Type 810 | Type 812
Technical Documentation

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Contents

1 Introduction

This document describes the direct connection, communication and operating of the Type 810 and Type 812 Doppler Velocity Flowmeter.

The Type 810 flowmeter is ATEX/UKEX approved while the Type 812 in form, function and performance is identical but is not ATEX/UKEX approved. Within this document, **with the exception of any reference to ATEX/UKEX**, the name Type 810 and Type 812 are interchangeable.

Valeport's Type 810 is a self-contained continuous wave doppler flowmeter that offers industry-standard performance coupled with robust build quality and reliability, all backed up by Valeport's exceptional customer service and support mechanisms.

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2 Supporting Documents

Item	Document
RS232	EIA/TIA-232 Standard
RS485	EIA/TIA-485 Standard
MODBUS	Modbus_over_serial_line_V1_02.pdf Modbus_Application_Protocol_V1_1b3.pdf
SDI-12	SDI-12_version1_3 January 26, 2013.pdf

3 Description

The Type 810 (Doppler Velocity Flowmeter) is a self-contained velocity sensor incorporating all of the electronics and signal processing to output velocity and signal quality statistics for input to data loggers and SCADA systems.

The Type 810 uses advanced proprietary Digital Signal Processing techniques and low noise electronics to provide measurements in both clean and dirty water, at very low velocities and in very shallow water.

3.1 Applications

Velocity input to data loggers and SCADA systems, including

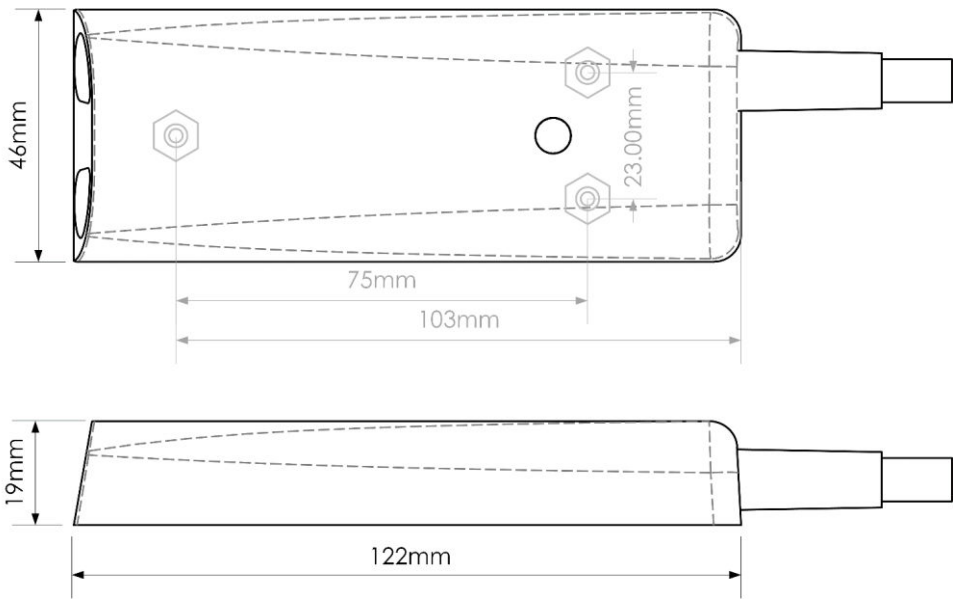
- Sewers and waste water treatment plant
- Clean water treatment plant and distribution
- Irrigation canals and channels
- Rivers and streams

3.2 Key Features

- Low profile sensor
- Flow measurement possible in very shallow water
- Bi -directional flow, with flow range of 0.01 to 5 metres/sec
- High sensitivity enables applications in clean water
- Direct output of velocity and data quality information
- Wide input voltage range
- Low power consumption
- Integral temperature measurement
- Real time speed of sound correction
- ATEX/UKEX and IECEx certification (Type 810 only)
- RS232, RS485, Modbus, SDI-12 interfacing

3.3 Mechanics Specification

3.3.1 Dimension



3.3.2 Weight

Sensor with 10 metre cable: <1.1 kg

3.3.3 Materials

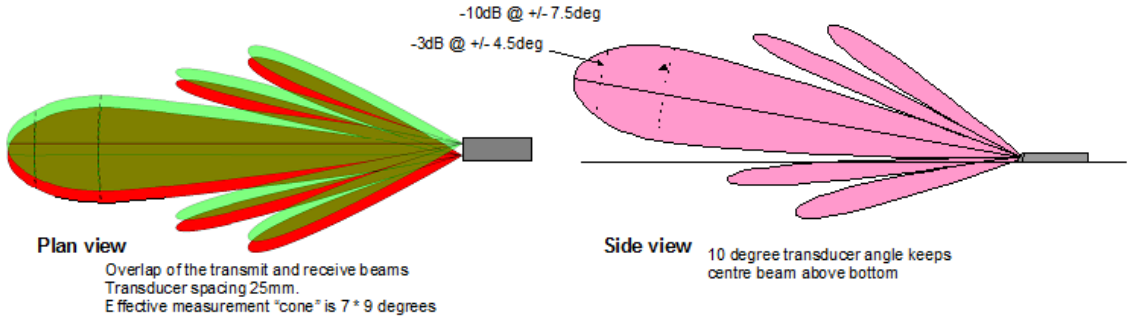
Wetted parts: 316 Stainless steel, PVDF, polyurethane

3.3.4 Mounting

Sensor has 3 mounting points on the underside

3.4 Acoustic Specification

DSP Doppler using twin 1 MHz transducers



3.5 Safety

The user is responsible for making all necessary safety arrangements to deal with the inherent hazards of the measurement site (gas detector) and the fluid to which the measurement is applied (suitable protective gloves, etc.), for which Valeport cannot be held responsible.

The DVP sensors are designed to be suitable for use in areas with potentially explosive atmospheres up to and including Zone 1.

Ⓔx II 2G Ex ib IIC T4 Gb

This approval is valid only through observation of all relevant safety and installation guidelines. Failure to follow these guidelines may render the site unsafe.

3.5.1 Special Conditions for Safe Use

Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.
While a DVP system with proper installation and operation meets ATEX/UKEX/IECEx requirements for use in defined hazardous locations, these requirements must also be observed with regard to associated tools and equipment at the site.

The installation and use of this product may subject you to hazardous working conditions that can cause you serious or fatal injuries. Take any necessary precautions before entering a worksite. Install and operate this product in accordance with all applicable safety and health regulations, and local ordinances.
The equipment Temperature Class is T4 certified for use in ambient temperatures in the range -20°C to +60°C and should not be used outside this range.

3.5.2 Instructions specific to hazardous area installations

The following instructions apply to the Type 810 Doppler Flowmeter covered by certificate number Sira 13ATEX2380X and CSAE 22UKEX1109X.

1. The equipment may be used with flammable gases and vapours with apparatus Gas Groups IIA, IIB and IIC in Zone 1 or 2 locations.
2. The equipment Temperature Class is T4 certified for use in ambient temperatures in the range -20°C to +60°C and should not be used outside this range.
3. Installation shall be carried out in accordance with the applicable code of practice by suitably-trained personnel.
4. This equipment may not be repaired and, should damage to the probe assembly occur, the unit should be destroyed.
5. The X suffix to the certificate number is to indicate that there is a special condition for safe use, which is regarding the potential build-up of static electricity and the precautions to be taken.
6. If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

Aggressive substances - e.g. acidic liquids or gases that may attack metals, or solvents that may affect polymeric materials.

Suitable precautions e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

4 Electrical Specification

4.1 Wiring Information

4.1.1 10 Pin Connector

Cable Lengths:
Standard cable lengths start at 10 metres and can be increased, in 10m lengths up to 100 metres for ATEX/UKEX and 300 metres for non ATEX/UKEX environments.

Cable Connectors:

There are three options

Bare Wires | 10 pin female: Amphenol (62GB-16J12-10SN) | Souriau (UTS6JC1210S)

PIN	WIRE COLOUR	FUNCTION
C	BLACK	0V
D	RED	+VIN
A	PINK	SDI12
H	WHITE	RS485+ (B)
B	BROWN	RS485- (A)
F	GREEN	Serial GROUND note 1
J	BLUE	RS232 RXD (into unit)
K	YELLOW	RS232 TXD (out of unit)
G (Link to pin F)	ORANGE	PROBE DETECT
E		SCREEN

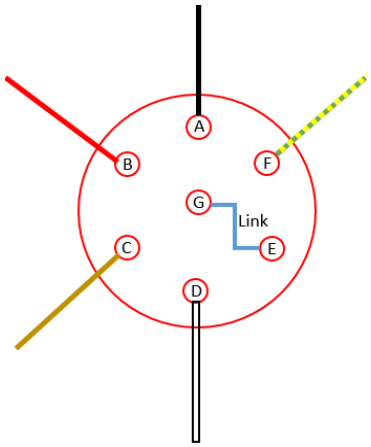
To prevent noise on the RS485 lines when using RS232 communication, connect the two RS485 lines together.

note 1 must not be left floating connect to zero volts if not used in either RS232 or RS485 grounding loop

4.1.2 7 Pin Connector

for example – operation with an EnviroLog 4G Telemetry system

Souriau: UTS6JC10E7P Pin	Wire Colour	Function
A	BLACK	0V
B	RED	+VIN
	PINK	
D	WHITE	RS485+ (B)
C	BROWN	RS485- (A)
G	GREEN	RS485 GROUND
	BLUE	
	YELLOW	
	ORANGE	
E - Link to pin G		PROBE DETECT
F	SCREEN + GREEN/YELLOW	SCREEN



4.2 Specification

<table>
<tr><td rowspan="3">Certification for use in potentially explosive atmospheres (Zone 1)</td><td>Provisions</td><td colspan="2">Ex II 2G
Ex ib IIC T4 Gb
Ta = -20 °C to +60 °C</td></tr>
<tr><td>Certificate Numbers</td><td colspan="2">Sira 13ATEX2380X
CSAE 22UKEX1109X
IECEx SIR 14.0051X</td></tr>
<tr><td>Standards</td><td colspan="2">EN IEC 60079-0:2018
EN 60079-11:2012
IEC 80079-34:2020</td></tr>
<tr><td>Electrical Parameters</td><td>Supply Parameters
T10,T9 V+,V-
Ui= 12.6 V
Ii=337 mA
Pi= 1.11 W
Ci= 220 nF
Li=123 µH</td><td colspan="2">Comms Parameters
T1 to T8, comms worst case combined
Ui= 5.88 V
Li= 6 x 11.55mA = 69.3 mA
Pi= 6 x 17mW = 102 mW
Ri= 84 Ω
Ci= 110 nF
Li= 0</td></tr>
</table>

4.2.1 Start Up

The Type 810 requires a total period of 255 msec to start up.

Start-up Procedure	Time
Bootloader window	100 msec
Hardware configuration	155 msec
Idle Mode	

4.3 Current Consumption

14 mA at 12 VDC on standby (IDLE)

25 mA at 12 VDC for measurement cycle

5 Serial Communication

5.1 Data Output

RS232 or RS485 (half duplex) depending on pin selection.

Baud rate is user selectable from 9600 to 115200. (19200 default).

Parity is user selectable even, odd or no (even default).

1 Stop bit

To prevent noise on the RS485 lines when using RS232 communication, connect the two RS485 lines together

5.2 Support Protocols

RS232/RS485

1. Hash Codes
2. Modbus (default), Slave ID = 0x01

SDI12 – See 7 SDI-12 Interface

5.3 Type 810 Variables

Below is an example of a Type 810 Variable.

Variable Details

Variable Name			Type	Count	Format		default
text1			ASCII	25	N/A		TEXT1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
001C	#004	Read	USER		NUL (00 hex)	DEL (7F hex)	See ASCII Type
	#003	Write	USER				

text1 is up to 24 characters (ASCII Format Type is 1 less than count, NUL terminated)

5.3.1 Variables Details

Variable Name

Name for variable

Type

The data type stored in the variable, one data type per variable. When using Modbus the user will have to convert the raw data bytes to the same data type.

Data Types

Type	Size (bytes)	Description
ASCII	1	(Single Byte)
Char	1	(Single Byte)
Unsigned Char	1	(Single Byte)
Short	2	(Big Endian)
Unsigned Short	2	(Big Endian)
Long	4	(Big Endian)
Unsigned Long	4	(Big Endian)
Float	4	(Big Endian)

Count

Number of values of the data type stored within the memory allocation.

For example
A variable with Type ‘Float’ and a count of 3 = memory size of 12 bytes

Default

Factory default value

Modbus Address

Memory address for Modbus protocol. See Modbus RTU Description for details on how to use this parameter.

Hash Code

Hash code number for Hash code protocol. See Hash Codes Description for details on how to use this parameter.

R/W

Variable can be a read, write or both. When a variable is both, two hash codes will be listed one for a read and one for a write command. See Hash Codes Description for an example.

Access

Certain variables require a higher access level, there are two levels of access USER and ADVANCED USER, variables with ADVANCED USER access requires a password before a variable can be changed. See Setting the Access Level to Advanced User for more information on this procedure.

Limits

Low and High value limits

Notes

Explanation of variable values

5.4 Hash Codes Description

Hash Codes can be used over both RS232 and RS485 (half duplex), the protocol allows the user to configure variables and operate the Type 810. There are two types of commands “Read” and “Write” and the format of these commands are slightly different, to send the commands the Type 810 needs to be in configuration mode.

Hash commands can be used with a PC Terminal Software like HyperTerminal, the major advantage of using hash command is that the Type 810 can be used in Free Running Mode.

When communicating over RS232 each character of the command is echoed back once they have been received by the Type 810, In RS485 the whole command is echoed back after the delimiter (<CR><LF>) has been received.

5.4.1 Enter Configuration Mode

To put the Type 810 in a configuration mode, follow the procedure below:

Send ‘#’ continuously until they are echoed back and then Send <CR><LF>, the Type 810 will return ERROR<CR><LF> followed by a new command prompt ‘>’

(User will have to wait until the measurement cycle is finished before the ‘#’ character is returned from the Type 810)

5.4.2 To Exit Configuration Mode

There are two methods to exit configuration mode:

Command Send #028<CR><LF>

Timeouts after 30 Seconds (if no characters are sent for 30 seconds)

5.4.3 Format

All commands start with a hash “#”, followed by a 3 digit number “004”. Variables with more than one value are separated with a semi-colon ‘;’.

5.4.4 Delimiting

All commands are terminated with a Carriage Return + Line Feed <CR><LF>.

5.4.5 Write Format

Command ⇨	Description
#NUM;VALUE0;VALUE1;VALUE2<CR><LF>	Example format of a hash code write command

⇦ Responses	Description
<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

5.4.6 Read Format

Command ⇨	Description
#NUM<CR><LF>	Example format of a hash code read command

⇦ Responses	Description
VALUE0;VALUE1;VALUE2;<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

5.4.7 Example - ASCII

Variable Details

Variable Name			Type	Count	Format		default
text1			ASCII	25	N/A		TEXT1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
001C	#004	Read	USER		NUL (00 hex)	DEL (7F hex)	See ASCII Type
	#003	Write	USER				
text1 is up to 24 characters (ASCII Format Type is 1 less than count, NUL terminated)							

Example

Hash Command – Read Text Field

Command ⇨	Description
#004<CR><LF>	Reads text field (text1)

⇦ Responses	Description
TEXT1<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

Hash Command – Write Text Field

Command ⇨	Description
#003;MAIN STREET<CR><LF>	Sets text field (text1)

⇦ Responses	Description
<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

5.4.8 Hash Command Errors

Reasons	Description	Return Value
Access Level	Certain variables require a higher Access Level	ACCESS DENIED!<CR><LF>
Excess Limits	Values entered excess low and high limits	ERROR<CR><LF>
Value Count	Incorrect number of values entered	ERROR<CR><LF>
Hash code number	Incorrect hash code number entered	ERROR<CR><LF>

5.5 Modbus RTU Description

Modbus RTU can be used over both RS232 and RS485 (half duplex), the protocol allows the user to configure and operate the Type 810.

5.5.1 Delimiting

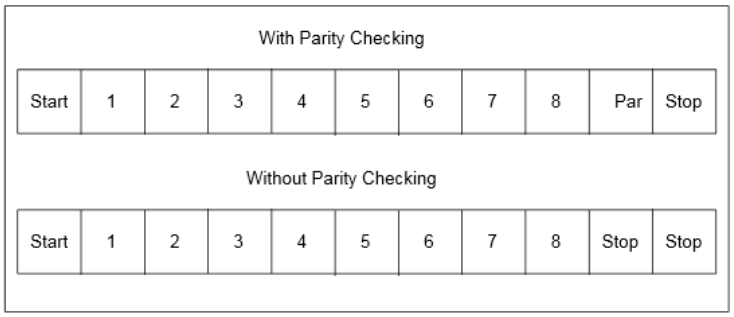
In Modbus RTU, bytes are sent consecutively with no space between them with 3-1/2 character space between commands for a delimiter, this allows the Type 810 to know when a new command is starting. Any delay between bytes will cause Modbus RTU to interpret it as the start of a new command.

5.5.2 Format and Byte Size

Each byte is sent as a string of 8 binary characters framed with 1 start bit, 1 bit for parity, and 1 stop bit. Making each byte 11 bits.

Even parity is default, other modes are selectable (odd parity, no parity) and may be used.

The use of no parity requires 2 stop bits.



5.5.3 Slave Address (ID)

The slave ID has to have a value between 1 and 247. (Type 810 default 1 = 01 hex)

To Change the Slave ID:

1. Setting the Access Level to Advanced User
2. Changing Modbus Slave ID

(The Modbus protocol requires that the address 0 is not used, as well as the addresses 248 to 255)

5.5.4 Function Code

There are two function codes used by the Type 810.

03: The Function Code (Read Holding Registers)

10: The Function Code (Write Multiple Registers 16 = 10 hex)

5.5.5 Data

The range of data bytes in Modbus RTU can be any characters from 00 to FF. (hex).

1 Register = 2 Bytes. (Big Endian)

5.5.6 Error Checksum

Each Modbus Command is terminated with two error checking bytes called CRC or Cyclic Redundancy Check.

5.5.7 More Information

See supporting documents

5.5.8 Modbus Commands to the Type 810

The Type 810 uses two types of Modbus command, one to read a register and other to write to one. The structure of these two commands are slightly different.

5.5.8.1 Modbus Command Structure

The example below shows how to read and write to the “text1” field, typical information that the user might what to store here is site information e.g. location ‘MAIN STREET’

Variable Details

Variable Name			**Type**	**Count**	**Format**		**default**
text1			ASCII	25	N/A		TEXT1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
001C	#004	Read	USER		NUL (00 hex)	DEL (7F hex)	See ASCII Type
	#003	Write	USER				

text1 is up to 24 characters (ASCII Format Type is 1 less than count, NUL terminated)

5.5.9 Functions

5.5.9.1 Read Holding Registers (FC=03)

Request ⇨ 01 03 00 1C 00 0D 45 C9

01: The Slave Address (1 = 01 hex)
03: The Function Code (read Holding Registers)
001C: The Data Address of the first register requested.
000D: The total number of registers requested. (read 13 registers, 26 ASCII characters)
45C9: The CRC (cyclic redundancy check) for error checking.

Response⇦01 03 1A 54 45 58 54 31 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 54 91 75

01: The Slave Address (1 = 01 hex)
03: The Function Code (read Analog Output Holding Registers)
1A: The number of data bytes to follow (13 registers x 2 bytes each = 26 bytes)
5445: The contents of register (ASCII: T, E)
5854: The contents of register (ASCII: X, T)
3100: The contents of register (ASCII: 1, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0000: The contents of register (ASCII: NUL, NUL)
0054: The contents of register (ASCII: NUL, T) the 26th byte isn't part of this field
9175: The CRC (cyclic redundancy check).

5.5.9.2 Write Multiple Registers (FC=16)

Request ⇨

1: The Slave Address (1 = 01 hex)
10: The Function Code (Write Multiple Registers 16 = 10 hex)
001C: The Data Address of the first register
000D: The number of registers to write (write to 13)
1A: The number of data bytes to follow (13 registers x 2 bytes each = 26 bytes)
4D41: The value to write to register (ASCII: M,A)
494E: The value to write to register (ASCII: I, N)
2053: The value to write to register (ASCII: 'Space' ,S)
5452: The value to write to register (ASCII: T, R)
4545: The value to write to register (ASCII: E, E)
5400: The value to write to register (ASCII: T, NUL)
0000: The value to write to register (ASCII: NUL, NUL)
0000: The value to write to register (ASCII: NUL, NUL)
0000: The value to write to register (ASCII: NUL, NUL)
0000: The value to write to register (ASCII: NUL, NUL)
0000: The value to write to register (ASCII: NUL, NUL)
0000: The value to write to register (ASCII: NUL, NUL)
0000: The value to write to register (ASCII: NUL, NUL)
F454: The CRC (cyclic redundancy check) for error checking.

The memory is protected after the variable length, the 26th byte will NOT be written to memory.

Response ⇦

: The Slave Address (1 = 01 hex)
: The Function Code (Write Multiple Registers 16 = 10 hex)
: The Data Address of the first register
: The number of registers written
: The CRC (cyclic redundancy check) for error checking

5.5.10 Modbus Exception Responses

Following a command request there are 4 possible outcomes from the Type 810 (Slave)

1. The request is successfully processed by the Type 810 and a valid response is sent.
2. The request is not received by the Type 810 therefore no response is sent.
3. The request is received by the Type 810 with a parity or CRC error. The Type 810 ignores the request and sends no response.
4. The request is received without an error but cannot be processed by the slave for another reason. The Type 810 replies with an exception response.

In a normal response, the Type 810 echoes the function code. The first sign of an exception response is that the function code is shown in the echo with its highest bit set. All function codes have 0 for their most significant bit. Therefore, setting this bit to 1 is the signal that the Type 810 cannot process the request.

Function Code in Request	Function Code in Exception Response
03 (03 hex)	131 (83 hex)
16 (10 hex)	144 (90 hex)

Typical Exception Response

: The Slave Address (1 = hex)
: The Function Code 03 (with the highest bit set)
: The Exception Code (ILLEGAL DATA ADDRESS)
: The CRC (cyclic redundancy check).

Exception Code	Name
01 (01 hex)	ILLEGAL FUNCTION
02 (02 hex)	ILLEGAL DATA ADDRESS
03 (03 hex)	ILLEGAL DATA VALUE

A more detail list of the exception code can be found in the supporting documents for Modbus.

5.6 Variables

5.6.1 Setting the Access Level to Advanced User

Certain variables require a higher access level, to increase the access level from USER to ADVANCED USER a password is needed. Once the correct password is set the Access Level will stay at ADVANCED USER until the Type 810 is power cycled or an incorrect password is entered.

ADVANCED USER password = “RETAW”.

Variable Details

Variable Name			Type	Count	Format		default
password			ASCII	8	N/A		RETAW
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0000	#000	Write	USER		NUL (00 hex)	DEL (7F hex)	ADVANCED USER = RETAW

Password is up to 7 characters (ASCII Format is 1 less than count, NUL terminated)

Incorrect passwords do not response with ERROR<CR><LF>

Examples

Modbus - Write

Command ⇨	Description
01 10 00 00 00 04 08 52 45 54 41 57 00 00 00 07 F4	This command increases the access level from user to advanced user using the password ‘RETAW’

Response ⇦	Description
01 10 00 00 00 04 C1 CA	Successful response
Modbus Exceptions	Exception response

Hash Command - Write

Command ⇨	Description
#000;RETAW<CR><LF>	This command increases the access level from user to advanced user using the password ‘RETAW’

Response ⇦	Description
<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

5.7 Serial Communication Settings

5.7.1 Changing Communication Protocols

The Type 810 supports Modbus and Hash protocols over RS232 and RS485, the communication protocol is user selectable. Changing the protocol requires ADVANCE USER Access, Set the Access Level to Advanced User before continuing with this command.

Variable Details

Variable Name			Type	Count	Format		default
protocol			Unsigned char	1	#;		1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0132	#097	Read	USER		0	1	0 – Hash 1 - Modbus
	#096	Write	ADVANCED USER				

Once protocol has been changed, User MUST use the new protocol to change back (if required)

If Parity is set to 'None' and Protocol is Modbus Stop Bit/s is 2 (not 1)

MODBUS is ONLY AVAILABLE in Mode 2 when the Output line select is set to None

Examples

Modbus - Write

Command ⇨	Description
01 10 01 32 00 01 02 00 00 B282	Sets protocol to 0 – Hash

Response ⇦	Description
01 10 01 32 00 01 A1 FA	Successful response
Modbus Exceptions	Exception response

Hash Command - Write

Command ⇨	Description
#096;1<CR><LF>	Sets protocol to 1 – Modbus

Response ⇦	Description
<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons
ACCESS DENIED!<CR><LF> >	Error response - Access Level

5.7.2 Changing Baud Rate

The serial baud rate is user selectable. Changing the protocol requires ADVANCE USER Access, Send the Access Password before continuing with this command.

Variable Details

Variable Name			Type	Count	Format		default
Baud Rate			unsigned long	1	NUM;		19200
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
00B8	#020	Read	USER		9600	115200	9600,19200,38400,57600 ,115200
	#019	Write	ADVANCED USER				

Can only valid baud rates, if an invalid baud rate is used the Type 810 defaults to 19200

Once baud rate has been changed, user MUST change the serial port settings

Examples

Modbus – Read

Command ⇨	Description
01 03 00 B8 00 02 44 2E	Reads Baud Rate

Response ⇦	Description
01 03 04 00 00 4B 00 CC C3	Successful response – (00 00 4B 00 hex) = 19200
Modbus Exceptions	Exception response

Modbus – Write

Command ⇨	Description
01 10 00 B8 00 02 04 00 01 C2 00 F9 DD	Sets Baud Rate - (00 01 C2 00 hex) = 115200

Response ⇦	Description
01 10 00 B8 00 02 C1 ED	Successful response
Modbus Exceptions	Exception response

Hash Command – Read

Command ⇨	Description
#020<CR><LF>	Reads Baud Rate

Response ⇦	Description
19200;<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

Hash Command – Write

Command ⇨	Description
#019;115200<CR><LF>	Sets Baud Rate to 115200

Response ⇦	Description
CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons
ACCESS DENIED!<CR><LF> >	Error response - Access Level

5.7.3 Changing Parity

The parity is user selectable. Changing the protocol requires ADVANCE USER Access, Send the Access Password before continuing with this command.

Variable Details

Variable Name			Type	Count	Format		default
Parity			unsigned char	1	#;		2 – Even
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
01A1	#091	Read	USER		0	2	0 – None 1 – Odd 2 – Even
	#090	Write	ADVANCED USER				

If parity is set to ‘None’ and Protocol is Modbus Stop Bit/s is 2 (not 1)

Once baud rate has been changed, user MUST change the serial port settings

Examples

Modbus – Read

Command ⇨	Description
01 03 01 A1 00 01 D4 14	Reads the Parity

Response ⇦	Description
01 03 02 02 00 B9 24	Successful response – (02 hex) 2 - Even
Modbus Exceptions	Exception response

Modbus – Write

Command ⇨	Description
01 10 01 A1 00 01 02 01 00 AE 71	Sets the Parity – 1 - ODD

Response ⇦	Description
01 10 01 A0 00 01 00 17	Successful response
Modbus Exceptions	Exception response

Hash Command – Read

Command ⇨	Description
#090<CR><LF>	Reads the Parity

Response ⇦	Description
2;<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

Hash Command – Write

Command ⇨	Description
#090;1<CR><LF>	Sets the Parity – 1 - ODD

Response ⇦	Description
<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons
ACCESS DENIED!<CR><LF> >	Error response - Access Level

5.7.4 Changing Modbus Slave ID

Changing the Slave ID of the Type 810 is possible over both Modbus and hash codes (default 01 hex), changing the Slave ID requires ADVANCE USER Access.

Variable Details

Variable Name			Type	Count	Format		default
Slave ID			Unsigned char	1	###;		001
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
01A0	#095	Read	USER		001	247	
	#094	Write	ADVANCED USER				

Slave ID will change after the response has been returned

Once Slave ID have been changed, remember to change Master to match new address

Examples

Modbus – Read

Command ⇨	Description
01 03 01 A0 00 01 85 D4	Reads Slave ID - 01 (hex)

Response ⇦	Description
01 03 02 01 02 38 15	Successful response
Modbus Exceptions	Exception response

Modbus – Write

Command ⇨	Description
01 10 01 A0 00 01 02 02 00 AF 50	Sets Slave ID to 02 (hex)

Response ⇦	Description
01 10 01 A0 00 01 00 17	Successful response
Modbus Exceptions	Exception response

Hash Command – Read

Command ⇨	Description
#095<CR><LF>	Reads Slave ID- 01 (hex)

Response ⇦	Description
001;<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

Hash Command – Write

Command ⇨	Description
#094;2<CR><LF>	Sets Slave ID to 02 (hex)

Response ⇦	Description
CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons
ACCESS DENIED!<CR><LF> >	Error response - Access Level

5.7.5 Modbus – Using Hash Commands

This feature allows the user to interrupt the Type 810 and use hash commands when the communication protocol is set to Modbus. If the Type 810 receives a single '#' (0x23) the Type 810 outputs the following message and will only accept hash commands from this point, to reset to Modbus the Type 810 requires a power cycle.

```
[iniFile]
file=dvp_comms
[Serial]
Baud=19200
Parity=2
DataBits=8
[Protocol]
Type=1
```

The message shows the Serial Settings plus the Protocol Type

One use of this feature is when a Type 810's Modbus Slave ID is unknown; the user can use hash codes to read the Slave ID.

```
file=dvp_comms
[Serial]
Baud=19200
Parity=2
DataBits=8
[Protocol]
Type=1

ERROR
>#095
001;
>
```

Do NOT use '#' (0x23) as a Slave ID

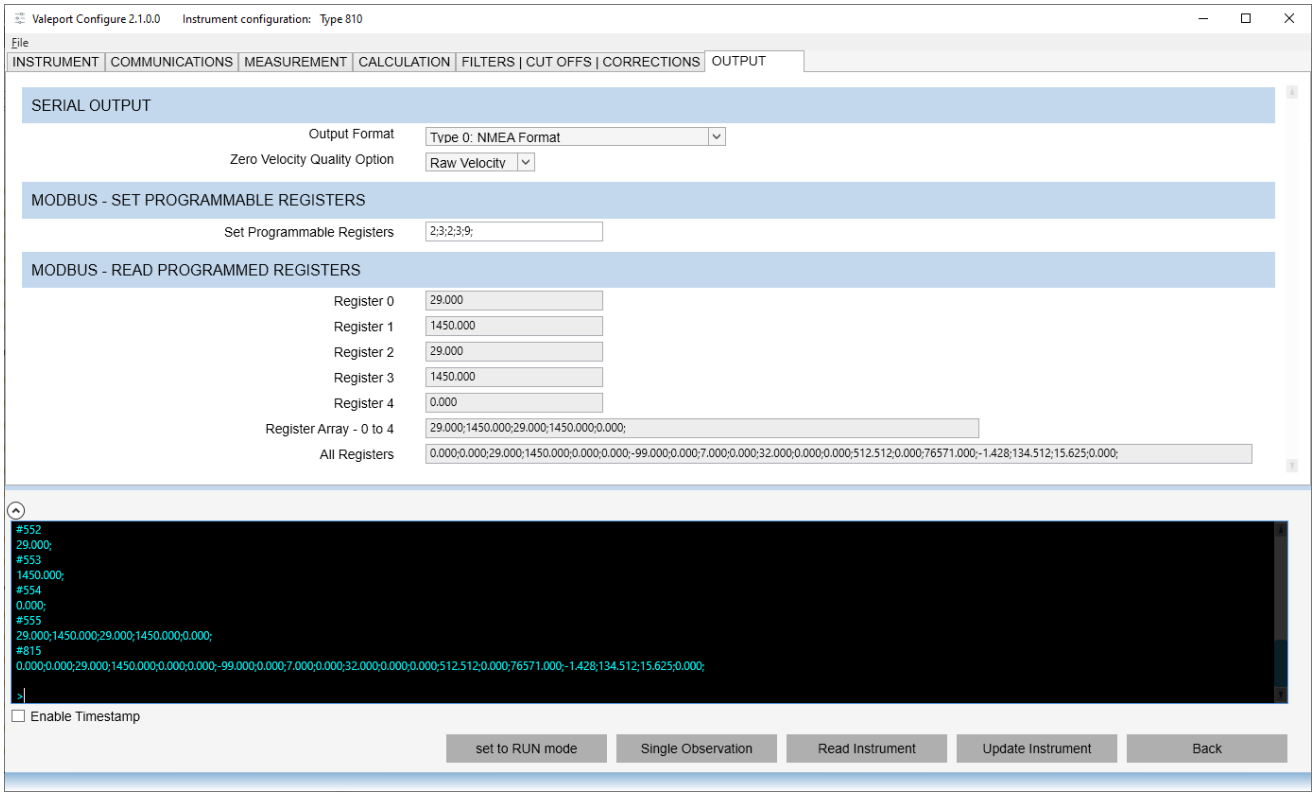
5.7.6 Modbus Register Array

From firmware version 0810706C8 a new configurable Modbus array was developed to assist in efficient read events.

Most easily set up using Valeport's Configure utility it allows for 5 programable registers to be read individually or as an array in the same order as programmed - register 0 to 4. Your choices are:

0	Peak Velocity (histogram peak/most commonly occurring value)
1	WM Velocity (**W**eighted **M**ean) – best estimate of flow speed available
2	Temperature
3	Speed Of Sound
4	Quality Number - 0 to 100 (100 is the best quality)
5	Max Velocity - (highest recorded velocity)
6	Flow - (Calculated using look up tables and level input)
7	Not Used
8	GainLevel.Range - Split by the decimal point, Auto Gain by default – see gain level variable for more details. Automatic Ranging by default, (see velocity range variable for more details)
9	Flow balance – (balance between forward and reverse flow)
10	Not Used
11	Standard Deviation (of all observed velocity values)
12	Peak Signal - Highest returned signal strength
13	Not Used
14	Not Used
15	Probe Serial Number
16	Not Used
17	Not Used
18	Bin Resolution, linked to range value
19	Average Velocity (of all observed velocity values)

Using the 'Set Programmable Register' field select the 5 parameters you require in the order you require them in a semi colon separated string – reg0;reg1;reg2;reg3;reg4.



Variable Name			Type	Count	Format		default
Set 5 Register Array			F_UCHAR	2.5	#;#;#;#;#		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0A10	#556	Read	USER		0	19	Write 5 registers
	#557	Write					Read 5 registers
You must select 5 registers							

Variable Name			Type	Count	Format		default
Set 5 Register Array			F_UCHAR	10	#.###;#.###;#.###; #.###;#.###		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09FC	#555	Read	USER		0	1000000	Read measurements 5 registers

Variable Name			Type	Count	Format		default
Reg0			F_Float	2	#.###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09E8	#550	Read	USER		0	1000000	Read measurement

Variable Name			Type	Count	Format		default
Reg1			F_Float	2	#.###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09EC	#551	Read	USER		0	1000000	Read measurement

Variable Name			Type	Count	Format		default
Reg2			F_Float	2	#.###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09F0	#552	Read	USER		0	1000000	Read measurement

Variable Name			Type	Count	Format		default
Reg3			F_Float	2	#.###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09F4	#553	Read	USER		0	1000000	Read measurement

Variable Name			Type	Count	Format		default
Reg4			F_Float	2	#.###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09F8	#554	Read	USER		0	1000000	Read measurement

6 Principles of Measurement

A measurement cycle is made up of one or more pulses (default 3) plus an auto pulse at the start, depending on the water condition more or less pulses can be used. The more pulses used the longer it takes to complete a measurement cycle and the minimum interval between measurement cycles is governed by the number of pulses.

Single Measurement Cycle (3 pulse example (additional pulses = 2))

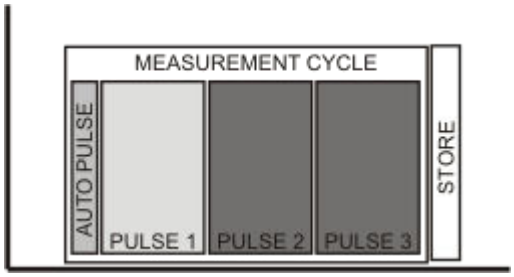
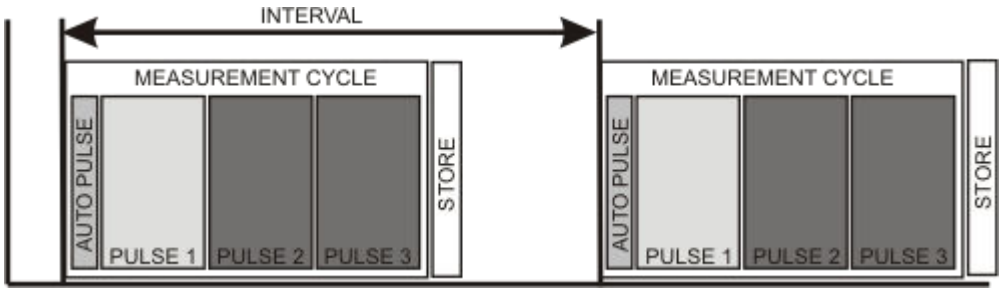


FIGURE – Measurement Cycles with set Interval



Variable Details

Variable Name			Type	Count	Format		default
additional pulses			unsigned char	1	###;		2 additional pulse - total 3
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0117	#085	Read	USER		0	5	Number of additional pulses
	#084	Write	USER				

The total number of pulses effect the measurement interval

6.1 Measurement Mode

The Type 810 has 3 modes of operation. The following section description these modes and lists the variables. The different modes offer the capacity to take multiple readings, apply averaging, run continuously with serial output and request measurements. The measurement cycle across all modes are the same.

The measurement mode can be changed using the measurement mode variable.

Variable Details

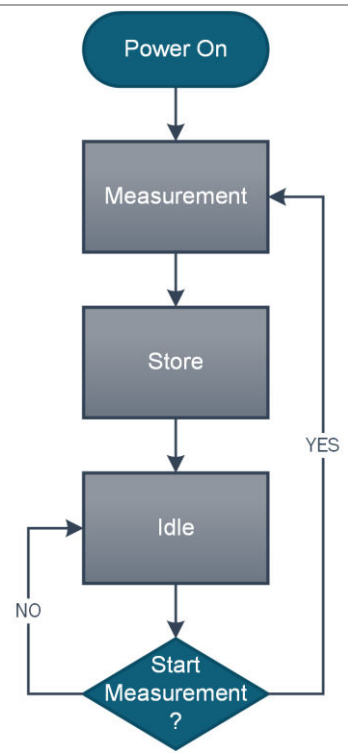
Variable Name			Type	Count	Format		default
measurement mode			unsigned char	1	###;		0 – Single Measurement
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0100	#052	Read	USER		0	2	0 – Single Measurement 1 – Multi-Measurements 2 – Free Running
	#051	Write	USER				

In Modes 0 and 1 the measurement cycles began once the start measurement flag has been set, after the measurement cycle is complete the flag is clear and results can be requested. Between measurement cycles the Type 810 can be interrupt (IDLE), careful consideration to timings is need to prevent the Type 810 being interrupted before all cycles are completed.

Mode 0 – Single Measurement

Description

- On a Power ON a measurement is taken, then then Type 810 sits in IDLE mode until the start measurement flag has been set.
- Single Measurement cycle.
- No averaging can be applied.
- Results can be requested using the results variable.

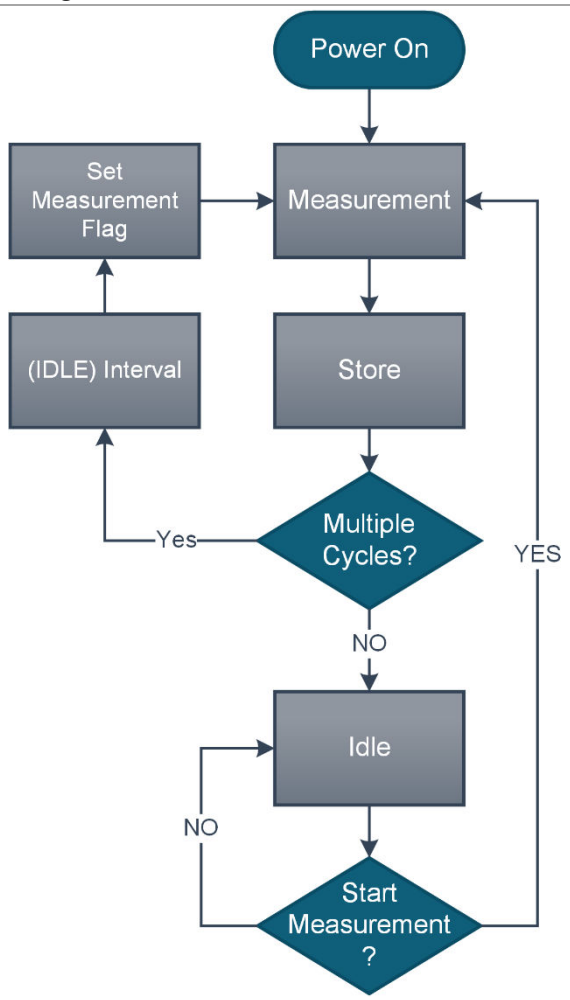
Flow Diagram	Measurement Sequence
	• Set Start Measurement Flag • [WAIT] Minimum Interval • Select Cycle Store Location • Request Output Results • See Example

Mode 1 – Multiple-Measurements

Description

- After Power ON a measurement is taken, then Type 810 sits in IDLE mode until the start measurement flag has been set.
- Mode 1 has the ability to take multiple measurement cycles before the results are requested.
- Measurement are taken at set intervals.
- Mode 1 has both moving and exponential smoothing of velocity readings.
- Note: Averaging requires constant power to the Type 810.
- Mode 1 Results can be requested using the results variable and selecting the cycle store number.
- On a power cycle all measurement results will be lost.

Flow Diagram



Measurement Sequence

Multiple Cycles -3 Cycle Example

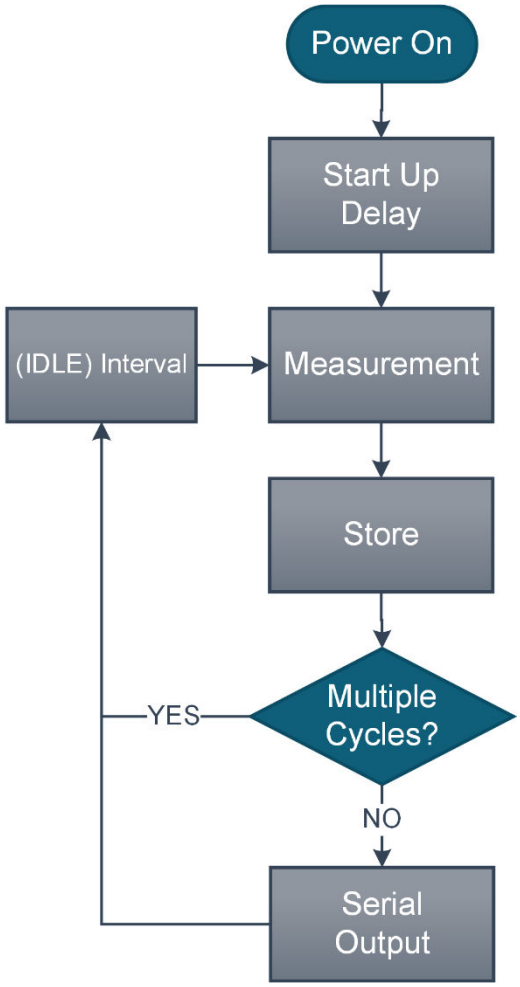
- Set Start Measurement Flag
- [WAIT] Current Interval (Cycle 2)
- [WAIT] Current Interval (Cycle 1)
- [WAIT] Current Interval (Cycle 0)
- Select Cycle Store Location (2)
- Request Output Results
- Select Cycle Store Location (1)
- Request Output Results
- Select Cycle Store Location (0) - Newest Measurement
- Request Output Results

- See Example

Mode 2 – Continuous

Description

- After Power ON, the Type 810 waits for a delay period before taking a velocity measurement is taken. (Start Delay)
- Mode 2 has the ability to take multiple measurement cycles before the results are output over the Serial Lines (output line select - RS232, RS485 or None)
- The Serial Output format is selected using the Output format variable.
- Measurement are taken at set intervals.
- Mode 2 has both moving and exponential smoothing of velocity readings. Averaging requires constant power to the Type 810.
- On a power cycle all measurement results will be lost.

Flow Diagram	Measurement Sequence
	• Measurements are Free Running • Results are outputted over serial lines RS232 or RS485 (output line select) • When Cycle Multiple is set to 1 the rate of output is the current interval. • When Cycle Multiple is greater than 1, the output rate is Current Interval * number of cycles • Output Format is in NMEA format, see example

6.2 Measurement Parameters

6.2.1 Timings

The Type 810 calculates the minimum interval between measurement cycles based on the number of pulses (whole seconds), if the interval is less than the minimum interval then the minimum interval is used. The current interval can be read using the commands listed below.

A measurement cycle has a maximum time of 5 seconds (auto pulse + pulse + additional pulses (5))

For Example

If the interval is set to 1 second and measurement is set to its maximum (auto pulse + pulse + additional pulses (5))

The current interval would be 5 Seconds.

Variable Details

Variable Name			Type	Count	Format		default
interval			unsigned char	1	###;		5
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0102	#056	Read	USER		1	120	Desired cycle interval in seconds (Secs)
	#055	Write	USER				

Variable Name			Type	Count	Format		default
minimum interval			unsigned char	1	###;		3
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0104	#060	Read	USER		1	5	Calculated minimum cycle interval (Secs)

Variable Name			Type	Count	Format		default
current interval			unsigned char	1	###;		2 additional pulse - total 3
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0105	#062	Read	USER		1	5	Current Cycle interval (Secs)

6.2.2 Multiple Cycles

Variable Details

Variable Name			Type	Count	Format		default
cycle multiple			unsigned char	1	###;		1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0118	#058	Read	USER		1	5	Set the number of cycles in a measurement.
	#057	Write	USER				

Variable Name			Type	Count	Format		default
cycle store			unsigned char	1	###;		0 – Current Results
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0106	#064	Read	USER		0	4	
	#063	Write	USER				

6.3 NMEA Output Format

Mode 2 - Free Running Output formats are selected using output format variable. Currently there are two options.

0 - NMEA

Output	Description
$PDVPM0	NMEA
0	Cycle Index
0.047	Velocity
M/s	Velocity Units
24.0	Temperature
C	Temperature Units
1450.000	Speed of Sound
M/s	Speed of Sound Units
70	Quality Number
*1c	NMEA Checksum

```
$PDVPM0,0,0.045,M/s,24.0,C,1450.000,M/s,77,*19
$PDVPM0,0,0.052,M/s,24.0,C,1450.000,M/s,66,*1f
$PDVPM0,0,0.048,M/s,24.0,C,1450.000,M/s,68,*1a
$PDVPM0,0,0.045,M/s,24.0,C,1450.000,M/s,76,*18
$PDVPM0,0,0.046,M/s,24.0,C,1450.000,M/s,76,*1b
$PDVPM0,0,0.047,M/s,24.0,C,1450.000,M/s,73,*1f
$PDVPM0,0,0.047,M/s,24.0,C,1450.000,M/s,70,*1c
$PDVPM0,0,0.050,M/s,24.0,C,1450.000,M/s,72,*18
$PDVPM0,0,0.051,M/s,24.0,C,1450.000,M/s,79,*12
```

1 - NMEA with Average

Output	Description
$PDVPM1	NMEA
0	Cycle Index
0.185	Velocity
M/s	Velocity Units
0.243	Average Velocity
M/s	Average Velocity Units
24.5	Temperature
C	Temperature Units
1450.000	Speed of Sound
M/s	Speed of Sound Units
85	Quality Number
*27	NMEA Checksum

```
$PDVPM1,0,0.218,M/s,0.147,M/s,24.5,C,1450.000,M/s,57,*28
$PDVPM1,0,0.290,M/s,0.184,M/s,24.5,C,1450.000,M/s,60,*23
$PDVPM1,0,0.233,M/s,0.197,M/s,24.5,C,1450.000,M/s,58,*23
$PDVPM1,0,0.295,M/s,0.222,M/s,24.5,C,1450.000,M/s,60,*29
$PDVPM1,0,0.297,M/s,0.242,M/s,24.5,C,1450.000,M/s,60,*2d
$PDVPM1,0,0.324,M/s,0.263,M/s,24.5,C,1450.000,M/s,61,*26
$PDVPM1,0,0.185,M/s,0.243,M/s,24.5,C,1450.000,M/s,85,*27
```

NMEA checksum calculation description: XOR checksum of the data string (not including $ and *)

6.4 Auto Pulse

The auto pulse is active when range and/or gain type is set to auto. (Default auto). This addition pulse adjusts the gain level and velocity range to match the condition/velocity of the water and to optimised the final measurement results.

6.4.1 Velocity Range

Variable Details

Variable Name			Type	Count	Format		default
range type			unsigned char	1	#;		0 – Auto Ranging
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0176	#710	Read	USER		0	1	0 - Auto Ranging 1 - Fixed
	#709	Write	ADVANCED USER				

Fixing the velocity range less than (±5 M/s), should only be used when maximum flow velocity for site is known

Variable Name			Type	Count	Format		default
velocity range			unsigned char	1	#;		0 - (±5M/s)
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0130	#093	Read	USER		0	2	0 - (±5M/s) 1 - (±2M/s) 2 - (±1M/s)
	#092	Write	ADVANCED USER				

Selecting a range which is less that the maximum flow velocity will result in erroneous measurements

6.4.2 Signal Level (Gain Level)

Variable Details

Variable Name			Type	Count	Format		default
gain type			unsigned char	1	#;		0 – Auto Gain
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0184	#722	Read	USER		0	1	0 - Auto Gain 1 - Fixed
	#721	Write	ADVANCED USER				

Gain type SHOULD ALWAYS be set to Auto to prevent signal saturation.

Variable Name			Type	Count	Format		default
gain level			unsigned char	1	##;		7
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
012E	#718	Read	USER		0	7	0 = Gain of +1 1 = Gain of +2 2 = Gain of +4 3 = Gain of +5 4 = Gain of +8 5 = Gain of +10 6 = Gain of +16 7 = Gain of +32
	#717	Write	ADVANCED USER				

Gain level is adjust for measurement pulses when gain type is set to auto gain

6.5 Measurement Example
Request a Measurement (Mode 0 and 1)

In mode 0 the measurement cycle interval is determined by the master, to start a measurement the user must set the “start measurement” flag to 1. Once the measurement is complete this flag is set back to 0.

Once this command is sent the Type 810 will not respond to any other command until a measurement cycle has been completed.

Variable Details

Variable Name			Type	Count	Format		default
Start measurement			unsigned char	1	#;		1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0133	#099	Read	USER		0	1	1 – Start a measurement cycle
	#098	Write	USER				
Auto runs after write							

Examples

Modbus Command

Command	Description
01 10 01 33 00 01 02 01 00 B2 C3	This command instructs the unit to start a measurement cycle

Responses	Description
01 10 01 33 00 01 F0 3A	Successful response
Modbus Exceptions	Exception response

Hash Command

Command	Description
#098;1<CR><LF>	This command instructs the unit to start a measurement cycle

Responses	Description
<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

FAQ

How long after sending the command will the measurement start? 0.075 secs

Request Measurement Results

After the measurement is complete, the user must send a request to retrieved the results, if a single measurement cycle is used make should the cycle store variable is set to 0 (Current Reading), when the Type 810 is using multiple measurement cycles (Mode 1) the user must set the cycle store variable to update the results variable.

For example

If cycle multiple = 3. A total of 6 commands are need to retrieve all the data.

Set Cycle store to 0, Read Results (Newest Measurement)

Set Cycle store to 1, Read Results

Set Cycle store to 2, Read Results

Variable Details

Variable Name			Type	Count	Format		default
cycle store			unsigned char	1	###;		0 – Current Results
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0106	#064	Read	USER		0	4	Update Cycle Results 0 – 4 (0 = Newest Cycle)
	#063	Write	USER				

If more than one cycle is used (mode 1), the user is required to send an additional command to write the cycle results into the measurement results. (cycle store).

Variable Name			Type	Count	Format		default
results			Float	20	#.###;		1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
01E0	#815	Read	USER		N/A	N/A	Read Measurement Results

Auto runs after write
Single measurement mode make sure cycle store is set to 0

Examples

Modbus Command
Set Cycle Store

Command	Description
01 10 01 06 00 01 02 00 00 B6 F6	Sets the Cycle Store to 0 (Newest Measurement)

Responses	Description
01 10 01 06 00 01 E0 34	Successful response
Modbus Exceptions	Exception response

Read Results

Command	Description
01 03 01 E0 00 28 45 DE	This command reads the measurement outputs

Responses	Description
01 03 50 3F 31 C8 4B 3F 33 C1 58 41 E8 00 00 44 B5 40 00 42 B5 73 E9 3F 33 BE 9A 00 00 00 00 42 A2 E7 D2 40 0C CC CD 42 C8 00 00 00 00 00 00 42 2F 32 E6 45 7A 00 00 44 3E 70 B4 40 C0 20 C5 47 3B 55 00 3F 33 BE 9A 41 86 8B 44 40 7A 00 00 00 00 00 00 23 CF	Successful response – Modbus response with 80 bytes of raw data
Modbus Exceptions	Error response

*Data from response converted from raw binary to float values (20) (Big Endian)

	#	Raw	Float	Output
0	0	3F 31 C8 4B	0.694463	Peak Velocity
1	4	3F 33 C1 58	0.702169	WM Velocity (**W**eighted **M**ean)
2	8	41 E8 00 00	29	Temperature
3	12	44 B5 40 00	1450	SOS
4	16	42 B5 73 E9	90.72639	Quality Number
5	20	3F 33 BE 9A	0.702127	Max Velocity
6	24	00 00 00 00	0	Flow (Calculated using look up tables, Setting Level)
7	28	42 A2 E7 D2	81.45277	Not Used
8	32	40 0C CC CD	2.2	Gain. Range
9	36	42 C8 00 00	100	Flow balance
10	40	00 00 00 00	0	Not Used
11	44	42 2F 32 E6	43.79971	Standard Deviation
12	48	45 7A 00 00	4000	Peak Signal
13	52	44 3E 70 B4	761.761	Not Used
14	56	40 C0 20 C5	6.004	Not Used
15	60	47 3B 55 00	47957	Probe SN
16	64	3F 33 BE 9A	0.702127	Not Used
17	68	41 86 8B 44	16.818	Not Used
18	72	40 7A 00 00	3.90625	Resolution
19	76	00 00 00 00	0	Average Velocity

Hash Command

Set Cycle Store

Command	Description
#063;0<CR><LF>	Sets the Cycle Store to 0 (Newest Measurement)

Responses	Description
<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

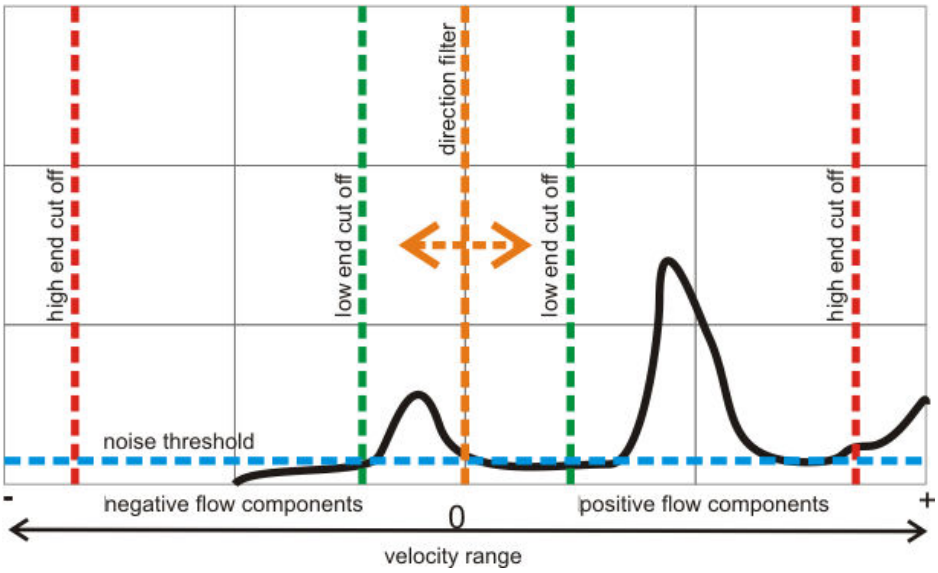
Read Results

Command	Description
#815<CR><LF>	Successful response – Hash Read, 20 values separated by ';'

Responses	Description
#815<CR><LF>0.694;0.702;29.000;1450.000; 90.726;0.702;0.000;81.453;2.200;100.000; 0.000;43.800;4000.000;761.761;6.004; 47957.000;0.702;16.818;3.906;0.000;<CR><LF> >	Successful response
ERROR<CR><LF> >	Error response – possible reasons

6.6 Measurement Correction and Filters

Histogram Filters enable expert user to filter unwanted signals from the final result.



6.6.1 Noise threshold - (Read - #704, Write - #703)

Doppler shifts that are unrelated to the measurement of velocities in a water flow are often called signal noise. In some situations, background noise may interfere with the calculation of the correct velocity readings. The level can be set to reject these unwanted signals. The noise threshold is a percentage value of the peak velocity.

6.6.2 Direction Filter - (Read - #702, Write - #701)

The user can configure the probe to look at process certain components, all values, positive components only or negative components only with respect to the head.

6.6.3 Low end cut off - (Read - #706, Write - #705)

Under certain conditions the user may want to reject a percentage of the low-end velocities from the final result. The percentage is that of the full range -+5 M/s.

6.6.4 High end cut off - (Read - #708, Write - #707)

Under certain conditions the user may want to reject a percentage of the high-end velocities from the final result. The percentage is that of the full range -+5 M/s.

6.6.5 Suppression level - (Read - #748, Write - #747)

Removes unwanted return signals from histogram (default - Medium)

6.6.6 Correction Factor - (Read - #066, Write - #065)

Sets correction factor applied to the final velocity reading

6.6.7 Velocity/Quality Output Option

When the Type 810 Quality Number < 20 %, by Default the Type 810 will output the raw velocity value. See below

6.6.8 System Noise Level

Can be reduced to a lower level at sites where the signal levels are small, this may increase noise on the final velocity reading (Use with care). See below

6.7 Averaging

The Type 810 has two types of averaging, Exponential and Moving Average which are selectable and configurable using the following variables. The averaging functions are only available in measurement modes 1 and 2.

6.7.1 Averaging Variables

Variable Details

Variable Name			Type	Count	Format		default
average type			unsigned char	1	###;		0 – Exponential
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
010C	#068	Read	USER		0	1	0 Exponential 1 Moving average
	#067	Write	USER				

Averaging is only applied in Measurement Modes 1 and 2

Averaging is only applied if the smoothing factor is greater than 0

Variable Name			Type	Count	Format		default
Smoothing factor			unsigned char	1	###;		0 – no smoothing
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
010D	#070	Read	USER		0	10	In exponential mode, number is smooth factor applied to the raw velocity measurement In moving average, number is the number of cycles which are in the moving average 0 = no smoothing.
	#069	Write	USER				

Averaging is only applied in Measurement Modes 1 and 2

Averaging is only applied if the smoothing factor is greater than 0

Variable Name			Type	Count	Format		default
Step Allowed			Float	1	#.###;		0.000
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
016C	#104	Read	USER		0	5	Averaging is applied when the change in velocity is less than the step allowed value (M/s)
	#103	Write	USER				

Averaging is only applied in Measurement Modes 1 and 2

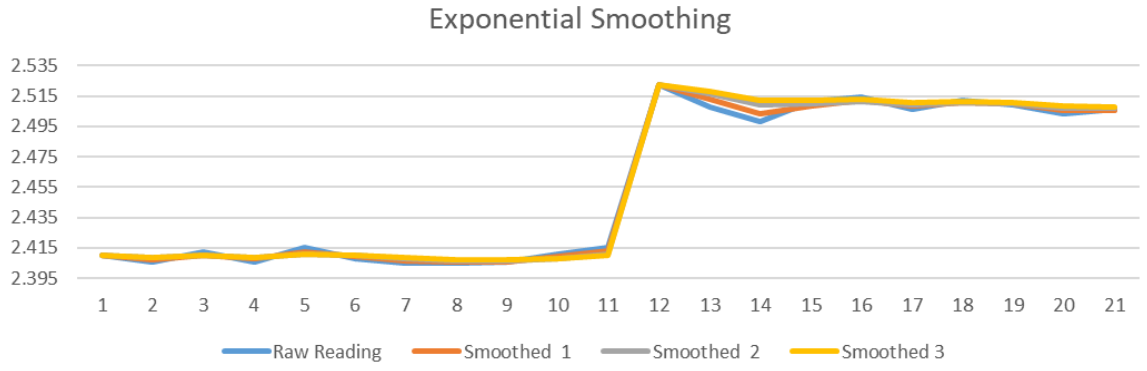
Averaging is only applied if the smoothing factor is greater than 0

6.7.2 Exponential Example

Exponential Question

$$Differential\ Multiple = 1 - \left(\frac{1}{EXP\left(\frac{1}{Smoothing\ factor}\right)}\right)$$

Smoothing Factor [SF]	1	2	3	
Differential multiple	0.6321	0.3935	0.2835	
Step allowed	0.1	0.1	0.1	
Raw Reading	Smoothed 1	Smoothed 2	Smoothed 3	Comments
2.410	2.410	2.410	2.410	1st reading = raw reading
2.406	2.407	2.408	2.409	subsequent readings, smoothing factor applied if change is less than "Step allowed" [SA= absolute difference between previous smooth reading and new raw reading]
2.412	2.410	2.410	2.410	
2.406	2.408	2.408	2.409	
2.415	2.412	2.411	2.410	
2.408	2.410	2.410	2.410	
2.405	2.407	2.408	2.408	
2.405	2.406	2.407	2.407	
2.406	2.406	2.406	2.407	
2.411	2.409	2.408	2.408	
2.415	2.413	2.411	2.410	
2.522	2.522	2.522	2.522	Note step change (new start for smoothing)
2.508	2.513	2.516	2.518	
2.498	2.504	2.509	2.512	
2.511	2.508	2.510	2.512	
2.514	2.512	2.512	2.513	
2.506	2.508	2.509	2.511	
2.512	2.511	2.510	2.511	
2.509	2.510	2.510	2.510	
2.503	2.505	2.507	2.508	
2.506	2.506	2.507	2.508	



A Power Cycle will reset the average values

6.8 Flow Calculation and Level Inputs

The flow cross-sectional area is deduced from the liquid level measurement and a stored description of the pipe or channel cross-section. The flow velocity is multiplied by the flow cross sectional area to give the flow rate, and integrated to give the total discharge.

The channel/pipe description are lookup tables – please contact supplier for details for creating these tables

The Type 810 has a two-level variable which can be updated using the following commands. The flow level and silt level are stored in 10th of mm.

Variable Name			Type	Count	Format		default
level			unsigned short	1	#;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09B4	#522	Read	USER		0	65000	Level (in 10th of mm)
	#521	Write	USER				

Variable Name			Type	Count	Format		default
silt level			unsigned short	1	#;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0994	#511	Read	USER		0	65000	Level (in 10th of mm)
	#510	Write	USER				

6.8.1 Flow Outputs

The calculated flow rate is updated after each measurement and can be read using the results variables (Float Index: 6).

Variable Name			Type	Count	Format		default
area			float	1	#.###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0998	#512	Read	USER		-1.00E+06	1.00E+06	Reads Area in M² (calculated from Level)

Variable Name			Type	Count	Format		default
flowv			float	1	#.###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09AC	#519	Read	USER		-1.00E+06	1.00E+06	Reads Last Flow from Velocity

Flow related outputs are calculated.

Variable	Usage	Calculation
area	used for Flow from V calc	Interpolated from level using lookup tables from 10ths of mm to m^2. Uses lookup to calculate area. Then subtracts the area due to silt level also in metres.
flowv	flow in user units from m/s flow and m2 area	(flow velocity in m/s x area in m^2 x volume_conversion[1]) / volume_conversion[0]

7 SDI-12 Interface

All SDI-12 standard command (SDI-12 version 1.3) are implemented in the Type 810. SDI-12 is only supported in Mode 0.

Please refer to http://www.sdi-12.org/specification.php for further detail. The SDI-12 conformance has been verified with the SDI-12 verifier from NR Systems, Inc.

Wiring for SDI-12 communications is detailed in the wiring information.

There is no functionality via the SDI-12 interface to change Type 810 configuration so any configuration changes such as output units, sampling period or addition pulses via the serial interface.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RS232/485 communications are possible while wired for SDI-12 but will interrupt any SDI-12 communications.

The Type 810 will output the following parameters (on aD0!) in SDI12 mode:

Value Index	Parameter	Default Units
<value 0>	WM Velocity	m
<value 1>	Temperature	degrees C
<value 2>	SOS	m
<value 3>	Quality Number	%
<value 4>	Flow Balance	% (±)

For Example – Address = 0

0D0! 0+0.195+25.000+1450.000+56.303+100.000LFU<CR><LF>

Value	Parameter	Default Units
+0.195	Velocity	m
+25.000	Temperature	degrees C
+1450.000	SOS	m
+56.303	Quality Number	%
+100.000	Flow Balance	% (±)

The Type 810 supports the following SDI12 commands:

Code	Response	Description
a!	a<CR><LF>	Acknowledge Active Command a = sensor address default address = 0
aI!	allccccccccmmmmmmvvvxxx . . . xxx<CR><LF>	Send Identification Command a - the sensor address ll - the SDI-12 version number, indicating SDI-12 version compatibility; for example, version 1.3 is encoded as 13 cccccccc - an 8 character vendor identification, usually a company name or its abbreviation mmmmmm - 6 characters specifying the sensor model number vvv - 3 characters specifying the sensor version xxx . . . xx - an optional field, up to 13 characters, used for a serial number or other specific sensor information that is not relevant for operation of the data recorder <CR><LF> - terminates the response
?!	a<CR><LF>	Address Query Command a = sensor address NB if more than one sensor is connected to the bus, all will respond to this command causing a bus contention.
aAb!	b<CR><LF>	Change Address Command b - the address of the sensor (will equal the new address or the original address if the sensor is unable to change the address)
aM!	atttn<CR><LF> followed by a<CR><LF> after a delay of ttt seconds	Start Measurement Command a - the sensor address ttt - the specified time, in seconds, until the sensor will have the measurement(s) ready n - the number of measurement values the sensor will make and return in one or more subsequent D commands; n is a single digit integer with a valid range of 1 to 9
aMC!	atttn<CR><LF> followed by a<CR><LF> after a delay of ttt seconds	Start Measurement Command with CRC (Cyclic Redundancy Check) a - the sensor address ttt - the specified time, in seconds, until the sensor will have the measurement(s) ready (see measurement timings) n - the number of measurement values the sensor will make and return in one or more subsequent D commands; For the Type 810 n= 5 If using this command the response to aD0! command is extended by a CRC value
aD0!	0<Velocity><Temperature><SOS< Quality Number><Flow Balance><CR><LF>	Send Data Command (after aM! Or aMC!) a - the sensor address <value> - data value in requested position <CRC> - if measurement was requested by aMC! command

7.1 SDI-12 Variable

This variable can only be changed over RS232 or RS485.

Variable Name			Type	Count	Format		default
SDI 12 Enabled			unsigned char	1	#;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0189	#616	Read	USER		0	1	0 – Disabled 1 - Enabled
	#615	Write	ADVANCED USER				

SDI-12 by default is disabled

SDI-12 is only supported in Mode 0

Variable Name			Type	Count	Format		default
SDI 12 Optional			ASCII	14	N/A		OPTIONAL_DATA
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
01D4	#612	Read	USER		Space (32 hex)	~ (7E hex)	An optional field, up to 13 characters, used for a serial number or other specific sensor information that is not relevant for operation of the data recorder
	#611	Write	USER				

up to 13 characters (ASCII Format Type is 1 less than count, NUL terminated)

printable ASCII characters only 0x32 to 0x7E

7.1.1 Supporting Document

SDI-12 SDI-12_version1_3 January 26, 2013.pdf

8 Restoring Defaults

Variable Name			Type	Count	Format		default
default settings			unsigned char	1	N/A		N/A
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
012C					0	2	0 - All Settings (Measurement and Communication Settings) 1 - Measurement Settings 2 - Communication Settings
	#999	Write	ADVANCED USER				

All User defined variables will be restored back to factory defaults

Communication Defaults – SDI-12 Address = 0, Modbus Slave ID = 1

9 Statement on In-Band Noise

Due to the nature of the measurement, any large levels of in-band noise (1MHz (±) 8 KHz) during the pulse measurement can affect the final velocity value.

In a high percentage of installations, the effects of in-band and out-band noise won't be seen but in conditions where the return signals are low or in static water the Type 810 may be subject to inaccurate results due to external noise. By default, the Type 810 is set to output a velocity reading, velocity readings should always be verified by the quality number and any erroneous readings should be removed from the dataset. Settings can be adjusted to eliminate erroneous readings, for example, increasing the system noise threshold (default: Medium) and noise threshold (default: 10).

To prevent the output of a raw reading when quality is low (< 20%) set Velocity/Quality Output Option to 1 (zero the velocity when quality is < 20%).

10 Commands

10.1 Measurement Settings

Variable Name			Type	Count	Format		default
Start measurement			unsigned char	1	#;		1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0133	#099	Read	USER		0	1	1 – Start a measurement cycle
	#098	Write	USER				
Auto runs after write							

Variable Name			Type	Count	Format		default
additional pulses			unsigned char	1	###;		2 additional pulse - total 3
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0117	#085	Read	USER		0	5	Number of additional pulses
	#084	Write	USER				
The total number of pulses effect the measurement interval							

Variable Name			Type	Count	Format		default
Velocity/Quality Output Option			unsigned char	1	###;		0 – Output Raw Velocity
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0110	#770	Read	USER		0	1	Velocity/Quality Output Option 0 – Output Raw Velocity 1 - Zero Velocity
	#769	Write	USER				
Variable Name			**Type**	**Count**	**Format**		**default**
measure_on_power_up			unsigned char	1	#;		1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0178	#714	Read	USER		0	1	On power up the Type 810 takes a measurement 0 - disabled 1 - enabled
	#713	Write	ADVANCED USER				

Variable Name			Type	Count	Format		default
System noise level (baseline)			unsigned short	1	#;		2– Medium
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
09CC	#774	Read	USER		0	3	Sets the level for system noise 0 - Off 1 - Low 2 - Medium (Default) 3 - High
	#773	Write	ADVANCED USER				

Changing this variable may increase noise on the final velocity reading (Use with care)

Multiple Cycles and Measurement Results

Variable Name			Type	Count	Format		default
cycle multiple			unsigned char	1	###;		1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0118	#058	Read	USER		1	5	Set the number of cycles in a measurement.
	#057	Write	USER				

Variable Name			Type	Count	Format		default
cycle store			unsigned char	1	###;		0 – Current Results
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0106	#064	Read	USER		0	4	Update Cycle Results 0 – 4 (0 = Newest Cycle)
	#063	Write	USER				

If more than one cycle is used (mode 1), the user is required to send an additional command to write the cycle results into the measurement results. (cycle store).

Variable Name			Type	Count	Format		default
Results			Float	20	#.###;		N/A
Modbus Address	Hash Code	R/W	Access		Low Limit	High Limit	Notes
01E0	#815	Read	USER		N/A	N/A	Read Measurement Results

Auto runs after write

Single measurement mode - make sure cycle store is set to 0

Index	#	Raw	Float	Output
0	0	3F 31 C8 4B	0.694463	Peak Velocity
1	4	3F 33 C1 58	0.702169	WM Velocity
2	8	41 E8 00 00	29	Temperature
3	12	44 B5 40 00	1450	SOS
4	16	42 B5 73 E9	90.72639	Quality Number
5	20	3F 33 BE 9A	0.702127	Max Velocity
6	24	00 00 00 00	0	Flow (Calculated using look up tables, Setting Level)
7	28	42 A2 E7 D2	81.45277	Not Used
8	32	40 0C CC CD	2.2	Gain. Range
9	36	42 C8 00 00	100	Flow balance
10	40	00 00 00 00	0	Not Used
11	44	42 2F 32 E6	43.79971	Standard Deviation
12	48	45 7A 00 00	4000	Peak Signal
13	52	44 3E 70 B4	761.761	Not Used
14	56	40 C0 20 C5	6.004	Not Used
15	60	47 3B 55 00	47957	Probe SN
16	64	3F 33 BE 9A	0.702127	Not Used
17	68	41 86 8B 44	16.818	Not Used
18	72	40 7A 00 00	3.90625	Resolution
19	76	00 00 00 00	0	Average Velocity

10.1.1 Flow Variables

10.1.1.1 Look up tables

Variable Name			Type	Count	Format		default
Lookup area height			unsigned short	128	#;		All zeros
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0118	#501	Read	USER		0	65000	Level values Reads and Loads up all 128 height values in 10ths of mm
	#500	Write	ADVANCED USER				

Write Command uses Load function which expects binary data (2 Byte - Big Endian unsigned short)

Variable Name			Type	Count	Format		default
Lookup area			float	128	#.######;		All zeros
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0118	#503	Read	USER		-1.00E+06	1.00E+06	Level to Area Conversion Reads and Loads up all 128 area values in M2
	#502	Write	ADVANCED USER				

Write Command uses Load function which expects binary data (4 Byte - Big Endian float)

Variable Name			Type	Count	Format		default
start delay			unsigned char	1	###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0101	#054	Read	USER		0	100	Start delay in seconds after a Power ON
	#053	Write	USER				

Used only for Mode 2 but configurable in all modes

10.1.1.2 Measurement Timing Variables

Variable Name			Type	Count	Format		default
interval			unsigned char	1	###;		5
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0102	#056	Read	USER		1	120	Desired cycle interval in seconds (Secs)
	#055	Write	USER				

Variable Name			Type	Count	Format		default
minimum interval			unsigned char	1	###;		3
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0104	#060	Read	USER		1	5	Calculated minimum cycle interval (Secs)

Variable Name			Type	Count	Format		default
current interval			unsigned char	1	###;		2 additional pulse - total 3
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0105	#062	Read	USER		1	5	Current Cycle interval (Secs)

10.2 Communication Settings

Variable Name			Type	Count	Format		default
Protocol			Unsigned char	1	#;		1
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0132	#097	Read	USER		0	1	0 – Hash 1 - Modbus
	#096	Write	ADVANCED USER				

Once protocol has been changed, User MUST use the new protocol to change back (if required)

If Parity is set to 'None' and Protocol is Modbus Stop Bit/s is 2 (not 1)

MODBUS is ONLY AVAILABLE in Mode 2 when the Output line select is set to None

Variable Name			Type	Count	Format		default
Baud Rate			unsigned long	1	NUM;		19200
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
00B8	#020	Read	USER		9600	115200	9600,19200,38400,57600, 115200
	#019	Write	ADVANCED USER				

Can only valid baud rates, if an invalid baud rate is used the Type 810 defaults to 19200.

Once baud rate has been changed, user MUST change the serial port settings.

Variable Name			Type	Count	Format		default
SDI 12 Enabled			unsigned char	1	#;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0189	#616	Read	USER		0	1	0 – Disabled 1 - Enabled
	#615	Write	ADVANCED USER				

SDI-12 by default is disabled

SDI-12 is only supported in Mode 0

Variable Name			Type	Count	Format		default
Parity			unsigned char	1	#;		2 – Even
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
01A1	#091	Read	USER		0	2	0 – None 1 – Odd 2 – Even
	#090	Write	ADVANCED USER				

If parity is set to 'None' and Protocol is Modbus Stop Bit/s is 2 (not 1)

Once baud rate has been changed, user MUST change the serial port settings.

Variable Name			Type	Count	Format		default
Slave ID			Unsigned char	1	###;		001
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
01A0	#095	Read	USER		001	247	
	#094	Write	ADVANCED USER				

Slave ID will change after the response has been returned

Once Slave ID has been changed, remember to change the master to match new address.

Variable Name			Type	Count	Format		default
output line select			unsigned char	1	#;		0 – Serial Out
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
01B0	#080	Read	USER		0	1	0 – Outputs on RS232 1 - Outputs on RS485 2 - None
	#079	Write	ADVANCED USER				

Used only for Mode 2 but configurable in all modes

Variable Name			Type	Count	Format		default
output format			unsigned char	1	###;		0
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0111	#078	Read	USER		0	99	0 - NMEA Format 1 - NMEA Format with average See NMEA Output Format
	#077	Write	USER				

Used only for Mode 2 but configurable in all modes

Variable Name			Type	Count	Format		default
software_version			ASCII	50	N/A		
Modbus Address	**Hash Code**	**R/W**	**Access**		**Low Limit**	**High Limit**	**Notes**
0085	#004	Read	USER		NUL (00 hex)	DEL (7F hex)	See ASCII Type
Software_versions is up to 49 characters (ASCII Format Type is 1 less than count, NUL terminated)							

Example

Request ⇨ 01030085001995E9

Response⇦

0103323038313037303643352 04A616E203131203230313820313333A343200353800000000000000000000000000000000000000000000000F66A

01: The Slave Address (1 = 01 hex)
03: The Function Code (read Analog Output Holding Registers)
32: The number of data bytes to follow (25 registers x 2 bytes each = 50 bytes)
(0810706C5 Jan 11 2018 13:42)

30 = 0
38 = 8
31 = 1
30 = 0
37 = 7
30 = 0
36 = 6
43 = C
35 = 5
20 = <Space>
4A = J
61 = a
6E = n
20 = <Space>
31 = 1
31 = 1
20 = <Space>
32 = 2
30 = 0
31 = 1
38 = 8
20 = <Space>
31 = 1
33 = 3
3A = :
34 = 4
32 = 2
00 = NULL terminated
(Unused memory locations)
F66A: The CRC (cyclic redundancy check).

11 Declarations of Conformity

Any changes or modifications to the product or accessories supplied, that are not authorised by Valeport Ltd, could void the compliance of the product and negate your authority to operate it. This product has demonstrated compliance under conditions that include the use of shielded cables. It is important that you use shielded cables compliant with the product's conformance, to protect from potential damage and reduce the possibility of interference to other electronic devices

11.1 Type 810: Ex Approved Doppler Sensor – UK Declaration of Conformity

UK Declaration of Conformity

The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016' UKSI 2016:1107 (as amended).

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Description	The Type 810 Doppler Velocity Probe is designed to generate electronic signals related to the flow velocity of the liquid in which the probe is immersed. The apparatus is comprised of a plastic moulded housing into which are fitted a printed circuit board (PCB) and two piezoelectric crystals. These are all potted within the housing. An integral cable provides the connection facilities to external circuits.
Manufacturer	Valeport Ltd, Totnes TQ9 5EW, UK
Notified Body	Only for UKEX Regulation SI 2016 No.1107 (as amended). CSA Group Testing UK Ltd, Approved Body Number 0518 Hawarden, Deeside CH5 3US, UK
Provisions	Ex II2G Ex ib IIC T4 Gb Ta = -20°C to +60°C
Certificate Numbers	CSAE 22UKEX1109X IECEx SIR 14.0051X
Standards	EN IEC 60079-0:2018 EN 60079-11:2012 BS 8888:2020 BS EN 61326-1:2013 (Basic Level) BS EN IEC 63000:2018

This document certifies that the equipment detailed above has been manufactured in compliance with SI 2012 No. 3032 (RoHS Regulations), SI 2016 No.1091 (EMC Regulations) and SI 2016 No.1107 (as amended) (UKEX Regulation), pertaining to equipment intended for use in potentially explosive atmospheres.

Special Conditions for Safe Use

Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

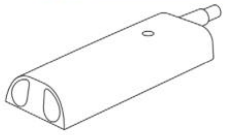
The ambient temperature range is -20°C to +60°C.

Signed

Jeremy Law, Ex Management Representative
Valeport Limited

Sensor serial number: _____

Date: _____



11.2 Type 810: Ex Approved Doppler Sensor – EU Declaration of Conformity

EU Declaration of Conformity

The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Directive 2014/34/EU.

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Description	The Type 810 Doppler Velocity Probe is designed to generate electronic signals related to the flow velocity of the liquid in which the probe is immersed. The apparatus is comprised of a plastic moulded housing into which are fitted a printed circuit board (PCB) and two piezoelectric crystals. These are all potted within the housing. An integral cable provides the connection facilities to external circuits.
Manufacturer	Valeport Ltd, Totnes TQ9 5EW, UK
Notified Body	Only for ATEX Directive 2014/34/EU. CSA Group Netherlands B.V., Notified Body Number 2813 Utrechtseweg 310 (B42), 6812 AR Arnhem
Provisions	Ex II2G Ex ib IIC T4 Gb Ta = -20°C to +60°C
Certificate Numbers	Sira 13ATEX2380X IECEx SIR 14.0051X
Standards	EN IEC 60079-0:2018 EN 60079-11:2012 BS 8888:2020 BS EN 61326-1:2013 (Basic Level) BS EN IEC 63000:2018

This document certifies that the equipment detailed above has been manufactured in compliance with 2015/863/EU (RoHS Directive), 2014/30/EU (EMC Directive) and 2014/34/EU (ATEX Directive), pertaining to equipment intended for use in potentially explosive atmospheres.

Special Conditions for Safe Use

Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

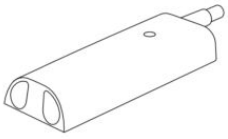
The ambient temperature range is -20°C to +60°C.

Signed 

Jeremy Law, Ex Management Representative
Valeport Limited

Sensor serial number: _____

Date: _____



Ver C

11.3 Type 812: UK Declaration of Conformance

UK Declaration of Conformity

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Description The Type 812 Doppler Velocity Probe is designed to generate electronic signals related to the flow velocity of the liquid in which the probe is immersed. The apparatus is comprised of a plastic moulded housing into which are fitted a printed circuit board (PCB) and two piezoelectric crystals. These are all potted within the housing. An integral cable provides the connection facilities to external circuits.

Manufacturer Valeport Ltd, Totnes TQ9 5EW, UK

Standards BS 8888:2020 BS EN 61326-1:2013 (Basic Level) BS EN IEC 63000:2018

This document certifies that the equipment detailed above has been manufactured in compliance with SI 2012 No.3032 (RoHS Regulations) and SI 2016 No.1091 (EMC Regulations).

Special Conditions for Safe Use

Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

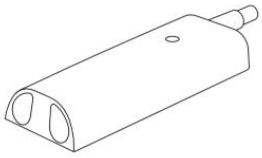
The ambient temperature range is -20°C to +60°C.

Signed

Jeremy Law, Chief of Operations
Valeport Limited

Sensor serial number: _____

Date: _____



Ver B

11.4 Type 812: EU Declaration of Conformance

EU Declaration of Conformity

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Description The Type 812 Doppler Velocity Probe is designed to generate electronic signals related to the flow velocity of the liquid in which the probe is immersed. The apparatus is comprised of a plastic moulded housing into which are fitted a printed circuit board (PCB) and two piezoelectric crystals. These are all potted within the housing. An integral cable provides the connection facilities to external circuits.

Manufacturer Valeport Ltd, Totnes TQ9 5EW, UK

Standards BS 8888:2020 BS EN 61326-1:2013 (Basic Level)
BS EN IEC 63000:2018

This document certifies that the equipment detailed above has been manufactured in compliance with 2015/863/EU (RoHS Directive) and 2014/30/EU (EMC Directive).

Special Conditions for Safe Use

Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

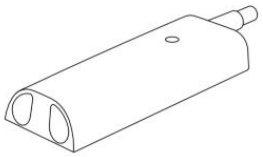
The ambient temperature range is -20°C to +60°C.

Signed

Jeremy Law, Chief of Operations
Valeport Limited

Sensor serial number: _____

Date: _____



Ver B