	REAL4	
0029-0030	2	Net energy accumulator	LONG	
0031-0032	2	Net energy decimal fraction	REAL4	
0033-0034	2	Temperature #1/inlet	REAL4	
0035-0036	2	Temperature #2/outlet	REAL4	
0037-0038	2	Analog input AI3	REAL4	
0039-0040	2	Analog input AI4	REAL4	
0041-0042	2	Analog input AI5	REAL4	
0043-0044	2	Current input at AI3	REAL4	In unit mA

0045-0046	2	Current input at AI3	REAL4	In unit mA
0047-0048	2	Current input at AI3	REAL4	In unit mA
0049-0050	2	System password	BCD	Writable。00H for unlock
0051	1	Password for hardware	BCD	Writable。“A55Ah” for unlock
0053-0055	3	Calendar (date and time	BCD	Writable。6 Bytes of BCD stands SMHDMY，lower byte first
0056	1	Day+Hour for Auto-Save	BCD	Writable。For example 0512H stands Auto-save on 12:00 on 5th。0012H for 12:00 on everyday。
0059	1	Key to input	INTEGER	Writable
0060	1	Go to Window #	INTEGER	Writable。
0061	1	LCD Back-lit lights for	INTEGER	Writable。In unit second
0062	1	Times for the beeper	INTEGER	Writable。Max 255
0062	1	Pulses left for OCT	INTEGER	Writable。Max 65535
0072	1	Error Code	BIT	16bits, see note 4
0077-0078	2	PT100 resistance of inlet	REAL4	In unit Ohm
0079-0080	2	PT100 resistance of outlet	REAL4	In unit Ohm
0081-0082	2	Total travel time	REAL4	In unit Micro-second
0083-0084	2	Delta travel time	REAL4	In unit Nino-second
0085-0086	2	Upstream travel time	REAL4	In unit Micro-second
0087-0088	2	Downstream travel time	REAL4	In unit Micro-second
0089-0090	2	Output current	REAL4	In unit mA
0092	1	Working step and Signal Quality	INTEGER	The high byte is the step and low for signal quality，range 00-99，the larger the better.
0093	1	Upstream strength	INTEGER	Range 0-2047
0094	1	Downstream strength	INTEGER	Range 0-2047
0096	1	Language used in user interface	INTEGER	0 : English，1:Chinese
0097-0098	2	Rate of measured travel time by calculated.	REAL4	Normal 100+-3%
0099-0100	2	Reynolds number	REAL4	
0101-0102	2	Pipe Reynolds factor	REAL4	
0103-0104	2	Working Timer	LONG	unsigned，in second
0105-0106	2	Total working time	LONG	unsigned，in second
0105-0106	2	Total power on-off time	LONG	unsigned

0113-0114	2	Net accumulator	REAL4	In Cubic Meter，float
0115-0116	2	Positive accumulator	REAL4	In Cubic Meter，float
0117-0118	2	Negative accumulator	REAL4	In Cubic Meter，float
0119-0120	2	Net energy accumulator	REAL4	In Cubic Meter，float
0121-0122	2	Positive energy accumulator	REAL4	In Cubic Meter，float
0123-0124	2	Negative energy accumulator	REAL4	In Cubic Meter，float
0125-0126	2	Flow for today	REAL4	In Cubic Meter，float
0127-0128	2	Flow for this month	REAL4	In Cubic Meter，float
0129-0130	2	Manual accumulator	LONG	
0131-0132	2	Manual accumulator decimal fraction	REAL4	
0133-0134	2	Batch accumulator	LONG	
0135-0136	2	Batch accumulator decimal fraction	REAL4	
0137-0138	2	Flow for today	LONG	
0139-0140	2	Flow for today decimal fraction	REAL4	
0141-0142	2	Flow for this month	LONG	
0143-0144	2	Flow for this month decimal fraction	REAL4	
0145-0146	2	Flow for this year	LONG	
0147-0148	2	Flow for this year decimal fraction	REAL4	
0158	1	Current window	INTEGER	
0165-0166	2	Failure time	LONG	In unit second
0173-0174	2	Current output frequency	REAL4	
0175-0176	2	Current output with 4-20mA	REAL4	
0181-0182	2	Temperature difference	REAL4	
0183-0184	2	Lost flow	REAL4	
0185-0186	2	Clock coefficient	REAL4	Should less than 0.1
0187-0188	2	Total time for Auto-Save	REAL4	Time to save by 0056
0189-0190	2	POS flow for Auto-Save	REAL4	Time to save by 0056
0191-0192	2	Flow rate for Auto-Save	REAL4	Time to save by 0056
0221-0222	2	Inner pipe diameter	REAL4	In millimeter
0229-0230	2	Upstream delay	REAL4	In microsecond
0231-0232	2	Downstream delay	REAL4	In microsecond
0233-0234	2	Calculated travel time	REAL4	In microsecond
0257-0288	32	LCD buffer	BCD	
0289	1	LCD buffer pointer	INTEGER	
0311	2	Worked time for today	LONG	Unsigned, in seconds
0313	2	Worked time for this month	LONG	Unsigned, in seconds
1437	1	Unit for flow rate	INTEGER	See note 5
1438	1	Unit for energy totalizer	INTEGER	0=GJ 1=Kcal
1439	1	Multiplier for accumulator	INTEGER	Range 0~7,see note 1
1440	1	Multiplier for energy accumulator	INTEGER	Range 0~10,see note 1
1441	1	Unit for energy flow rate	INTEGER	0=GJ/h ， 1=Kcal/h
1442	1	Device address	INTEGER	
1451	2	User scale factor	REAL4	

1521	2	Manufacturer scale factor	REAL4	Read only
1523	1	Multiplier for accumulator	INTEGER	Same address with
1524	1	Multiplier for energy accumulator	INTEGER	water meter, but has different meaning
1525	1	Unit for energy accumulator	INTEGER	
1529	2	Electronic serial number	BCD	High byte first

Note：（1） The internal accumulator is been presented by a LONG number for the integer part together with a REAL number for the decimal fraction. In general uses, only the integer part needs to be read. Reading the fraction can be omitted. The final accumulator result has a relation with unit and multiplier. Assume N stands for the integer part (for the positive accumulator, the integer part is the content of REG 0009, 0010, a 32-bits signed LONG integer,), Nf stands for the decimal fraction part (for the positive accumulator, the fraction part is the content of REG 0011, 0012, a 32-bits REAL float number,), n stands for the flow multiplier (REG 1439).

then

The final positive flow rate=$(N+Nf) \times 10^{n-3}$ (in unit decided by REG 1439)。

The meaning of REG 1439 which has a range of 0~7 is as following:

0	cubic meter	(m3)
1	liter	(L)
2	American gallon	(GAL)
3	imperial gallon	(IGL)
4	American million gallon	(MGL)
5	Cubic feet	(CF)
6	American oil barrel	(1 barrel =42gallon) (OB)
7	Imperial oil barrel	(IB)

While

The energy flow rate =$(N+Nf) \times 10^{n-4}$（unit decided by REG 1440)。

(2) Other variables are not given here. Call us if you have a need.

(3) Please note there are many of the data that is not applicable for the non-energy measurement users. These none-energy-related registers only serves for the intension of only one unique register table provided both with flow meter and energy meat.

（4）Meaning in error code

Bit0 no received signal
Bit1 low received signal
Bit2 poor received signal
Bit3 pipe empty
Bit4 hardware failure
Bit5 receiving circuits gain in adjusting
Bit6 frequency at the frequency output over flow
Bit7 current at 4-20mA over flow
Bit8 RAM check-sum error
Bit9 main clock or timer clock error
Bit10 parameters check-sum error

Bit11 ROM check-sum error
Bit12 temperature circuits error
Bit13 reserved
Bit14 internal timer over flow
Bit15 analog input over range

Please try to override these energy-related bits first when in flow-only measurement,（5）Unit code for flow rate

0	Cubic meter/second	1	Cubic meter /minute	2	Cubic meter /hour	3	Cubic meter /day
4	liter/second	5	liter /minute	6	liter /hour	7	liter /day
8	American gallon/second	9	American gallon /minute	10	American gallon /hour	11	American gallon /day
12	Imperial gallon/second	13	Imperial gallon /nimute	14	Imperial gallon /hour	15	Imperial gallon /day
16	American million gallon/second	17	American million gallon /minute	18	American million gallon /hour	19	American million gallon/day
20	Cubic feet/second	21	Cubic feet/minute	22	Cubic feet/hour	23	Cubic feet/day
24	American oil barrel/second	25	American oil barrel/minute	26	American oil barrel/hour	27	American oil barrel/day
28	Imperial oil barrel/second	25	Imperial oil barrel/minute	26	Imperial oil barrel/hour	27	Imperial oil barrel/day

§4.2.2 REGISTER TABLE for the DATE accumulators

（1） REGISTER for accumulators by day

Accumulator data for every past day are stored in a loop queue. Every day has 16 bytes of data and there are 128 days in total. The current pointer which has a range of 0~127 for the day is in REG 0162. if the pointer is decreased by 1 when the pointer is 0, then new pointer value will be 127. Assume REG 0162= 1, the data for yesterday are in REG 3337~3344, the data for day before yesterday are in REG3329-3336, and the data for day of 2 days ago are in REG 4345-4352.

REGISTER TABLE for the DAY accumulators

block No	Register	number	variable	format	note
n/a	0162	1	Data pointer	Integer	Range:0~127
	3329	1	Day and Error Code	BCD	Day in high byte
	3330	1	Month and year	BCD	Year in high byte
0	3331-3332	2	Total working time	LONG	
	3333-3334	2	Net total flow for the day	REAL4	
	3335-3336	2	Net total energy for the day	REAL4	
	3337	1	Day and Error Code	BCD	Day in high byte
	3338	1	Month and year	BCD	Year in high byte

1	3339-3340	2	Total working time	LONG	
	3341-3342	2	Net total flow for the day	REAL4	
	3343-3344	2	Net total energy for the day	REAL4	
◦◦◦◦	◦◦◦◦◦◦◦◦◦◦	◦◦◦◦◦◦	◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦	◦◦◦◦◦◦	◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦
127	4345-4352	8			Data block No.127

note: see the meaning of the error code above.

（2） REGISTER for accumulators by month

The structure of month accumulator is the same as that of the day， please refer to related paragraph。 The difference is there are only 63 data blocks for the month accumulator, and day variable always has a value of 0.

REGISTER TABLE for the month accumulators

block No	Register	number	variable	format	Note
n/a	0163	1	Data pointer for the month	Integer	Range: 0~63
	2817	1	Error Code	BCD	
	2818	1	Month and year	BCD	Year in high byte
0	2819-2820	2	Total working time	LONG	
	2821-2822	2	Net total flow for the month	REAL4	
	2823-2824	2	Net total energy for the month	REAL4	
	2825	1	Error Code	BCD	
	2826	1	Month and year	BCD	Year in high byte
1	2827-2828	2	Total working time	LONG	
	2829-2830	2	Net total flow for the month	REAL4	
	2831-2832	2	Net total energy for the month	REAL4	
◦◦◦◦	◦◦◦◦◦◦◦◦◦◦	◦◦◦◦◦◦	◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦	◦◦◦◦◦◦	◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦◦
63	3321-3328	8			Data block No. 63

（3） There is no direct data for the year, data for the year could be conducted from the data of the months.

§4.2.3 REGISTERs for power-on and power-off

With every t power-on and power-off, the new generation flow meter will record data about the time, duration, statue byte and the flow rate into a data block. Every data block consists 32 bytes of data. There are as many as 32 blocks of data can be recorded, for 32 times of power-on and 32 times of power-off. The data blocks are in a structure of loop queue. The 33rd data block will override the first block by default. The location of the current block is presented in the data pointer. The current power-on data block is pointed by the decease by 1 of the pointer.

MODBUS registers table for the power-on and power-off.

block No	Register	No.	variable	format	Note
n/a	0164	1	Pointer	Integer	Range:0~31
	4353	1	Power-on second and minute	BCD	Second in low byte, minute in high
0	4354	1	Power-on hour and day	BCD	Hour in low byte, day in high
	4355	1	Power-on month and year	BCD	Month in low byte, year in high
	4356	1	Power-on error code	BIT	B15 stand for corrected lost flow.
	4357	1	Power-off second and minute	BCD	Second in low byte, minute in high
	4358	1	Power-off hour and day	BCD	Hour in low byte, day in high
	4359	1	Power-off month and year	BCD	Month in low byte, year in high
	4360	1	Power-off error code	BIT	B15 stand for corrected lost flow
	4361-4362	2	Flow rate when power on	REAL4	Flow rate after 60 seconds when power on
	4363-4364	2	Flow rate when power off	REAL4	
	4365-4366	2	Time duration when off	LONG	In seconds
	4367-4368	2	Corrected lost flow when off	REAL4	In cubic meters
	4369	1	Power-on second and minute	BCD	Second in low byte, minute in high
1	4370	1	Power-on hour and day	BCD	Hour in low byte, day in high
	4371	1	Power-on month and year	BCD	Month in low byte, year in high
	4372	1	Power-on error code	BIT	B15 stand for corrected lost flow.
	4373	1	Power-off second and minute	BCD	Second in low byte, minute in high
	4374	1	Power-off hour and day	BCD	Hour in low byte, day in high
	4375	1	Power-off month and year	BCD	Month in low byte, year in high
	4376	1	Power-off error code	BIT	B15 stand for corrected lost flow
	4377-4378	2	Flow rate when power on	REAL4	Flow rate after 60 seconds when power on
	4379-4380	2	Flow rate when power off	REAL4	
	4381-4382	2	Time duration when off	LONG	In seconds
	4383-4384	2	Corrected lost flow when off	REAL4	In cubic meters
……	……	……		……	……
31	4849-4864	16			The 32nd block

§4.3 The FUJI extended communication protocol

TDS-100M uses the compatible FUJI extended communication protocol with our previous Version7 ultrasonic flow meter, except the commands in red lines in the following table.

Command	Meaning	Data format
DQD(cr) note 0	Returns flow rate per day	±d.dddddE±dd(cr) note 1
DQH(cr)	Returns flow rate per hour	±d.dddddE±dd(cr)
DQM(cr)	Returns flow rate per minute	±d.dddddE±dd(cr)
DQS(cr)	Returns flow rate per second	±d.dddddE±dd(cr)
DV(cr)	Returns fluid velocity	±d.dddddE±dd(cr)
DI+(cr)	Returns positive totalizer	±ddddddE±d(cr)note 2
DI-(cr)	Returns negative totalizer	±ddddddE±d(cr)
DIN(cr)	Returns net totalizer	±ddddddE±d(cr)
DIE(cr)	Returns net energy totalizer	±ddddddE±d(cr)
DIE+(cr)	Returns positive energy totalizer	±ddddddE±d(cr)
DIE-(cr)	Returns negtive energy totalizer	±ddddddE±d(cr)
DIT(cr)	Returns net total flow for today	±ddddddE±d(cr)
DIM(cr)	Returns net total flow for this month	±ddddddE±d(cr)
DIY(cr)	Returns net total flow for this year	±ddddddE±d(cr)
DID(cr)	Returns the ID number/address	ddddd(cr) 5 bytes long
E(cr)	Return energy flow rate per hour	±d.dddddE±dd(cr)
DL(cr)	Returns the signal strength	UP:dd.d,DN:dd.d,Q=dd(cr)
DS(cr)	Returns percentage of AO output	±d.dddddE±dd(cr)
DC(cr)	Returns current error code	Note 3
DA(cr)	OCT and RELAY output	TR:s,RL:s(cr)note 4
DT(cr)	Returns the current date and time	yy-mm-dd,hh:mm:ss(cr)
Time@TDS1=(cr)	Set date and time yy-mm-dd,hh:mm:ss	
M@(cr)	Mimic key input. @ presents a key	M@(cr)note 5
LCD(cr)	Returns current window display	
LOCK0(cr)	Unlock the system	Has nothing to do with the original password.
LOCK1(cr)	Lock the system	Can be opened by press ENT key
MENUXX(cr)	Go to window XX	
C1(cr)	OCT turns on	
C0(cr)	OCT turns off	
R1(cr)	RELAY(OCT2) turns on	
R0(cr)	RELAY(OCT2)turns off	

FOdddd(cr)	Output n Hz at frequency output	Fdddd(cr)(lf)
AOa(cr)	Output a mA current at AO output	AOa(cr)(lf)Note 6
BA1(cr)	Return the resistance for T1	±d.dddddE±dd(cr)(lf)
BA2(cr)	Return the resistance for T2	±d.dddddE±dd(cr)(lf)
BA3(cr)	Returns the current (0~20mA) at AI3	±d.dddddE±dd(cr)(lf)
BA4(cr)	Returns the current (0~20mA) at AI4	±d.dddddE±dd(cr)(lf)
BA5(cr)	Returns the current (0~20mA) at AI5	±d.dddddE±dd(cr)(lf)
AI1(cr)	Returns the temperature at T1 input	±d.dddddE±dd(cr)(lf)
AI2(cr)	Returns the temperature at T2 input	±d.dddddE±dd(cr)(lf)
AI3(cr)	Returns the value for AI3	±d.dddddE±dd(cr)(lf)
AI4(cr)	Returns the value for AI4	±d.dddddE±dd(cr)(lf)
AI5(cr)	Returns the value for AI5	±d.dddddE±dd(cr)(lf)
ESN(cr)	Returns the ESN number	ddddddd(cr)(lf) note 7
N	Prefix for single byte addressing network	Note 8
W	Prefix for ID string addressing network	Note 8
P	Prefix to returns with check-sum	
&	Command connector to make a super command in one line.	Result commands should not exceed 253 bytes long.
RING(cr)(lf)	Command for modem handshaking	ATA(CR)(lf)
OK(cr)	Output by a modem	
	Output by flow meter to handshake a modem.	AT(CR)(LF)
GA(cr)	Special command for GSM network.	note 9
GB(cr)	Special command for GSM network.	note 9
GC(cr)	Special command for GSM network	note 9

注:

0.（cr）is carriage return, its ASCII value is 0DH. (lf) is line feed, its ASCII value is 0AH.

1. d stand for digit 0~9, a value of 0 is presented by +0.000000E+00

2. d stand for digit 0~9, there will no dot before 'E'.

3. 1~6 characters present the current statue of the flow meter. See the meaning of the characters in the chapter diagnostics.

4. s presents one of ON,OFF or UD

   For example 'TR:ON,RL:ON' stands for OCT and RELAY are in on state.

   'TR:UD,RL:UD" stands for the OCT and RELAY are not assigned.

5. @ is the key value, for example, 30H stand for the '0' key. The command 'M4(cr)' acts just like the number 4 key on the keypad was pressed.

6. 'a' stands for the output current. The maximum value should not exceed 20. For example AO2.34567, AO0.2

7. 'ddddddddd' stands for the Electronic Serial Number

8. If there are more one flow meter or other kinds of meters in a network, a prefix like 'N' or 'W' must be added before the basic command in the above table, or the system will

conflict.

9. The returns by the special command for GSM networks contends Chinese characters.

§4.3.1Command prefixes and the command connector

（1） The P prefix

The P prefix can be added before every basic command to make the returned message with a check-sum. The check-sum is obtained by a binary addition. For example, if the command DI+(CR) (44H,49H,2BH,0DH in binary numbers）will bring a return like +1234567E+0m3 (CR) (2BH,31H,32H,33H,34H,35H,36H,37H,45H,2BH,30H,6DH,33H,20H,0DH,0AH in binary numbers), then the PDI+(CR) will brings a return like +1234567E+0m3 !F7(CR), after the character'!' are the check-sum in ASCII format(2BH+31H+32H+33H+34H+35H+ 36H+37H+45H+2BH+30H+6DH+33H+20H=(2)F7H)

Pay attention to that there may be no characters or only spaces before the character '!'.

（2） the N prefix

The usage of prefix N goes like: N + single byte address + basic command.

For example if the address number 88 flow meter is going to be addressed, the command should like: NXDV(CR), the decimal value of X should be 88.

The prefix W is strongly recommended for new users.

（3） The W prefix

Usage: W + character string address + basic command

The value of the character string should have a value in the range of 0~65535, except for the value of 13（0DH carriage return），10（0AH line feed ），42（2AH *），38（26H&）.

For example, if the velocity of number 12345 flow meter is wanted, the command can be like: W12345DV(CR), (57H,31H,32H,33H,34H,35H,44H,56H,0DH in binary numbers)

（4） The command connecter &

The command connecter '&' adds several basic commands into a one-line super command. The super command should no exceed a length of over 253 characters. The prefix P should be added before every basic command, to make the returned results having a check-sum.

For example, if the 1)flow rate 2)velocity 3)positive totalizer 4) net energy totalizer 5) the AI1 input 6) the AI2 input of the address number 4321 flow meter are wanted to return with check-sum, the one-line command is like:

W4321PDQD&PDV&PDI+&PDIE&PBA1&PAI2(CR)

The returned data are:

+0.000000E+00m3/d!AC(CR)
+0.000000E+00m/s!88(CR)
+1234567E+0m3 !F7(CR)
+0.000000E+0GJ!DA(CR)
+7.838879E+00mA!59
+3.911033E+01!8E(CR)

§4.4 The easy-to-use water meter communication protocol

In order to replace a water meter in a water meter network, the water meter communication protocol is realized in TDS-100M flow meters.

interface：RS232，RS485

baud rate：9600 by default，select other 15 different baud rate by Menu 62

parity：NONE,EVEN,ODD can be chosen from Menu 62

Data bits：8

Stop bits: 1,2

In the following explanation:

XXh stands for the address (or network ID)of the instrument, range:00h-FFh.

YYh stands for the new address that will be assigned, range:00h-FFh.

ZZh the check-sum, which is obtained by means of binary addition of all the data bytes (take notice to that the addition is for the data bytes, not the controlling and commands bytes, and the carry over 0ffh is discarded.

H stands for that the number is a hexadecimal number.

All five command are like following:

（1）read water meter data (command 4A）

Format: 2Ah XXh 4Ah

Answer: 26h XXh 4Ah　LL(BCD coded ）ZZh

In the above, the contents of LL(BCD) are formatted as in the following table:

position	content	bytes	note
1~4	Flow rate	4	The actual value is divided by 1000, unit in cubic meter per hour.
5~8	Positive total flow	4	The actual value divided by 10, unit in cubic meter
9~12	Total time	4	Unit in hour
13	Error code	1	See table below

（2）reading the recorded meter data (command 49)

Format：2Ah XXh 49h

Answer:　26h XXh 49h　LL（BCD 码） ZZh

The difference between the command 4A and command 49 is that the late command reads out the data which are recorded in the meter by the time which is defined by command 4C.

（3）change the address of the meter (command 4B)

Format:　2Ah XXh 4Bh YYh

Answer:　26h XXh 4Bh YYh

If XXh=YYh, this command can be used to do a loop test the net work, or to scan and find the existed meters in the network. Please pay attention to that the network may lose meters if this command is used in a noisy network.

（4）change or assign a time for meter data recording (command 4C)

Format:　2Ah XXh 4Ch DDh HHh

Answer:　26h XXh 4Ch DDh HHh MMh ZZh

DDh stands for the day, HHh for hour,　MM for minute，data are in BCD code.

DD is the day of this month, for example: 2Ah 86h 4Ch 12h 15h stands for assigning a recording time for the number 86 meter 86. the meter will record the flow rate, total net flow, the working timer and the error code when time is 15:00 the 12th of this month. The recorded date will be read out by command 49.

If DD = 0, it stands that the data recording will take place by 15:00 for every day.

（5）standard date and time broadcasting （command 4D）

Format: 2Ah AAh 4Dh ssmmhhDDMMYY

Answer: no answer

In above, ssmmhhDDMMYY is the date and time in BCD format.

Diagnostic code: 00h stands that the system is working normally.
02h stands for the pipe may be empty or meter works improperly.
05h stand for there exist hardware failure, repair may needed.

§4.5 Key Value Table

The key values are used in a network application. By use of the key value and a command 'M', we can operate the flow meter through the network on a computer or other kind of terminals. For example, the command 'M0(cr)' acts just like the zero key on the keypad was pressed.

key	Key value (headecimal)	Key value (decimal)	ASCII value	key	Key value (headecimal)	Key value (decimal)	ASCII value
0	30H	48	0	8	38H	56	8
1	31H	49	1	9	39H	57	9
2	32H	50	2	.	3AH	58	:
3	33H	51	3	◄	3BH	59	;
4	34H	52	4	MENU	3CH	60	<
5	35H	53	5	ENT	3DH	61	=
6	36H	54	6	▲/+	3EH	62	>
7	37H	55	7	▼/-	3FH	63	?