MASTER

RS485 Comms

Instruction Manual

RS485 COMMUNICATIONS (SEVENTH EDITION REV 2)

August 2023

Part Number M-485-0-007-2P

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CHAPTER 1: START HERE...

About this Manual

It is important that this manual is referred to for correct installation and operation.

This manual has been written for people who need to use a digital communication link and communication protocols to communicate with the Pulsar Ultra Series range of Level instrumentation.

In producing this manual, it has been assumed that the reader has some experience of communication protocols and is familiar with the Pulsar Ultra Series range of instruments.

Disclaimer: Pulsar accepts no responsibility for any loss or damage caused by miss-application of the information contained in this document.

Tips

TIP: Look for this icon throughout your Pulsar Measurement manual to find helpful information and answers to frequently asked questions.

Additional Information

Additional Information

At various parts of the manual, you will find sections like this that explain specific things in more detail.

References

— **See Also**

References to other parts of the manual.

CHAPTER 2 TERMINAL CONNECTIONS

Ultra Wall units

Ultra 3 Wall Mount
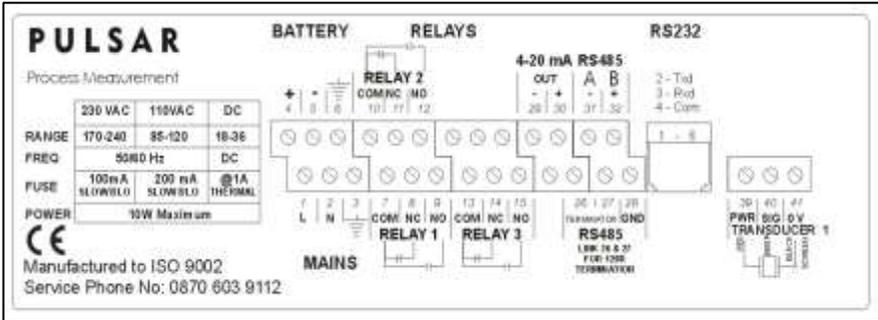
TERMINAL NO.	DESCRIPTION
28	SCR – Cable shield can be connected to this grounding point
31	RS485 negative (Profibus A - Green)
32	RS485 positive (Profibus B – Red)

If termination is required fit a wire link across 26 & 27

Ultra 5 Wall Mount
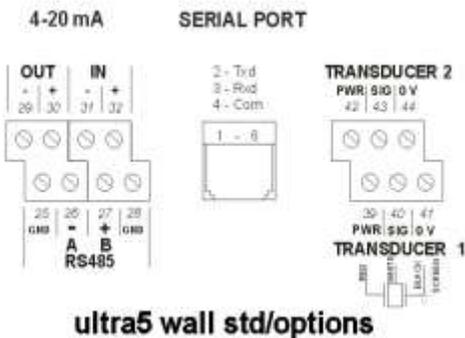
TERMINAL NO.	DESCRIPTION
25 or 28	SCR – Cable shield can be connected to this grounding point
26	RS485 negative (Profibus A - Green)
27	RS485 positive (Profibus B – Red)

If termination is required fit the 120ΩR across 26 & 27

UltraLite Wall Mount

ultraLite 5 RELAY WALL
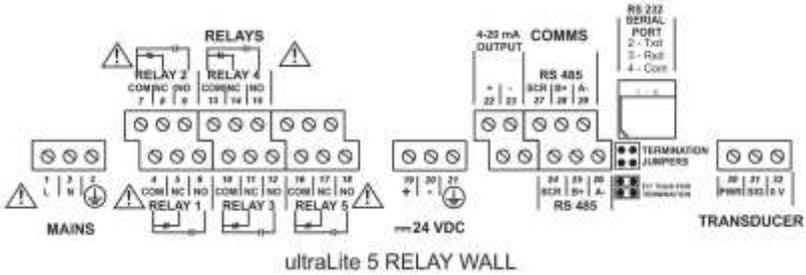
TERMINAL NO.	DESCRIPTION
24 or 27	SCR – Cable shield can be connected to this grounding point
26 or 29	RS485 negative (Profibus A - Green)
25 or 28	RS485 positive (Profibus B – Red)

If termination required fit jumpers as indicated above.

Ultra Twin Wall Mount

ultra Twin wall mount
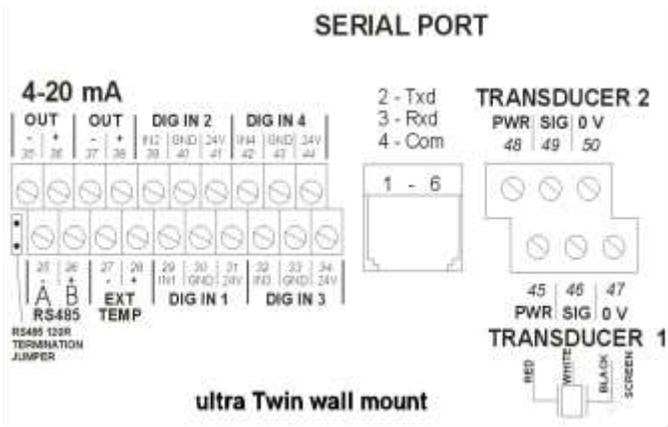
TERMINAL NO.	DESCRIPTION
25	RS485 negative (Profibus A green)
26	RS485 positive (Profibus B red)

If termination required fit jumper, as indicated above. Connect SCR to an available GND.

FlowCERT Lite

TERMINAL NO.	DESCRIPTION
35	RS485 negative (Profibus A green)
36	RS485 positive (Profibus B red)

If termination required fit jumper, as indicated above. Connect SCR to an available GND.

FlowCERT
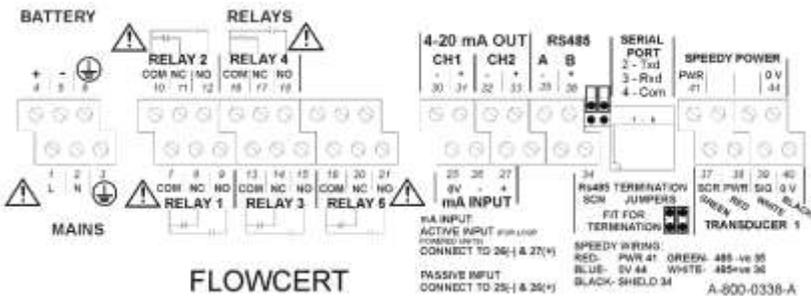
TERMINAL NO.	DESCRIPTION
35	RS485 negative (Profibus A green)
36	RS485 positive (Profibus B red)

If termination required fit jumper, as indicated above. Connect SCR to an available GND.

Ultra 4 Wall
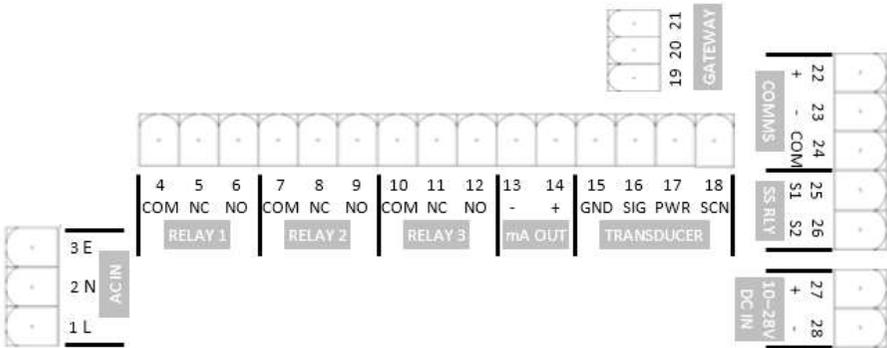
TERMINAL NO.	DESCRIPTION
23	RS485 negative (Profibus A Green)
24	RS485 positive (Profibus B Red)

If termination is required, change the dip switches located on the comms board (located underneath the LCD board) to 'ON'.

Sludge Finder 2
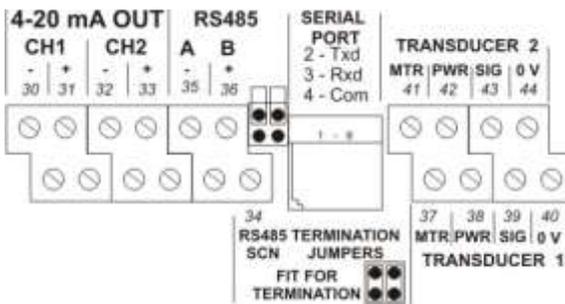
TERMINAL NO.	DESCRIPTION
34	SCN – Cable shield can be connected to this grounding point
35	RS485 negative (Profibus A Green)
36	RS485 positive (Profibus B Red)

If termination required fit jumper, as indicated above.

Ultra Fascia Mounts

Ultra 3 Fascia Mount
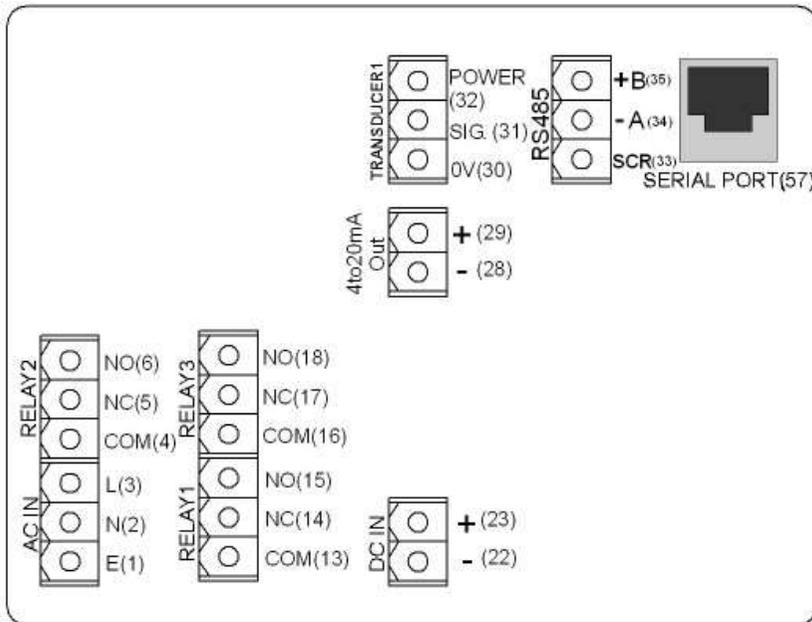
TERMINAL NO.	DESCRIPTION
33	SCN – Cable shield can be connected to this grounding point
34	RS485 negative (Profibus A Green)
35	RS485 positive (Profibus B Red)

If termination is required fit the 120ΩR across 34 & 35.

Ultra 5 Fascia Mount
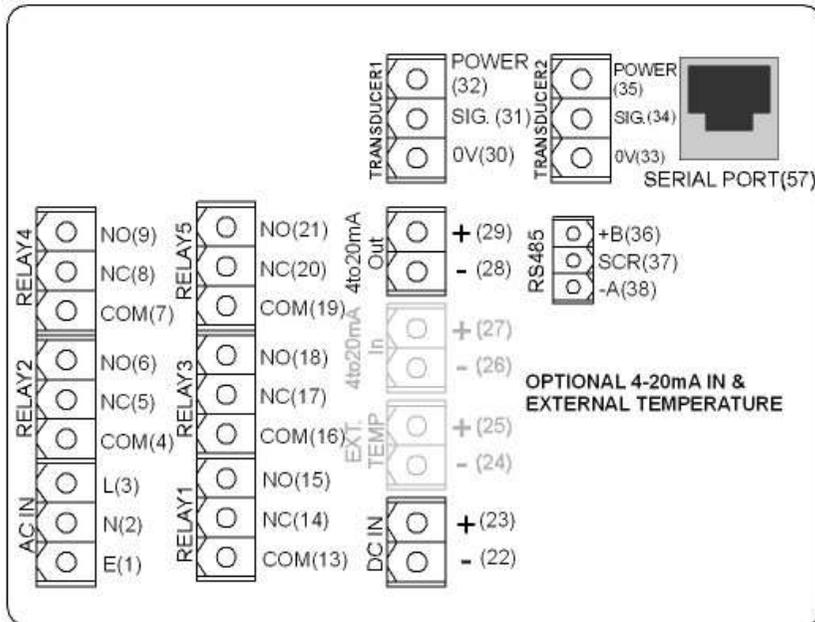
TERMINAL NO.	DESCRIPTION
37	SCN – Cable shield can be connected to this grounding point
38	RS485 negative (Profibus A Green)
36	RS485 positive (Profibus B Red)

If termination is required fit the 120ΩR across 36 & 38.

UltraLite Fascia Mount
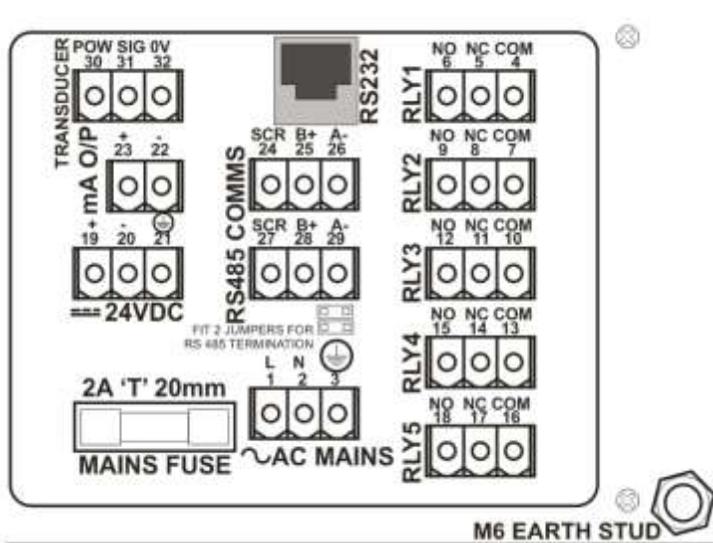
If termination is required fit the 120ΩR across 36 & 38

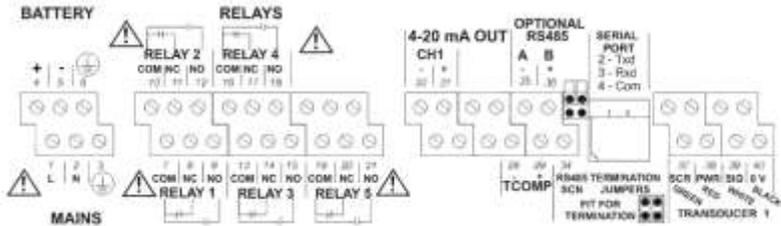| TERMINAL NO.	DESCRIPTION
24 or 27	SCN – Cable shield can be connected to these grounding points
26 or 29	RS485 negative (Profibus A Green)
25 or 28	RS485 positive (Profibus B Red)

If termination is required fit jumpers as indicated as above.

Ultra Twin Fascia Mount
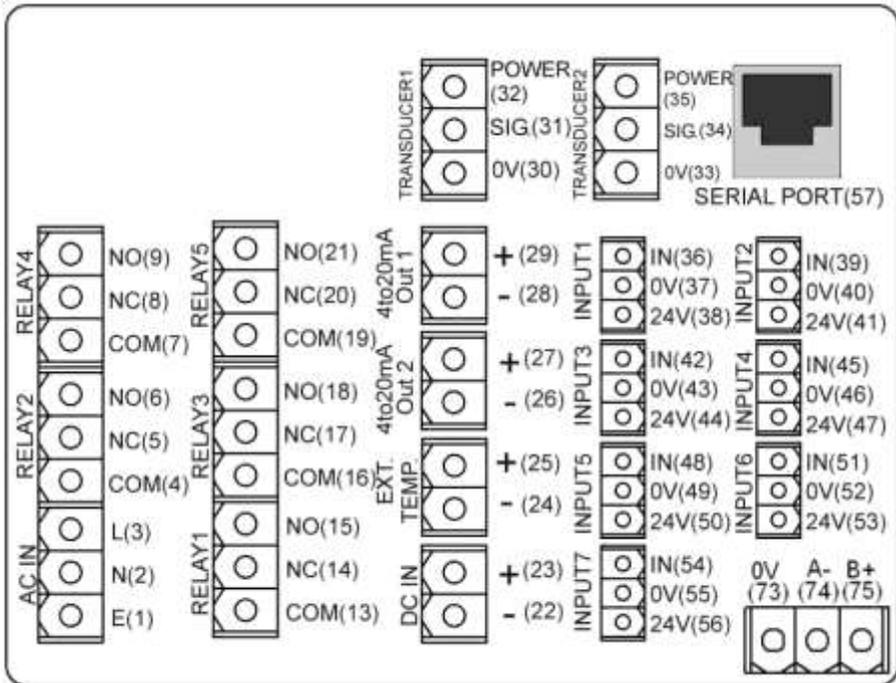
TERMINAL NO.	DESCRIPTION
73	0V or SCN – Cable shield can be connected to this grounding point
74	RS485 negative (Profibus A Green)
75	RS485 positive (Profibus B Red)

If termination is required fit the 120ΩR across 74 & 75

Zenith Fascia Mount
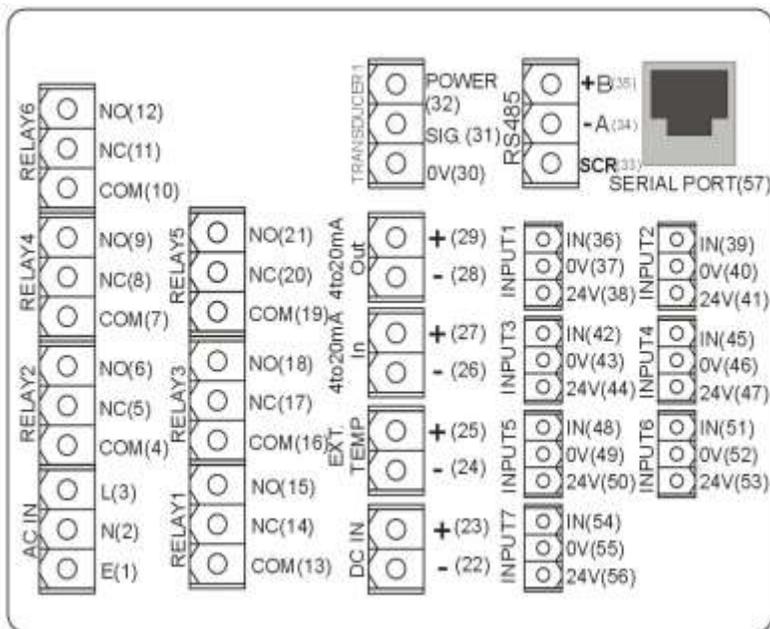
Additional Information

When the RS485 communications option is fitted to the Ultra Zenith Fascia mount unit the second transducer input is not available for differential or average applications.

TERMINAL NO.	DESCRIPTION
33	SCN – Cable shield can be connected to this grounding point
34	RS485 negative (Profibus A Green)
35	RS485 positive (Profibus B Red)

If termination is required fit the 120ΩR across 34 & 35

Quantum Fascia Mount
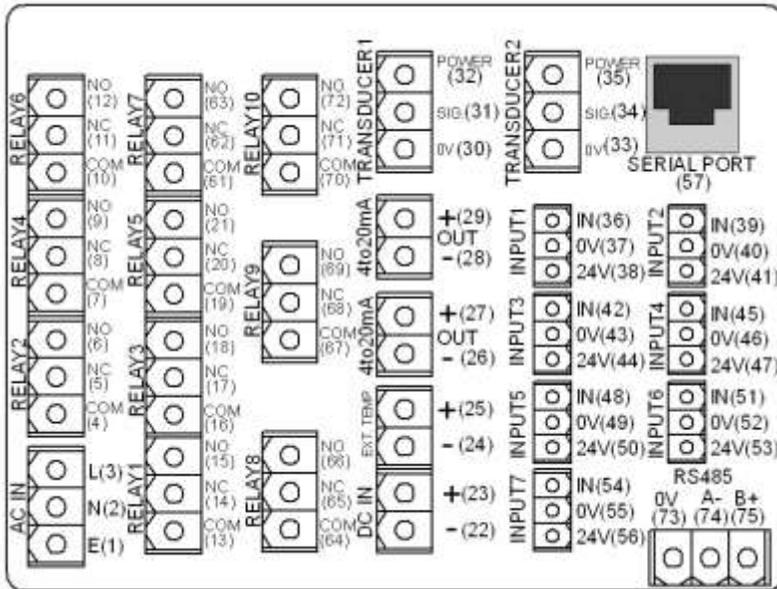
TERMINAL NO.	DESCRIPTION
73	0V or SCN – Cable shield can be connected to this grounding point
74	RS485 negative (Profibus A Green)
75	RS485 positive (Profibus B Red)

If termination is required fit the 120ΩR across 74 & 75

Ultra 4 Fascia Mount
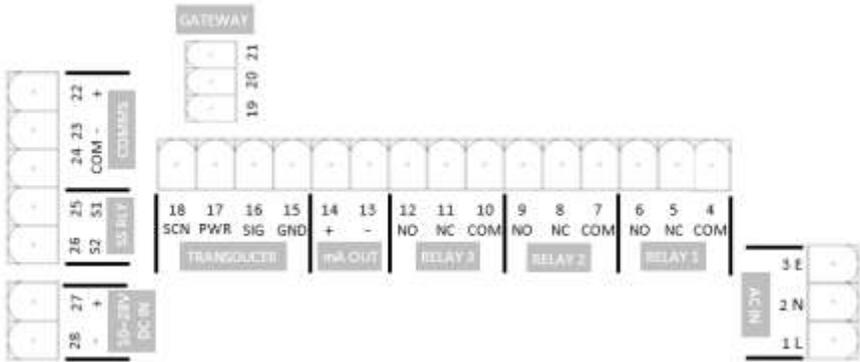
TERMINAL NO.	DESCRIPTION
23	RS485 Negative (Profibus A Green)
22	RS485 negative (Profibus B Red)

If termination is required, change the dip switches located inside the cover of the controller on the comms board (located underneath the LCD board) to 'ON'.

The RS 232, which is fitted as standard on all Pulsar units, is used for connecting to a PC when using Pulsar software, to carry out programming, echo analysis or data retrieval. It should be noted that the RS 485 communications will be interrupted on the units when connected to the RS 232 interface. The only unit that does not do this is the Ultra 4.

Connecting the RS 485

All Pulsar units are designed for 2-wire RS 485, however, in the case of MODBUS, if your controller has a 4-wire system then link as follows:

RX+ and TX+ are to be linked and connected to RS 485 positive and RX- and TX- are to be linked and connected to RS 485 negative. It should be noted this method of wiring can only be used where all units on the loop are configured to work with a 2-wire interface.

Additional Information

The first and last unit in the RS 485 loop should have a 120R line terminator fitted.

Electrical Wiring

Cable Specifications

Either of the two cable types detailed below can be used. Please note that the cable types 1 and 2, specified below, are NOT related to the wire numbers A and B in the above diagram. Type 1 is recommended as it allows higher speed and longer cable length.

SPECIFICATION	TYPE 1 CABLE	TYPE 2 CABLE
Characteristic impedance	135 to 165Ω at a frequency of 3 to 20 MHz	135 to 165 Ω at a frequency of > 100 kHz
Cable capacitance	< 30 pF per metre	Typically. < 60 pF per metre
Core diameter	Max. 0.34 mm^2, corresponds to AWG 22	Max. 0.22 mm^2, corresponds to AWG 24
Cable type	Twisted pair cable, 1x2 or 2x2 or 1x4 lines	Twisted pair cable, 1x2 or 2x2 or 1x4 lines
Resistance	< 110 Ω per km	
Shielding	Copper shielding braid or shielding braid and shielding foil	Copper shielding braid or shielding braid and shielding foil

Belden B3079A meets cable 1 specification, but there are other choices. For more information refer to the PROFIBUS Product Guide produced by the PROFIBUS User Group.

Maximum Line Length Per Segment

BAUDRATE (KBIT/SEC)	9.6	19.2	93.75	187.5	500	1500
Type 1 cable	1200m	1200m	1200m	1000m	400m	200m
Type 2 cable	1200m	1200m	1200m	600m	200m	-

Earthing the Shield

The PROFIBUS standard suggests that both ends of the transmission line should be connected to safety earth. If such a course is followed, care must be taken to ensure that differences in local earth potential do not allow circulating currents to flow, as these can not only induce large common mode signals in the data lines but can also produce potentially dangerous heating in the cable. Where doubt exits, it is recommended that the shield be earthed at only one section of the network.

CHAPTER 3 MODBUS

Device Set Up

The following parameters will be found in the Pulsar Control Unit under the Device Set Up menu and will require programming before the RS 485 communications can be used.

PAR NO.	OPTIONS	DESCRIPTION
P130	0 = Off 1 = Slave	Select mode, Off or Slave. Choose 1 for Slave.
P131	0 = Modbus RTU 1 = Modbus ASCII	Protocol, select either 0 for Modbus RTU, or 1 for ASCII over RS485.
P132	1 to 255	Device address. Enter the device number for this unit.
P133	1200, 2400, 4800, 9600, 19200, 38400, 115200	Baud rate. Enter the system baud rate
P134	0 = No Parity 1 = Odd Parity 2 = Even Parity	Parity. Set your system parity.
P135	1 = One stop bit 2 = Two stop bits	Stop bits. Set your system stop bit setting.
P136	0 = Unsigned integer 1 = Signed Integer 2 = Float Modicon 3 = Float IEEE	Data format. Set your preference: **Unsigned**: 0 to 65335 **Signed**: -32768 to +32768 F**loat Modicon**: 32-bit floating bit value. Where the most significant value in the sequence is stored first (Big endian) **Float IEEE**: 32-bit floating point values. Where the least significant value is stored first (Little endian byte swapped).
P137	0 to 9999	Delay in milliseconds

Important Information
Only slave operation with Modbus RTU and Modbus ASCII are available.

Safety Symbols

A data communication protocol defines the rules and structure of messages used by all devices on a network for data exchange. This protocol also defines the orderly exchange of messages, and the detection of errors.

Modbus

MODBUS defines a digital communication network to have only one MASTER and one or more SLAVE devices. Either a single or multi-drop network is possible. The two types of communications networks are illustrated in the diagram below:
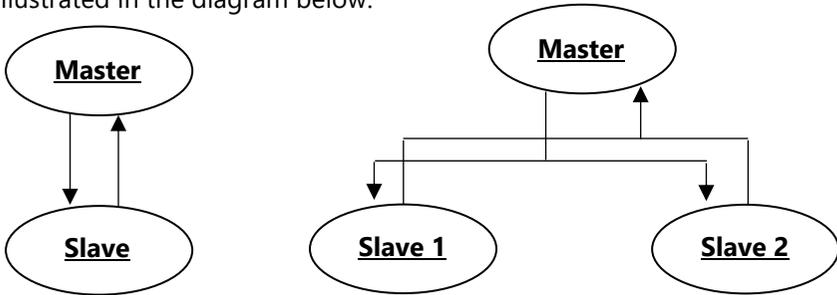
A typical transaction will consist of a request sent from the master followed by a response from the slave. The message in either direction will consist of the following information:

Start of Transmission	Device Address	Function Code	Data or List of Data	CRC Error Check	End of Transmission

- Each slave has a unique *Device Address*.
- The device address 0 is a special case and is used for message broadcast to all slaves. This is restricted to parameter write operations.
- Level controllers support a subset of Modbus standard function codes. There are 8 Modbus functions used: 1, 2, 3, 4, 5, 6, 8 and 16.
- The data will include instrument parameters referenced by a *Register Address*.
- Sending a communication with a unique device address will cause only the device with that address to respond. That device will check for errors,

- perform the requested task and the reply with its own address, data and a checksum.
- Sending a communication with the device address 0 is a broadcast communication that will send information to all devices on the network. Each will perform the required action but will not transmit a reply.

Typical Transmission Line Activity

This diagram is to illustrate typical sequence of events on a Modbus transmission line.
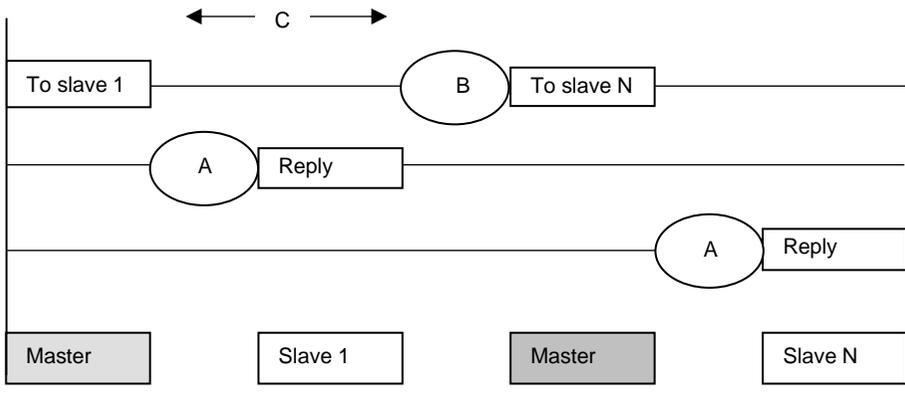
- Period 'A': the processing time (latency) required by the slave to complete the command and construct a reply.
- Period 'B': the processing time required by the master to analyse the slave response and formulate the next message.
- Period 'C': the wait time calculated by the master for the slaves to perform the operation. None of the slaves will reply to a broadcast message.

Message Frame Format

Device Address

Each slave has a unique address. The Modicon Modbus protocol defines the address range limits as 1 to 247. The Level Controller will support an address range of 1 to 254. The device address used by the instrument is set using the Set-up Parameters List according to the instrument manuals.

Device address 0 is a special case that will broadcast a message to all slaves simultaneously.

Parameter Address

Data bits or data words exchange information between master and slave devices. This data consists of parameters. All parameters communicated between master and slaves have a 16-bit parameter address, which is referred to as *Register Address*.

The Modbus Register Address range is 100 to 999 according to parameter list of P100-P999 on the ultrasonic level instruments. Accessible variables are dependent upon the type of level instruments installed. For example, all parameters related to flow will not be available for reading/writing if the level instrument is a pump advanced unit. In this instance, accessing these parameters will result in an error code 02 (data unavailable – refer to Error Checking Section for more details).

Function Codes

Standard Modicon Modbus provides function codes from 1 to 247. Pulsar Modbus protocols support function 1, 2, 3, 4, 6, 8 and 16. For more details of query and response correspond to each function, refers to Section 5 for more descriptions.

FUNCTION CODE	FUNCTION DESCRIPTIONS	DATA TYPE
01	Read coil status	Bit mapped
02	Read input status	Bit mapped
03	Read holding registers	Integer
04	Read Input register	Integer
05	Force single coil	
06	Write single register	Integer
08	Diagnostic loop back	None
16	Write multiple registers	Integer

It is recommended that function code 03 or function code 04 is used for reads and function code 06 is used for writes. This includes Boolean data. Other codes are supplied for purposes of compatibility.

The level instruments will transmit error code if they receive a request including an unsupported function code.

Request & Response Conventions

Parameter Resolution and Scaling

Standard Modbus protocol limits data to 16 bits per parameter. This reduces the active range of parameters from 0 to 65535 (decimal) as unsigned integer and from –32767 to +32767 as signed integer.

The protocol is also limited to integer communication only. The Pulsar level controller provides data in either signed or unsigned integer type (word). In Integer Format, all parameters will be rounded to the specified units. Example of this protocol is shown in Section 5. The following table shows the unit symbols and their corresponding conversions.

UNIT SYMBOL	SCALING	DESCRIPTIONS
U_NO	None	no unit
U_MU	× mm	measurement
U_MA	× 0.01 mA	mA input/output
U_SE	× seconds	number of seconds
U_MN	× 0.01 minute	number of minutes
U_HR	× 0.1 hour	number of hours
U_DDMM	ddmm	dd:mm
U_DATE	packed date	see note [1]
U_TIME	hhmm	hh:mm
U_PC	× 0.01 %	percentage
U_TP	× 0.1 °C	temperature in C
U_DB	× 0.01 dB	decibels
U_M3	None	cubic metre
U_VU	None	volume unit
U_FLO	× 0.1	flow unit
U_VEL	× 0.001 m/s	flow velocity
U_RATE	× mm/minute	rate

Example 1 Write date to Modbus

To write to Modbus a date of 02/03/01 – the coded date is calculated as follows:

> **Important Information**
>
> Only slave operation with Modbus RTU and Modbus ASCII are available.

xxx = (month * 50) + day = (03 * 50) + 02 = 152
yxxx = (year * 1000) + xxx = (01 * 1000) + 152 = 1152 (decimal)

To decode back to normal format of ddmmyy,

yy = 1152 mod 1000 = 1
mm = (1152 rem 1000) mod 50 = 3
dd = 1152 – yy * 1000 – mm * 50 = 2

Therefore,

ddmmyy = dd * 10000 + mm * 100 + yy = 20301 (decimal)

which has string equivalent of 02/03/01.

Example 2 Taking temperature reading

Taking a temperature reading from Modbus register = 256
Actual temperature value is = 256 * Scaling = 256 * 0.1= 25.6 $^{\circ}$C

Error Checking

The Modbus protocol defines the response to several error conditions. A slave device can detect a corrupted command or, one that contains an incorrect instruction, and will respond with an error code.

With some errors the slave devices on the network are unable to make a response. After a wait period the master will interpret the failure to reply as a communication error. The master should then re-transmit the command.

A slave device that has detected a corrupted command or a command that contains an incorrect instruction will respond with an error message. The error message has the following syntax.

DEVICE ADDRESS	FUNCTION CODE	ERROR RESPONSE CODE	CRC CHECKSUM	
1 byte	1 byte	1 byte	MSB	LSB

The function code byte contains the transmitted function code but with the most significant bit set to 1. (This is the result of adding 128 to the function code).

The error response code indicates the type of error detected. The level instruments support the following error response code:

ERROR CODE	ERROR	DESCRIPTION
0x01	Illegal function	The message function received is not an allowable action
0x02	Illegal address	The address referenced in the data field is not an allowable address for the slave
0x03	Illegal data value	The value referenced in the data field is not allowable in the addressed slave location
0x04	Failure in associated device	The slave has failed to respond to a message, or an abortive error occurred
0x05	Acknowledge	The slave has accepted and is processing the long duration program command
0x06	Busy, rejected message	The message was received without error, but the slave is processing a long duration program command
0x07	NAK Negative Acknowledgement	The PROGRAM function just requested could not be performed
0x08	Invalid checksum	Checksum is incorrect or corrupted
0x09	Invalid data count	The number of data count is outside the specified data range

Message Timings

Mode of Transmission

The mode of transmission describes the structure of information within a message and the number coding system used to exchange a single character of data.

The Modbus protocols define a mode of transmission for both ASCII and RTU modes of transmission. The Pulsar level controllers support both transmission modes. Details of how to set up these modes are provided in the appropriate controller manuals.

The definition of the mode of transmission for a single character is:

Start bit (1 bit)	Data bits (7 or 8 bits)	Parity bit (odd, even or none)	Stop bits (1 or 2 bits)

Transmission baud rate can be set ranges from 1200 – 38400 baud. Factory default setting is 19200 baud.

Wait Period

There are several errors for which the slave devices on the network are unable to make a response:

- If the master attempts to use an invalid address, then no slave device will receive the message.
- For a message corrupted by interference, the transmitted CRC will not be the same as the internally calculated CRC. The slave device will reject the command and will not reply to the master.

After a wait period, the master will re-transmit the command.

A wait period is also required after a broadcast communication to device address 0.

The wait period should exceed the instrument latency plus the message transmission time. Typical wait periods, for a single parameter read are at most 100 ms for the level controller.

Important Information

Failure to observe the wait period, after a broadcast, will negate the broadcast message.

Latency

The time taken for the level controller to process a message and start the transmission of a reply is called the latency. This does not include the time taken to transmit the request or reply.

The parameter functions read 1 word (function code 03), write 1 word (function code 06) and Loopback (function code 08) are processed within the latency of between 20 and 100 ms.

For parameter functions, read N bits (function 01), read N words (function 03 or function 04) and write N words (function 16) the latency is indeterminate. The latency will depend on the instrument activity and the number of parameters being transferred and will take from 100 to 500 ms approximately.

It is possible to artificially increase the latency by setting the *Comms Delay* parameter in the set-Up configuration list. This is sometimes required to allow a guaranteed gap between requests and responses needed by some RS485 adapters to switch from transmit to receive states.

Message Transmission Time

The time required to transmit a message will depend on the length of the message and the baud rate.

$$TransmissionTime = \frac{(NumberOfBytes * 3.5) * BitsPerCharacter}{BaudRate}$$

To find the number of bytes, refer to the relevant function code. The three extra bytes are for the end of transmission characters.

The number of bits per character will be ten, or eleven if a parity bit is used. (For Modbus RTU: 1 start bit, 8 data bit, an optional parity bit and 1 stop bit)

For example, reading a single word with the function code 03 at 19200 baud (no parity bit)

$$transmission = \frac{(8*3.5)*10}{19200} = 6ms \qquad response = \frac{(9*3.5)*10}{19200} = 6.5ms$$

The wait period for this transmission will exceed 22.5 ms (6 + 6.5 + 10.0).

For a broadcast command (device address 0) the master would not expect a reply. In this case the wait period will exceed 16 ms (6 + 10.0)

Modbus Functions
Function 1: Read Output Status

REGISTERS ADDRESS	DESCRIPTION	DATA TYPE	UNIT/RANGE
00001 – 00006	Relay status	Bit mapped	None

Important Information
1. Bit value of **1** represents an **ACTIVE STATE** of the corresponding relay.
2. Bit value of **0** represents an **IN-ACTIVE STATE** of the corresponding relay.

Example: Query: reading relay 2 to 4

Slave address	11
Function	01
Addr Hi	00
Addr Lo	02
No. of points hi	00
No. of points lo	03
Error check	

Response: relay 2 = on, relay 3 = off, relay 4 = on

Slave address	11
Function	01
Byte count	01
Data (coil 2-4)	0a
Error check	

Function 2: Read Input Status

REGISTERS ADDRESS	DESCRIPTION	DATA TYPE	UNIT/RANGE
10001 – 10006	Digital Input status	Bit mapped	None
10009 – 10016	Ultrasonic status [1]	Bit mapped	None

BIT	VALUE 0 DESCRIPTION	VALUE 1 DESCRIPTION
0	Loss of echo	Echo OK
1	Xdr 1 faulty	Xdr 1 OK
2	Xdr 2 faulty	Xdr 2 OK
3	mA Input 1 faulty	mA input 1 OK
4	mA Input 2 faulty	mA input 2 OK [1]
5	Xdr 1 Wiper faulty	Xdr 1 Wiper OK [1]
6	Xdr 2 Wiper faulty	Xdr 2 Wiper OK [1]
7-15	Reserved	Reserved

[1]SludgeFinder 2 only

Important Information

Digital input bit value of 1 indicates ON condition and 0 indicates OFF condition.

Example Query: reading digital inputs 3-7

Slave address	11
Function	02
Addr Hi	00
Addr Lo	03
No. of points hi	00
No. of points lo	05
Error check	

Response: inputs 7-3 = on, on, off, off, on

Slave address	11
Function	02
Byte count	01
Data (input 7-3)	64
Error check	

Function 3: Read Holding Registers (Static Parameters)

REGISTERS ADDRESS	DESCRIPTION	DATA TYPE	UNIT/RANGE
10001 – 10006	Digital Input status	Bit mapped	None

BIT	VALUE 0 DESCRIPTION	VALUE 1 DESCRIPTION
0	Loss of echo	Echo OK
1	Xdr 1 faulty	Xdr 1 OK
2	Xdr 2 faulty	Xdr 2 OK
3	mA Input 1 faulty	mA input 1 OK
4	mA Input 2 faulty	mA input 2 OK [1]
5	Xdr 1 Wiper faulty	Xdr 1 Wiper OK [1]
6	Xdr 2 Wiper faulty	Xdr 2 Wiper OK [1]
7-15	Reserved	Reserved

Important Information

Digital input bit value of 1 indicates ON condition and 0 indicates OFF condition.

Example Query: reading parameter P586

Slave address	11
Function	03
Addr Hi	02
Addr Lo	4A
No. of points hi	00
No. of points lo	01
Error check	

Response: P586 = 10.01 (transmit as 1001 = 03E9)

Slave address	11
Function	03
Byte count	02
Data Hi (MSB)	03
Data Lo (LSB)	E9
Error check	

Function 4: Read Input Registers (Common Dynamic Variables)

This function provides accesses to common system variables of the ultrasonic level instruments. Availability is dependent on unit type.

Ultra series controllers

REGISTERS	DESCRIPTION	UNIT
Point Measurement 1		
30001	Point 1 Level	U_MU
30002	Point 1 Distance	U_MU
30003	Echo 1 Confidence	U_DB
30004	Echo 1 Strength	U_DB
30005	Echo 1 HALL	U_DB
30006	Average Noise 1	U_DB
30007	Peak Noise 1	U_DB
30008	Point 1 Temperature	U_TP
Point Measurement 2		
30010	Point 2 Level	U_MU
30011	Point 2 distance	U_MU
30012	Echo 2 confidence	U_DB
30013	Echo 2 strength	U_DB
30014	Echo 2 HALL	U_DB
30015	Average noise 2	U_DB
30016	Peak noise 2	U_DB
30017	Point 2 temperature	U_TP
mA Input / Output		
30019	Velocity input (speedy)	U_MS
30020	mA input reading	U_MA
30021	mA output 1 value	U_MA
30022	mA output 2 value	U_MA
Time to Overflow Statuses		
30023	Time to Overflow for Relay 1	U_MN
30024	Time to Overflow for Relay 2	U_MN
30025	Time to Overflow for Relay 3	U_MN
30026	Time to Overflow for Relay 4	U_MN
30027	Time to Overflow for Relay 5	U_MN
30028	Time to Overflow for Relay 6	U_MN
30066	Time to overflow for relay 7 (whole min)	U_MN
30067	Time to overflow for relay 8 (whole min)	U_MN
30068	Time to overflow for relay 9 (whole min)	U_MN
30069	Time to overflow for relay 10 (whole min)	U_MN

REGISTERS	DESCRIPTION	UNIT
Statuses		
30030	Relay statuses	U_NO
30031	Digital inputs	U_NO
30032	Ultrasonic status	U_NO
Application		
30040	Average level	U_MU
30041	Differential level	U_MU
30042	Pump healthy	U_NO
30043	Pump out of service	U_NO
30044	Fail count relay 1	U_NO
30045	Fail count relay 2	U_NO
30046	Fail count relay 3	U_NO
30047	Fail count relay 4	U_NO
30048	Fail count relay 5	U_NO
30049	Fail count relay 6	U_NO
30076	Fail count relay 7	U_NO
30077	Fail count relay 8	U_NO
30078	Fail count relay 9	U_NO
30079	Fail count relay 10	U_NO
Pump Statuses		
30042	Pump Healthy	U-NO
30043	Pump Out of Service	U-NO
30044	Attempt count Relay 1	U-NO
30045	Attempt count Relay2	U-NO
30046	Attempt count Relay 3	U-NO
30047	Attempt count Relay 4	U-NO
30048	Attempt count Relay 5	U-NO
30049	Attempt count Relay 6	U-NO
Totalisers		
30050	System tot. top half (Point 1)	U_NO
30051	System tot. bottom half (Point 1)	U_NO
30052	Resettable tot. top half (Point 1)	U_NO
30053	Res. tot. bottom half (Point 1)	U_NO
30054	Daily tot. top half (Point 1)	U_NO
30055	Daily tot. bottom half (Point 1)	U_NO
30056	Inst. Uncertainty UcQ	U_PC
30057	Percent Vol. Uncertainty	U_PC

REGISTERS	DESCRIPTION	UNIT
Totalisers (Continued)		
30090	System tot. top half (Point 2)	U_NO
30091	System tot. bottom half (Point 2)	U_NO
30092	Resettable tot. top half (Point 2)	U_NO
30093	Res. tot. bottom half (Point 2)	U_NO
30094	Daily tot. top half (Point 2)	U_NO
30095	Daily tot. bottom half (Point 2)	U_NO
Volume		
30060	Volume reading (Point 1)	U_M3
30061	Pumped volume (Point 1)	U_M3
30062	Volume Reading (Point 2)	U_M3
30063	Average volume (Point 1 & 2)	U_M3
30064	Total volume (Point 1&2)	U_M3
Flow		
30070	Flow reading (Point 1)	U_FLO
30071	Average Flow (Point 1)	U_FLO
30072	Flow reading (Point 2)	U_FLO
30073	Average flow (Point 2)	U_FLO
30074	Average flow (Point 1 & 2)	U_FLO
30075	Total flow (point 1 & 2)	U_FLO
Date & Time		
30080	Current time	U_TIME
30081	Current date	U_DATE

UNIT/RANGE	SCALING
U_MU	x mm
U_DB	x 0.01 dB
U_TP	x 0.1 ˚C
U_MA	x 0.01 mA
U_NO	no scaling
U_M3	x 0.1 x volume units
U_FLO	x 0.1 x flow units
U_MN	x 0.01 min
U_MS	x mm/sec

Example: Query: reading level 1 (current level on transducer 1)

Slave address	11
Function	04
Addr Hi	00
Addr Lo	00
No. of points hi	00
No. of points lo	01
Error check	

Response: level1=1.001 metres (transmit as 1001= 03E9)

Slave address	11
Function	04
Byte count	02
Data Hi (MSB)	03
Data Lo (LSB)	E9
Error check	

Function 5: Force Single Coil

This function provides a means of forcing a single coil to either ON or OFF. When broadcast the function forces the same coil references in all attached slaves.

Important Information

Digital input bit value of 1 indicates ON condition and 0 indicates OFF condition.

The query message will specify the coil reference that is to be forced, coils are addressed starting at zero, therefore coil 1 is addressed as 0.

The requested ON/OFF state is specified by a constant in the query data field, a value of **FF00** (Hex) will request the coil to be forced **ON**, where as a value of **0000** (Hex) will request the coil to be forced **OFF**. All other values are not recognised and will have no effect on the coil status. Once the coil status has been forced, then the controller will take control of either switching it OFF or ON.

DEVICE ADDRESS	FUNCTION CODE	COIL ADDRESS		FORCED DATA		CRC	
		MSB	LSB	MSB	LSB	MSB	LSB
1 byte	1 byte						

Example: Query: Force coil 2 to be ON

Slave address	11
Function	05
Addr Hi	00
Addr Lo	01
Data Hi	FF
Data Lo	00
Error check	

Response:

Slave address	11
Function	05
Addr Hi	00
Addr Lo	01
Data Hi	FF
Data Lo	00
Error check	

Function 6: Write Single Register (Static Parameters)

REGISTERS ADDRESS	DESCRIPTION	UNIT/RANGE
40100 – 10999 [1]	Setup parameters [2]	[3]

Important Information

1. Only parameters from P100 to P999 (x1000 for point 2 on Twin and SludgeFinder2) are available for writing from remote communication. Parameters less than P100 must be accessed directly on the unit keypad or infra-red communicator.

2. Refer to Pulsar instrument's manual for list of accessible parameters.

3. Units dependant on parameter. Please refer to parameter listings at the end of this manual.

Example: Query: writing to P100 = 1

Slave address	11
Function	06
Addr Hi	00
Addr Lo	64
Data Hi	00
Data Lo	01
Error check	

Response:

Slave address	11
Function	06
Addr Hi	00
Addr Lo	64
Data Hi	00
Data Lo	01
Error check	

Function 8: Diagnostic Loopback

This function provides a means of testing the communications link by means of a 'Loopback' operation. The data sent to the instrument is returned unchanged. Only diagnostic code 0 from Modicon Specification is supported.

DEVICE ADDRESS	FUNCTION CODE	DIAGNOSTIC CODE		LOOPBACK DATA		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

The reply to function 08 is the same as the command.

Example: Command

DEVICE ADDRESS	FUNCTION CODE	DIAGNOSTIC CODE		LOOPBACK DATA		CRC	
02	08	00	00	12	34	ED	4F

Example: Reply

DEVICE ADDRESS	FUNCTION CODE	DIAGNOSTIC CODE		LOOPBACK DATA		CRC	
02	08	00	00	12	34	ED	4F

Important Information

4. Only parameters from P100 to P999 (x1000 for point 2 on Twin and SludgeFinder2) are available for writing from remote communication. Parameters less than P100 must be accessed directly on the unit keypad or infra-red communicator.
5. Refer to Pulsar instrument's manual for list of accessible parameters.
6. Units dependant on parameter.

Function 16: Write Multiple Registers (Static Parameters)

REGISTERS ADDRESS	DESCRIPTION	UNIT/RANGE
40100 – 10999 [1]	Setup parameters [2]	[3]

Example: Query: writing to P100 = 1, P101=2

Slave address	11
Function	10
Addr Hi	00
Addr Lo	64
No. of registers hi	00
No. of registers lo	02
Data Hi	00
Data Lo	01
Data Hi	00
Data Lo	02
Error check	

Response:

Slave address	11
Function	06
Addr Hi	00
Addr Lo	64
No. of registers hi	00
No. of registers lo	02
Error check	

CHAPTER 4 PROFIBUS DP

The PROFIBUS Family

PROFIBUS is a vendor independent, open field bus standard for a wide range of applications in manufacturing, process and building automation. Vendor independence and openness are guaranteed by the PROFIBUS standard EN50170. With PROFIBUS, devices from different manufacturers can inter-communicate. Suitable interfaces exist for PLCs, which include Siemens, Mitsubishi, and Allen- Bradley range.
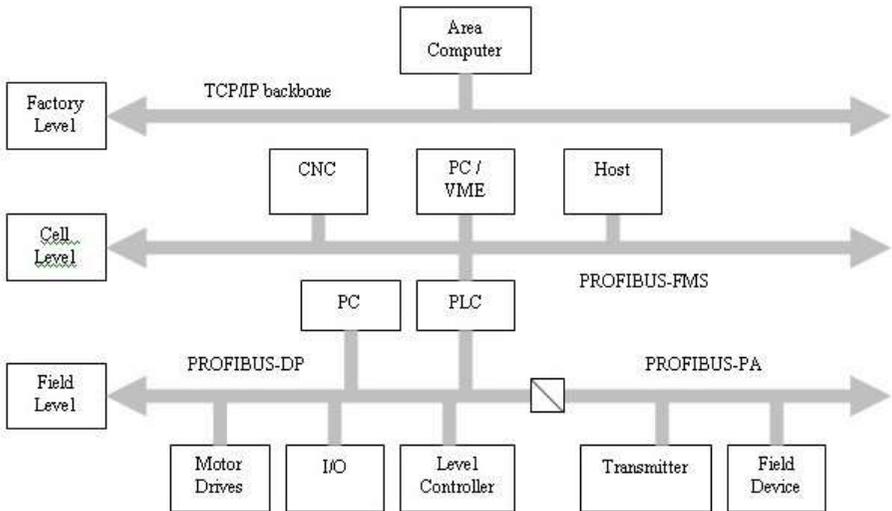
The Pulsar range, of level and control instrumentation, support the PROFIBUS-DP variant of the PROFIBUS protocol, which is designed especially for communication between control systems and distributed I/O at the device level. It is most often used to allow a central Programmable Logic Controller or PC based control system to use external *slave* devices for I/O or specialised functions. The principal advantage is that these devices may be distributed around a machine, thereby saving on the cost of point-to-point wiring. The *open* nature of the network also permits equipment from different manufacturers to mix on the same bus. Additionally, the off-loading of complex and specialised tasks such as level controller lessens the processing load on the central PLC so that its other functions may be carried out more efficiently and requires less CPU memory.

PROFIBUS-DP is described in DIN 19245 Part 3, and forms part of EN 50170. The PROFIBUS-DP network uses a high-speed version of RS485 standard, permitting baud rates of up to 12 Mbaud.

A maximum of 32 PROFIBUS-DP stations (nodes) may be contained within a single network segment. Use of RS 485 repeaters allows a total of up to 127 stations.

PROFIBUS-DP is a multimaster, master-slave, token passing network. More detailed information, including a detailed guide to products available, may be obtained from the various worldwide PROFIBUS user organisations, you will find contact information in trade magazines or by reference to http://www.profibus.com on the World Wide Web.

PROFIBUS is available in two other types, aimed at different application areas, as follows:

- **PROFIBUS-PA** is designed especially for process automation. It permits sensors and actuators to be connected on one common bus line even in intrinsically safe areas. PROFIBUS-PA permits data communication and power over the bus, using intrinsically safe, 2-wire technology according to the international standard IEC 1158-2, but may also be used on the standard RS 485 cabling for non-intrinsically safe applications.
- **PROFIBUS-FMS** is the general-purpose solution for communication tasks at the cell level.

Pulsar PROFIBUS devices may only be used on the PROFIBUS-DP networks.

Principles of Operation

PROFIBUS-DP distinguishes between master devices and slaves. It allows slave devices to be connected on a single bus thus eliminating considerable plant wiring typical with conventional communications systems. Fig 2-1 compares the two systems.

- **Master devices** determine the data communication on the bus. A master can send messages without an external request when it holds the bus access rights (the token). Masters is also called active stations in the PROFIBUS protocol.

- **Slave devices** are peripheral devices. Typical slave devices include input/output devices, valves, motor drives and measuring transmitters. The Pulsar Level controllers are intelligent slaves. This means they will only respond to a master when requested to do so.

PROFIBUS-DP is based around the idea of a 'cyclic scan' of devices on the network, during which *input* and *output* data for each device is exchanged.

I/O Data Exchange

The process of reading the inputs and writing the outputs is known as an I/O exchange. Typically, the parameters from each slave device will be mapped to an area of PLC input and output registers, or a single function block, so that the controlling ladder logic or program interfaces with the devices as if it were an internally fitted module. It is NOT necessary, therefore, for the programmer to know anything about the physical network. The process of network configuration is usually performed using a PC based program that allows the devices on the network to be defined and device parameters to be mapped into the PLC registers or function blocks.

The cyclical scan occurs in the following order:

1. Values from each device, *Input Data*, are first scanned over the network into a pre-defined set of input registers in the master controller. Such values might be a set of digital input readings for a digital input unit, or the measured level and alarm status from a level controller,

2. The master then runs its control program (such as a ladder logic program) using the input data read from the slave devices,

3. The master writes output values, *Output Data,* into a pre-defined set of output registers. For example, one of the digital inputs read in input

data might be used to select one of a set points to be sent to the level controller.

4. These outputs are then written to each slave device, and the scan-process-write cycle repeats.
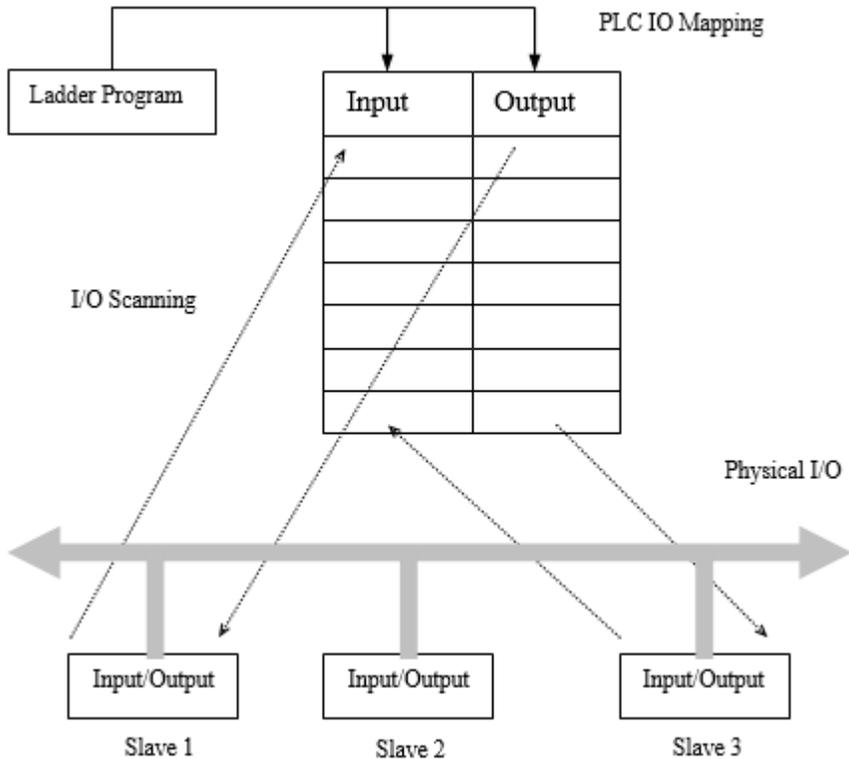
Figure 2: PROFIBUS IO Exchange

Typically, no more than 32 bytes of input data and 32 bytes of output data are exchanged for each device during the data exchange. Some PLC masters allow no more than this, although the PROFIBUS-DP standard provides the possibility of transferring 240 bytes in each direction. The input and output data lengths of a device are variable, and it is possible to have devices with only input data, only output data, or both.

The input and output data mixture used by a given slave device is defined by what is known as GSD file. See Section 5 for more details. For simple devices such as digital or analogue I/O blocks, this is fixed. However, since more complex devices often have a much wider choice of possible values to send, it is usually possible to edit the GSD file to change the mapping of device parameters onto Profibus inputs or outputs. This is the case with most Pulsar implementations, which also allow access to parameter data not in the GSD input/output data file. The GSD is imported into the PROFIBUS Master Network Configuration software before the network is created.

> **Important Information**
> - PROFIBUS Input Data = Values sent from a device to a master controller or PLC
> - PROFIBUS Output Data = Values sent from a master controller or PLC to a device

Device Set Up and Network Configuration

Device Set Up
PROFIBUS-DP Set Up Parameters

The following parameters will be found in the Pulsar Control Unit under the Device Set Up menu and will require programming to allow configuration of the PROFIBUS-DP interface.

PARAMETER NO.	OPTIONS	DESCRIPTION
P132	1 to 255	Device Address – Enter the device number for this unit
P143	0 = Unlocked 1 = Locked	Unit address is locked or unlocked (ability to be changed from external master device).

> **Important Information**
> Node address is the slave device address (Default = 126)
>
> Address Locked (Default = 0 Unlocked). Pulsar PROFIBUS-DP supports Set Slave Address function (SSA). In this case the master PLC can change the slave address and can lock the address and set this parameter to 1. To allow the slave address to be changed again, user needs to manually reset the parameter P143 to 0 (unlocked).

Network Configuration

Having wired and configured the controller, the master PLC or PC-based supervisory package must be configured to set-up the parameters that it will be able to read and write to. This is known as 'network configuration'.

The network is configured by importing GSD files into master PROFIBUS network configuration software; this should be explained in the network configuration software documentation. GSD is an acronym of a German phrase meaning 'Device Database'.

The Pulsar GSD files are supplied with your Pulsar Level Controller. Please view the readme file on the CD ROM to ensure you select the correct one.

The standard GSD file can be downloaded from the Pulsar website at https://pulsarmeasurement.com/downloads

,or downloaded from the disc supplied:

- PULSxxxx.GSD – standard parameter mapping. This is the default file, which is pre-configured for commonly used parameters.

Note: xxxx is the company Identification Number allocated to Pulsar by Profibus Organisation.

The Master network configuration software uses the GSD files to produce a further binary file that is downloaded into Master PLC or PC supervisory package. Once the configuration file has been downloaded, the network can be set running. If all is well, the input data will then be transferred from the controller to the master, and the output data will be transferred from the master to the controller.

With multiple Pulsar applications, if all Pulsar level controllers are of the same type, only one GSD file needs to be configured.

Request & Response Conventions

Parameter Resolution and Scaling

PROFIBUS-DP protocol limits data to 16 bits per parameter. This reduces the active range of parameters from 0 to 65535 (decimal) as unsigned integer.

The Pulsar level controller provides data in unsigned integer type (word) and all parameters will be rounded to the specified units. The following table shows the unit symbols and their corresponding conversions.

UNIT SYMBOL	SCALING	DESCRIPTION
U_NO	None	no unit
U_MU	× mm	Measurement
U_MA	× 0.01 mA	mA input/output
U_SE	× seconds	Number of seconds
U_MN	× 0.01 minute	Number of minutes
U_HR	× 0.1 hour	Number of hours
U_DDMM	ddmm	dd:mm
U_DATE	packed date	see note (1)
U_TIME	hhmm	hh:mm
U_PC	× 0.01 %	Percentage
U_TP	× 0.1 °C	Temperature in C
U_DB	× 0.01 dB	Decibels
U_M3	None	cubic metre
U_VU	None	Volume unit
U_FLO	× 0.1	flow unit
U_VEL	× 0.001 m/s	flow velocity
U_RATE	× mm/minute	Rate

Example 1: Write Date

To write a date of 02/03/01 – the coded date is calculated as follows:

> **Important Information**
>
> This date presentation comprises of coded date in the form yxxx, where xxx is calculated as follows to give the date and month.

xxx = (month * 50) + day = (03 * 50) + 02 = 152
yxxx = (year * 1000) + xxx = (01 * 1000) + 152 = 1152 (decimal)

To decode back to normal format of ddmmyy,

yy = 1152 mod 1000 = 1
mm = (1152 rem 1000) mod 50 = 3
dd = 1152 – yy * 1000 – mm * 50 = 2

Therefore,

ddmmyy = dd * 10000 + mm * 100 + yy = 20301 (decimal)
which has string equivalent of 02/03/01.

Example 2: Temperature Reading

Taking a temperature reading = 256
Actual temperature value is = 256 * Scaling = 256 * 0.1= 25.6 °C

Profibus Diagnostics

One of the features of PROFIBUS-DP is that priority diagnostic information is provided for each slave. The Pulsar controller uses the Ext_Diag_Data area of this message (byte 7 and 8) to send a word containing 16 bits of information pertaining to the process and alarm status of the controller. The documentation supplied with the master should provide further details on how to access diagnostic information.

BIT	VALUE 0 DESCRIPTION	VALUE 1 DESCRIPTION
0	Loss of echo	Echo OK
1	Xdr 1 faulty	Xdr 1 OK
2	Xdr 2 faulty	Xdr 2 OK
3	mA Input 1 faulty	mA input 1 OK
4	mA Input 2 faulty	mA input 2 OK [1]
5	Xdr 1 Wiper faulty	Xdr 1 Wiper OK [1]
6	Xdr 2 Wiper faulty	Xdr 2 Wiper OK [1]
7-15	Reserved	Reserved

[1] Sludge Finder 2 only

Global Command

This is a PROFIBUS-DP feature, which is not supported by the Pulsar Level Controller.

List of Dynamic Variables

Availability and access to the following variables will be dependent on the Pulsar instrument in use. The following covers most of the ultra-controllers.

Ultra series controllers

REGISTERS	DESCRIPTION	UNIT
Point Measurement 1		
30001	Point 1 Level	U_MU
30002	Point 1 Distance	U_MU
30003	Echo 1 Confidence	U_DB
30004	Echo 1 Strength	U_DB
30005	Echo 1 HALL	U_DB
30006	Average Noise 1	U_DB
30007	Peak Noise 1	U_DB
30008	Point 1 Temperature	U_TP
Point Measurement 2		
30010	Point 2 Level	U_MU
30011	Point 2 distance	U_MU
30012	Echo 2 confidence	U_DB
30013	Echo 2 strength	U_DB
30014	Echo 2 HALL	U_DB
30015	Average noise 2	U_DB
30016	Peak noise 2	U_DB
30017	Point 2 temperature	U_TP
mA Input / Output		
30019	Velocity input (speedy)	U_MS
30020	mA input reading	U_MA
30021	mA output 1 value	U_MA
30022	mA output 2 value	U_MA
Time to Overflow Statuses		
30023	Time to Overflow for Relay 1	U_MN
30024	Time to Overflow for Relay 2	U_MN
30025	Time to Overflow for Relay 3	U_MN
30026	Time to Overflow for Relay 4	U_MN
30027	Time to Overflow for Relay 5	U_MN
30028	Time to Overflow for Relay 6	U_MN
30066	Time to overflow for relay 7 (whole min)	U_MN
30067	Time to overflow for relay 8 (whole min)	U_MN
30068	Time to overflow for relay 9 (whole min)	U_MN
30069	Time to overflow for relay 10 (whole min)	U_MN

REGISTERS	DESCRIPTION	UNIT
Statuses		
30030	Relay statuses	U_NO
30031	Digital inputs	U_NO
30032	Ultrasonic status	U_NO
Application		
30040	Average level	U_MU
30041	Differential level	U_MU
30042	Pump healthy	U_NO
30043	Pump out of service	U_NO
30044	Fail count relay 1	U_NO
30045	Fail count relay 2	U_NO
30046	Fail count relay 3	U_NO
30047	Fail count relay 4	U_NO
30048	Fail count relay 5	U_NO
30049	Fail count relay 6	U_NO
30076	Fail count relay 7	U_NO
30077	Fail count relay 8	U_NO
30078	Fail count relay 9	U_NO
30079	Fail count relay 10	U_NO
Pump Statuses		
30042	Pump Healthy	U-NO
30043	Pump Out of Service	U-NO
30044	Attempt count Relay 1	U-NO
30045	Attempt count Relay2	U-NO
30046	Attempt count Relay 3	U-NO
30047	Attempt count Relay 4	U-NO
30048	Attempt count Relay 5	U-NO
30049	Attempt count Relay 6	U-NO
Totalisers		
30050	System tot. top half (Point 1)	U_NO
30051	System tot. bottom half (Point 1)	U_NO
30052	Resettable tot. top half (Point 1)	U_NO
30053	Res. tot. bottom half (Point 1)	U_NO
30054	Daily tot. top half (Point 1)	U_NO
30055	Daily tot. bottom half (Point 1)	U_NO
30056	Inst. Uncertainty UcQ	U_PC
30057	Percent Vol. Uncertainty	U_PC

REGISTERS	DESCRIPTION	UNIT
Totalisers (Continued)		
30090	System tot. top half (Point 2)	U_NO
30091	System tot. bottom half (Point 2)	U_NO
30092	Resettable tot. top half (Point 2)	U_NO
30093	Res. tot. bottom half (Point 2)	U_NO
30094	Daily tot. top half (Point 2)	U_NO
30095	Daily tot. bottom half (Point 2)	U_NO
Volume		
30060	Volume reading (Point 1)	U_M3
30061	Pumped volume (Point 1)	U_M3
30062	Volume Reading (Point 2)	U_M3
30063	Average volume (Point 1 & 2)	U_M3
30064	Total volume (Point 1&2)	U_M3
Flow		
30070	Flow reading (Point 1)	U_FLO
30071	Average Flow (Point 1)	U_FLO
30072	Flow reading (Point 2)	U_FLO
30073	Average flow (Point 2)	U_FLO
30074	Average flow (Point 1 & 2)	U_FLO
30075	Total flow (point 1 & 2)	U_FLO
Date & Time		
30080	Current time	U_TIME
30081	Current date	U_DATE

UNIT/RANGE	SCALING
U_MU	x mm
U_DB	x 0.01 dB
U_TP	x 0.1 ˚C
U_MA	x 0.01 mA
U_NO	no scaling
U_M3	x 0.1 x volume units
U_FLO	x 0.1 x flow units
U_MN	x 0.01 min
U_MS	x mm/sec

CHAPTER 5 LIST OF STATIC PARAMETERS

Availability and access to the following variables will be dependent on the Pulsar instrument in use, please refer to the appropriate user manual for parameter descriptions and functionality. The RS485 address is equivalent to the parameter number multiplied by 40,000 i.e. **40xxx** where xxx is the parameter number.

In the case of the **Ultra Twin** and **SludgeFinder2**, the Register Addresses for **Point 2** will require 1000 to be added to the address: **41xxx**

Application

Operation

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40100	Operating Mode	U_NO
40101	Transducer Type	U_NO
40102	Material Type	U_NO
40103	Input 2 Type	U_NO

Distances

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40104	Measurement Unit	U_NO
40105	Empty Level	U_MU
40106	Span	U_MU
40107	Near Blanking	U_MU
40108	Far Blanking	U_PC
40115	Tank Depth	U_MU
40116	Transducer Depth	U_MU

mA Input

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40119	mA Status	U_NO
40120	Low mA Input	U_MA
40121	High mA Input	U_MA
40122	Low Level Input	U_MU
40123	High Level Input	U_MU
40124	mA Low Trim	U_MA
40125	mA High Trim	U_MA

Relays Set up

Relay 1

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40210	Relay 1 Type	U_NO
40211	Relay 1 Function	U_NO
40212	Relay 1 ID Group	U_NO
40213	Relay 1 Set Point 1	U_MU
40214	Relay 1 Set Point 2	U_MU
40215	Relay 1 Set Point 3	Refer to Instrument Manual
40216	Relay 1 Allocation	U_NO
40217	Relay 1 Closures	U_NO
40218	Relay 1 Fail Safe	U_NO
40219	Relay 1 Max. Rate	U_RATE

Relay 2

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40220	Relay 2 Type	U_NO
40221	Relay 2 Function	U_NO
40222	Relay 2 ID Group	U_NO
40223	Relay 2 Set Point 1	U_MU
40224	Relay 2 Set Point 2	U_MU
40225	Relay 2 Set Point 3	Refer to Instrument Manual
40226	Relay 2 Allocation	U_NO
40227	Relay 2 Closures	U_NO
40228	Relay 2 Fail Safe	U_NO
40229	Relay 2 Max. Rate	U_RATE

Relay 3

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40230	Relay 3 Type	U_NO
40231	Relay 3 Function	U_NO
40232	Relay 3 ID Group	U_NO
40233	Relay 3 Set Point 1	U_MU
40234	Relay 3 Set Point 2	U_MU
40235	Relay 3 Set Point 3	Refer to Instrument Manual
40236	Relay 3 Allocation	U_NO
40237	Relay 3 Closures	U_NO
40238	Relay 3 Fail Safe	U_NO
40239	Relay 3 Max. Rate	U_RATE

Relay 4

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40240	Relay 4 Type	U_NO
40241	Relay 4 Function	U_NO
40242	Relay 4 ID Group	U_NO
40243	Relay 4 Set Point 1	U_MU
40244	Relay 4 Set Point 2	U_MU
40245	Relay 4 Set Point 3	Refer to Instrument Manual
40246	Relay 4 Allocation	U_NO
40247	Relay 4 Closures	U_NO
40248	Relay 4 Fail Safe	U_NO
40249	Relay 4 Max. Rate	U_RATE

Relay 5

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40250	Relay 5 Type	U_NO
40251	Relay 5 Function	U_NO
40252	Relay 5 ID Group	U_NO
40253	Relay 5 Set Point 1	U_MU
40254	Relay 5 Set Point 2	U_MU
40255	Relay 5 Set Point 3	Refer to Instrument Manual
40256	Relay 5 Allocation	U_NO
40257	Relay 5 Closures	U_NO
40258	Relay 5 Fail Safe	U_NO
40259	Relay 5 Max. Rate	U_RATE

Relay 6

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40260	Relay 6 Type	U_NO
40261	Relay 6 Function	U_NO
40262	Relay 6 ID Group	U_NO
40263	Relay 6 Set Point 1	U_MU
40264	Relay 6 Set Point 2	U_MU
40265	Relay 6 Set Point 3	Refer to Instrument Manual
40266	Relay 6 Allocation	U_NO
40267	Relay 6 Closures	U_NO
40268	Relay 6 Fail Safe	U_NO
40269	Relay 6 Max. Rate	U_RATE

Relay 7

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40270	Relay 7 Type	U_NO
40271	Relay 7 Function	U_NO
40272	Relay 7 ID Group	U_NO
40273	Relay 7 Set Point 1	U_MU
40274	Relay 7 Set Point 2	U_MU
40275	Relay 7 Set Point 3	Refer to Instrument Manual
40276	Relay 7 Allocation	U_NO
40277	Relay 7 Closures	U_NO
40278	Relay 7 Fail Safe	U_NO
40279	Relay 7 Max. Rate	U_RATE

Relay 8

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40280	Relay 8 Type	U_NO
40281	Relay 8 Function	U_NO
40282	Relay 8 ID Group	U_NO
40283	Relay 8 Set Point 1	U_MU
40284	Relay 8 Set Point 2	U_MU
40285	Relay 8 Set Point 3	Refer to Instrument Manual
40286	Relay 8 Allocation	U_NO
40287	Relay 8 Closures	U_NO
40288	Relay 8 Fail Safe	U_NO
40289	Relay 8 Max. Rate	U_RATE

Relay 9

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40290	Relay 9 Type	U_NO
40291	Relay 9 Function	U_NO
40292	Relay 9 ID Group	U_NO
40293	Relay 9 Set Point 1	U_MU
40294	Relay 9 Set Point 2	U_MU
40295	Relay 9 Set Point 3	Refer to Instrument Manual
40296	Relay 9 Allocation	U_NO
40297	Relay 9 Closures	U_NO
40298	Relay 9 Fail Safe	U_NO
40299	Relay 9 Max. Rate	U_RATE

Relay 10

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40570	Relay 10 Type	U_NO
40571	Relay 10 Function	U_NO
40572	Relay 10 ID Group	U_NO
40573	Relay 10 Set Point 1	U_MU
40574	Relay 10 Set Point 2	U_MU
40575	Relay 10 Set Point 3	Refer to Instrument Manual
40576	Relay 10 Allocation	U_NO
40577	Relay 10 Closures	U_NO
40578	Relay 10 Fail Safe	U_NO
40579	Relay 10 Max. Rate	U_RATE

Pump "Advanced"

Run On

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40349	Prime Level	U_MU
40350	Run On Interval	U_HR
40351	Run On Duration	U_SE

Starting

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40352	Pump Start Delay	U_SE
40353	Power Up Delay	U_SE

Stopping

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40348	Stop Delay	U_SE

Exercise

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40354	Exercise Enable	U_NO
40355	Idle Time	U_MN
40356	Exercise Time	U_SE
40357	Pump Minimum Head	U_MU

Wall Cling

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40360	Wall Cling	U_MU

Storm

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40370	Pump Disable	U_NO
40371	Disable Time	U_MN

Digital Inputs

Common Parameters

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40300	Maximum Retries	U_NO
40301	Switch Mode	U_NO
40302	Override Delay	U_MN
40303	Minimum Override Level	U_MU
40304	Input Delay	U_SE
40305	Number of Input Filter	U_NO

Digital Input 1

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40372	Input 1 Type	U_NO
40373	Input 1 Function	U_NO
40374	Input 1 Assignment	U_NO

Digital Input 2

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40375	Input 2 Type	U_NO
40376	Input 2 Function	U_NO
40377	Input 2 Assignment	U_NO

Digital Input 3

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40378	Input 3 Type	U_NO
40379	Input 3 Function	U_NO
40380	Input 3 Assignment	U_NO

Digital Input 4

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40381	Input 4 Type	U_NO
40382	Input 4 Function	U_NO
40383	Input 4 Assignment	U_NO

Digital Input 5

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40384	Input 5 Type	U_NO
40385	Input 5 Function	U_NO
40386	Input 5 Assignment	U_NO

Digital Input 6

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40387	Input 5 Type	U_NO
40388	Input 5 Function	U_NO
40389	Input 5 Assignment	U_NO

Digital Input 7

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40390	Input 5 Type	U_NO
40391	Input 5 Function	U_NO
40392	Input 5 Assignment	U_NO

Tariff Guard

Set Up

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40393	Tariff Guard Enable	U_NO
40394	Lead Time	U_MN
40395	Lag Time	U_MN
40396	Minimum Pump Runtime	U_SE
40397	Tariff Guard Min. Head	U_MU
40398	Tariff Guard Overflow Level	U_MU

Peak Time 1

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40400	Day of Week 1	U_NO
40401	Week of Month 1	U_NO
40402	Start Date 1	U_DATE
40403	End Date 1	U_DATE
40404	Start Time 1	U_TIME
40405	End Time 1	U_TIME

Peak Time 2

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40406	Day of Week 2	U_NO
40407	Week of Month 2	U_NO
40408	Start Date 2	U_DATE
40409	End Date 2	U_DATE
40410	Start Time 2	U_TIME
40411	End Time 2	U_TIME

Peak Time 3

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40412	Day of Week 3	U_NO
40413	Week of Month 3	U_NO
40414	Start Date 3	U_DATE
40415	End Date 3	U_DATE
40416	Start Time 3	U_TIME
40417	End Time 3	U_TIME

Peak Time 4

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40418	Day of Week 4	U_NO
40419	Week of Month 4	U_NO
40420	Start Date 4	U_DATE
40421	End Date 4	U_DATE
40422	Start Time 4	U_TIME
40423	End Time 4	U_TIME

Peak Time 5

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40424	Day of Week 5	U_NO
40425	Week of Month 5	U_NO
40426	Start Date 5	U_DATE
40427	End Date 5	U_DATE
40428	Start Time 5	U_TIME
40429	End Time 5	U_TIME

Peak Time 6

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40430	Day of Week 6	U_NO
40431	Week of Month 6	U_NO
40432	Start Date 6	U_DATE
40433	End Date 6	U_DATE
40434	Start Time 6	U_TIME
40435	End Time 6	U_TIME

Peak Time 7

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40436	Day of Week 7	U_NO
40437	Week of Month 7	U_NO
40438	Start Date 7	U_DATE
40439	End Date 7	U_DATE
40440	Start Time 7	U_TIME
40441	End Time 7	U_TIME

Peak Time 8

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40442	Day of Week 8	U_NO
40443	Week of Month 8	U_NO
40444	Start Date 8	U_DATE
40445	End Date 8	U_DATE
40446	Start Time 8	U_TIME
40447	End Time 8	U_TIME

Peak Time 9

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40448	Day of Week 9	U_NO
40449	Week of Month 9	U_NO
40450	Start Date 9	U_DATE
40451	End Date 9	U_DATE
40452	Start Time 9	U_TIME
40453	End Time 9	U_TIME

Peak Time 10

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40454	Day of Week 10	U_NO
40455	Week of Month 10	U_NO
40456	Start Date 10	U_DATE
40457	End Date 10	U_DATE
40458	Start Time 10	U_TIME
40459	End Time 10	U_TIME

Data Logs

Totaliser Audits

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40460	Day 1	U_DATE
40461	Totaliser Bottom Half 1	U_NO
40462	Day 2	U_DATE
40463	Totaliser Bottom Half 2	U_NO
40464	Day 3	U_DATE
40465	Totaliser Bottom Half 3	U_NO
40466	Day 4	U_DATE
40467	Totaliser Bottom Half 4	U_NO
40468	Day 5	U_DATE
40469	Totaliser Bottom Half 5	U_NO
40470	Day 6	U_DATE
40471	Totaliser Bottom Half 6	U_NO
40472	Day 7	U_DATE
40473	Totaliser Bottom Half 7	U_NO
40474	Day 8	U_DATE
40475	Totaliser Bottom Half 8	U_NO
40476	Day 9	U_DATE
40477	Totaliser Bottom Half 9	U_NO
40478	Day 10	U_DATE
40479	Totaliser Bottom Half 10	U_NO
40480	System Totaliser Top Half	U_NO
40481	Resettable Totaliser Top Half	U_NO
40482	Totaliser 1 Top Half	U_NO
40475	Totaliser Bottom Half 8	U_NO
40476	Day 9	U_DATE

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40478	Day 10	U_DATE
40479	Totaliser Bottom Half 10	U_NO
40480	System Totaliser Top Half	U_NO
40481	Resettable Totaliser Top Half	U_NO
40482	Totaliser 1 Top Half	U_NO
40483	Totaliser 2 Top Half	U_NO
40484	Totaliser 3 Top Half	U_NO
40485	Totaliser 4 Top Half	U_NO
40486	Totaliser 5 Top Half	U_NO
40487	Totaliser 6 Top Half	U_NO
40488	Totaliser 7 Top Half	U_NO
40489	Totaliser 8 Top Half	U_NO
40490	Totaliser 9 Top Half	U_NO
40491	Totaliser 10 Top Half	U_NO

Pump Data Logs

Pump 1

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40510	Pump 1 Hours	U_HR
40511	Pump 1 Starts	U_NO
40512	Pump 1 Starts/Hour	U_NO
40513	Pump 1 Run On	U_NO
40514	Pump 1 Draw	U_VU
40515	Pump 1 Efficiency	U_PC

Pump 2

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40516	Pump 2 Hours	U_HR
40517	Pump 2 Starts	U_NO
40518	Pump 2 Starts/Hour	U_NO
40519	Pump 2 Run On	U_NO
40520	Pump 2 Draw	U_VU
40521	Pump 2 Efficiency	U_PC

Pump 3

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40522	Pump 3 Hours	U_HR
40523	Pump 3 Starts	U_NO
40524	Pump 3 Starts/Hour	U_NO
40525	Pump 3 Run On	U_NO
40526	Pump 3 Draw	U_VU
40527	Pump 3 Efficiency	U_PC

Pump 4

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40528	Pump 4 Hours	U_HR
40529	Pump 4 Starts	U_NO
40530	Pump 4 Starts/Hour	U_NO
40531	Pump 4 Run On	U_NO
40532	Pump 4 Draw	U_VU
40533	Pump 4 Efficiency	U_PC

Pump 5

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40534	Pump 5 Hours	U_HR
40535	Pump 5 Starts	U_NO
40536	Pump 5 Starts/Hour	U_NO
40537	Pump 5 Run On	U_NO
40538	Pump 5 Draw	U_VU
40539	Pump 5 Efficiency	U_PC

Pump 6

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40540	Pump 6 Hours	U_HR
40541	Pump 6 Starts	U_NO
40542	Pump 6 Starts/Hour	U_NO
40543	Pump 6 Run On	U_NO
40544	Pump 6 Draw	U_VU
40545	Pump 6 Efficiency	U_PC

Pump 7

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40546	Pump 7 Hours	U_HR
40547	Pump 7 Starts	U_NO
40548	Pump 7 Starts/Hour	U_NO
40549	Pump 7 Run On	U_NO
40550	Pump 7 Draw	U_VU
40551	Pump 7 Efficiency	U_PC

Pump 8

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40552	Pump 8 Hours	U_HR
40553	Pump 8 Starts	U_NO
40554	Pump 8 Starts/Hour	U_NO
40555	Pump 8 Run On	U_NO
40556	Pump 8 Draw	U_VU
40557	Pump 8 Efficiency	U_PC

Pump 9

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40558	Pump 9 Hours	U_HR
40559	Pump 9 Starts	U_NO
40560	Pump 9 Starts/Hour	U_NO
40561	Pump 9 Run On	U_NO
40562	Pump 9 Draw	U_VU
40563	Pump 9 Efficiency	U_PC

Pump 10

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40564	Pump 10 Hours	U_HR
40565	Pump 10 Starts	U_NO
40566	Pump 10 Starts/Hour	U_NO
40567	Pump 10 Run On	U_NO
40568	Pump 10 Draw	U_VU
40569	Pump 10 Efficiency	U_PC

Temperature Log

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40580	Min. Temperature	U_TP
40581	Min. Temp. Date	U_DATE
40582	Min. Temp. Time	U_TIME
40583	Max. Temperature	U_TP
40584	Max. Temp. Date	U_DATE
40585	Max. Temp. Time	U_TIME
40586	Current Temperature	U_TP

Volume

Set Up

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40205	Pumped Volume Enable	U_NO
40206	Settle Time	U_MN
40207	Totalising Method	U_NO

Conversion

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40600	Vessel Shape	U_NO
40601	Volume Conversion 1	U_MU
40602	Volume Conversion 2	U_MU
40603	Volume Conversion 3	U_MU
40604	Calculated Volume	U_M3
40605	Volume Unit	U_NO
40606	Weighting Factor	U_NO
40607	Maximum Volume	U_M3

Volume Breakpoints

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40610	Level Breakpoint 1	U_MU
40611	Volume 1	U_VU
40612	Level Breakpoint 2	U_MU
40613	Volume 2	U_VU
40614	Level Breakpoint 3	U_MU
40615	Volume 3	U_VU
40616	Level Breakpoint 4	U_MU
40617	Volume 4	U_VU
40618	Level Breakpoint 5	U_MU
40619	Volume 5	U_VU
40620	Level Breakpoint 6	U_MU
40621	Volume 6	U_VU
40622	Level Breakpoint 7	U_MU
40623	Volume 7	U_VU
40624	Level Breakpoint 8	U_MU
40625	Volume 8	U_VU
40626	Level Breakpoint 9	U_MU
40626	Level Breakpoint 9	U_MU
40627	Volume 9	U_VU
40628	Level Breakpoint 10	U_MU
40629	Volume 10	U_VU
40630	Level Breakpoint 11	U_MU
40631	Volume 11	U_VU
40632	Level Breakpoint 12	U_MU
40633	Volume 12	U_VU
40634	Level Breakpoint 13	U_MU
40635	Volume 13	U_VU
40636	Level Breakpoint 14	U_MU
40637	Volume 14	U_VU
40638	Level Breakpoint 15	U_MU
40639	Volume 15	U_VU
40640	Level Breakpoint 16	U_MU
40641	Volume 16	U_VU
40642	Level Breakpoint 17	U_MU
40643	Volume 17	U_VU

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40644	Level Breakpoint 18	U_MU
40645	Volume 18	U_VU
40646	Level Breakpoint 19	U_MU
40647	Volume 19	U_VU
40648	Level Breakpoint 20	U_MU
40649	Volume 20	U_VU
40650	Level Breakpoint 21	U_MU
40651	Volume 21	U_VU
40652	Level Breakpoint 22	U_MU
40653	Volume 22	U_VU
40654	Level Breakpoint 23	U_MU
40655	Volume 23	U_VU
40656	Level Breakpoint 24	U_MU
40657	Volume 24	U_VU
40658	Level Breakpoint 25	U_MU
40659	Volume 25	U_VU
40660	Level Breakpoint 26	U_MU
40661	Volume 26	U_VU
40662	Level Breakpoint 27	U_MU
40663	Volume 27	U_VU
40664	Level Breakpoint 28	U_MU
40665	Volume 28	U_VU
40666	Level Breakpoint 29	U_MU
40667	Volume 29	U_VU
40668	Level Breakpoint 30	U_MU
40669	Volume 30	U_VU
40670	Level Breakpoint 31	U_MU
40671	Volume 31	U_VU
40672	Level Breakpoint 32	U_MU
40673	Volume 32	U_VU

OCM Flow

PMD Type

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40700	PMD Type	U_NO
40701	Primary PMD	U_NO
40702	Calculation Type	U_NO
40703	Flow Minimum Head	U_MU
40704	Flow Maximum Head	U_MU
40705	Maximum Flow	U_FLO
40706	Flow Volume Unit	U_NO
40707	Flow Time Unit	U_NO
40708	Flow Decimals	U_NO
40709	Flow Cut Off	U_PC

Dimensions

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40710	Flow Par 710	U_MU
40711	Flow Par 711	U_MU
40712	Flow Par 712	U_MU
40713	Flow Par 713	U_MU
40714	Flow Par 714	U_MU
40715	Flow Par 715	U_MU
40716	Flow Par 716	U_NO
40717	Flow Exponent	U_NO
40718	K-Factor	U_NO
40719	Throat Width	U_MU

Calculations

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40720	Area	U_NO
40721	Cv Factor	U_NO
40722	Cd Factor	U_NO
40723	Ce Factor	U_NO
40724	Cu Factor	U_NO
40725	Kb Factor	U_NO

Velocity

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40726	Low mA Input	U_MA
40727	High mA Input	U_MA
40728	Low Velocity	U_VEL
40729	High Velocity	U_VEL

Flow Breakpoints

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40730	Head 1	U_MU
40731	Flow 1	U_FLO
40732	Head 2	U_MU
40733	Flow 2	U_FLO
40734	Head 3	U_MU
40735	Flow 3	U_FLO
40736	Head 4	U_MU
40737	Flow 4	U_FLO
40738	Head 5	U_MU
40739	Flow 5	U_FLO
40740	Head 6	U_MU
40741	Flow 6	U_FLO
40742	Head 7	U_MU
40743	Flow 7	U_FLO
40744	Head 8	U_MU
40745	Flow 8	U_FLO
40746	Head 9	U_MU
40747	Flow 9	U_FLO
40748	Head 10	U_MU
40749	Flow 10	U_FLO
40750	Head 11	U_MU
40751	Flow 11	U_FLO
40752	Head 12	U_MU
40753	Flow 12	U_FLO
40754	Head 13	U_MU
40755	Flow 13	U_FLO
40756	Head 14	U_MU
40757	Flow 14	U_FLO
40758	Head 15	U_MU

REGISTER ADDRESS	FLOW 15	U_FLO
40759	Flow 15	U_FLO
40760	Head 16	U_MU
40761	Flow 16	U_FLO
40762	Head 17	U_MU
40763	Flow 17	U_FLO
40764	Head 18	U_MU
40765	Flow 18	U_FLO
40766	Head 19	U_MU
40767	Flow 19	U_FLO
40768	Head 20	U_MU
40769	Flow 20	U_FLO
40770	Head 21	U_MU
40771	Flow 21	U_FLO
40772	Head 22	U_MU
40773	Flow 22	U_FLO
40774	Head 23	U_MU
40775	Flow 23	U_FLO
40776	Head 24	U_MU
40777	Flow 24	U_FLO
40778	Head 25	U_MU
40779	Flow 25	U_FLO
40780	Head 26	U_MU
40781	Flow 26	U_FLO
40782	Head 27	U_MU
40783	Flow 27	U_FLO
40784	Head 28	U_MU
40785	Flow 28	U_FLO
40786	Head 29	U_MU
40787	Flow 29	U_FLO
40788	Head 30	U_MU
40789	Flow 30	U_FLO
40790	Head 31	U_MU
40791	Flow 31	U_FLO
40792	Head 32	U_MU
40793	Flow 32	U_FLO

Pump Efficiency

Options

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40187	Pump Efficiency Enable	U_NO
40188	Calibration Delay	U_NO
40189	Calibration Duration	U_SE
40190	Persist Count	U_NO
40191	Demote Pump	U_NO
40192	Demote Flags	U_NO
40193	Calibrate Pumps	U_NO

Display

Options

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40800	Display Unit	U_NO
40801	Decimal Places	U_NO
40802	Display Offset	U_MU
40804	Display Conversion	U_NO
40805	Display Source	U_NO

Fail Safe

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40808	Fail Mode	U_NO
40809	Fail Time	U_MN

Auxiliary Display

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40810	Query Units	U_NO
40811	Query Alarms	U_NO
40812	Query Pumps	U_NO
40813	Query Controls	U_NO
40814	Query Miscellaneous	U_NO
40815	Query Auxiliary	U_NO

Totaliser

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40816	Totaliser Message	U_NO
40820	System Totaliser Bottom Half	U_NO
40821	Resettable Tot. Bottom Half	U_NO
40822	Totaliser Decimal	U_NO
40823	Totaliser Multiplier	U_NO
40824	Totaliser Enable	U_NO

Bargraph

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40829	Bargraph Allocation	U_NO

mA Output

Output 1

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40830	mA 1 Output Range	U_NO
40831	mA 1 Output Mode	U_NO
40834	mA 1 Low Level	U_MU
40835	mA 1 High Level	U_MU
40836	mA 1 Low Limit	U_MA
40837	mA 1 High Limit	U_MA
40838	mA 1 Low Trim	U_MA
40839	mA 1 High Trim	U_MA
40840	mA 1 Fail Mode	U_NO
40841	mA 1 Allocation	U_NO

Output 2

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40890	mA 2 Output Range	U_NO
40891	mA 2 Output Mode	U_NO
40892	mA 2 Low Level	U_MU
40893	mA 2 High Level	U_MU
40894	mA 2 Low Limit	U_MA
40895	mA 2 High Limit	U_MA
40896	mA 2 Low Trim	U_MA
40897	mA 2 High Trim	U_MA
40898	mA 2 Fail Mode	U_NO
40899	mA 2 Allocation	U_NO

Compensation

Offset

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40851	Measurement Offset	U_MU

Temperature

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40852	Temperature Source	U_NO
40853	Temperature Allocation	U_NO
40854	Fixed Temperature	U_TP
40855	External Temperature Scale	U_NO
40856	External Temperature Offset	U_NO

Stability

Damping

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40870	Fill Damping	U_RATE
40871	Empty Damping	U_RATE
40872	Fill Indicator	U_RATE
40873	Empty Indicator	U_RATE

Rate

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40874	Rate Update	U_NO
40875	Rate Time	U_SE
40876	Rate Distance	U_MU
40877	Rate Value	U_NO
40878	Rate Cut Off	U_RATE

Filters

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40880	Gate Mode	U_NO
40881	Fix Gate Distance	U_MU
40882	Peak Percentage	U_NO

Echo Processing

Transducer 1

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40900	Transducer 1 Status	U_NO
40901	Echo 1 Confidence	U_DB
40902	Echo 1 Strength	U_DB
40903	Average Noise 1	U_DB
40904	Peak Noise 1	U_DB
40905	Sensitivity 1	U_DB

Transducer 2

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40910	Transducer 2 Status	U_NO
40911	Echo 2 Confidence	U_DB
40912	Echo 2 Strength	U_DB
40913	Average Noise 2	U_DB
40914	Peak Noise 2	U_DB
40915	Sensitivity 2	U_DB

System

Passcode

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40921	Passcode Enable	U_NO
40922	Passcode	U_NO

Backup

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40925	Parameter Backup	U_NO

System Information

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40926	Software Revision	U_NO
40927	Hardware Revision	U_NO
40928	Serial Number	U_NO
40929	Site Identification	U_NO
40930	Factory Default	U_NO

Date and Time

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40931	System Date	U_DATE
40932	System Time	U_TIME
40933	Date Format	U_NO

LED Colours

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40935	LED Off Colour	U_NO
40936	LED Alarm Colour	U_NO
40937	LED Pump Colour	U_NO
40938	LED Control Colour	U_NO
40939	LED Miscellaneous Colour	U_NO

Watchdog

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40940	Number of watchdog starts	U_NO
40941	Start Date 0	U_DATE
40942	Start Time 0	U_TIME
40943	Start Date 1	U_DATE
40944	Start Time 1	U_ TIME
40945	Start Date 2	U_DATE
40946	Start Time 2	U_ TIME
40947	Start Date 3	U_DATE
40948	Start Time 3	U_ TIME
40949	Start Date 4	U_DATE
40950	Start Time 4	U_ TIME
40951	Start Date 5	U_DATE
40952	Start Time 5	U_ TIME
40953	Start Date 6	U_DATE
40954	Start Time 6	U_ TIME
40955	Start Date 7	U_DATE
40956	Start Time 7	U_ TIME
40957	Start Date 8	U_DATE
40958	Start Time 8	U_ TIME
40959	Start Date 9	U_DATE
40960	Start Time 9	U_ TIME

Daylight Saving

REGISTER ADDRESS	DESCRIPTION	UNIT/RANGE
40970	DST Enable	U_NO
40971	DST Time Difference	U_NO
40972	DST Start - Time	U_ TIME
40973	DST Start - Day of Week	U_NO
40974	DST Start - Week of Month	U_NO
40975	DST Start - Month of Year	U_NO
40976	DST End - Time	U_ TIME
40977	DST End - Day of Week	U_NO
40978	DST End - Week of Month	U_NO
40979	DST End - Month of Year	U_NO

CHAPTER 6 DISPOSAL

Incorrect disposal can cause adverse effects to the environment.

Dispose of the device components and packaging material in accordance with regional environmental regulations including regulations for electrical \ electronic products.

Transducers

Remove power, disconnect the Transducer, cut off the electrical cable and dispose of cable and Transducer in accordance with regional environmental regulations for electrical \ electronic products.

Controllers

Remove power, disconnect the Controller and remove battery (if fitted). Dispose of Controller in accordance with regional environmental regulations for electrical \ electronic products.

Dispose of batteries in accordance with regional environmental regulations for batteries.

EU WEEE Directive Logo

This symbol indicates the requirements of Directive 2012/19/EU regarding the treatment and disposal of waste from electric and electronic equipment.

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