1490 MODBUS Address List

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1 Introduction

1.1 Scope

This document describes the layout of the Modbus addresses for parameters supported by the instrument.

Advisory notes and comments are placed as footnotes within the document. They do not form essential requirements of the product.

1.2 Precedence

This document has been compiled from the best available information at the time of writing. Errors should be reported in the first instance to the author who will then update the document. Additions or changes to the requirements stated shall be submitted to the Project Leader at West Instruments Ltd for incorporation into this document. Changes submitted too late for incorporation into the plan of work may not be incorporated.

Some requirements refer to National & International Standards; the current versions of these standards shall always take precedence over the information contained in this document. Other documents that may take precedence are referred to in the text.

1.3 Audience

This document will be used anyone that needs to know the modbus parameters supported by the 1490 instrument.

2 Serial Communications

2.1 Supported Protocols

The unit supports two communication interfaces Modbus RTU and Modbus TCP. Modbus RTU is supported through the RS485 interface and Modbus TCP is supported through the optional Ethernet Module.

For a complete description of the Modbus protocol refer to the description provided at http://www.modbus.org/

2.2 RS485 Configuration

The RS485 address, bit rate and character format are configured via the front panel from the Comms Configuration menu.

Physical layer configuration settings possible are:

Data rate:	4800, 9600, 19200, 38400, 57600 or 115200 bps
Parity:	None (default), Even, Odd
Character format:	Always 8 bits per character.
Device Address:	*See below*.

2.3 RS485 Device Addressing

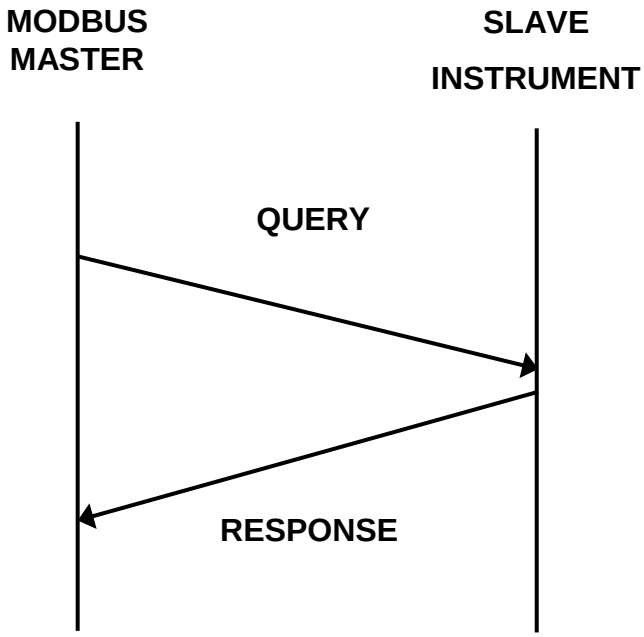
The instrument must be assigned a unique device address in the range 1 to 255. This address is used to recognise Modbus Queries intended for this instrument. With the exception of globally addressed broadcast messages, the instrument ignores Modbus Queries that do not match the address that has been assigned to it.

The instrument will accept broadcast messages (global queries) using device address 0 no matter what device address is assigned. No response messages are returned for globally addressed Queries.

2.4 Link Layer

A Query (or command) is transmitted from the Modbus Master to the Modbus Slave. The slave instrument assembles the reply to the master.

Figure 1. Modbus Link Layer



A message for either a QUERY or RESPONSE is made up of an inter-message gap followed by a sequence of data characters. The inter-message gap is at least 3.5 data character times - the transmitter must not start transmission until 3 character times have elapsed since reception of the last character in a message, and must release the transmission line within 3 character times of the last character in a message.

Note:

Three character times is approximately 0.25ms at 115200 bps, 0.51ms at 57600 bps, 0.75ms at 38400 bps, 1.5ms at 19200 bps, 3ms at 9600 bps and 6ms at 4800bps.

Data is encoded for each character as binary data, transmitted LSB first.

For a QUERY the address field contains the address of the slave destination. The slave address is given together with the Function and Data fields by the Application layer. The CRC is generated from the given address, function and data characters.

For a RESPONSE the address field contains the address of the responding slave. The Function and Data fields are generated by the slave application. The CRC is generated from the address, function and data characters.

The standard MODBUS RTU CRC-16 calculation employing the polynomial $2^{16}+2^{15}+2^{2}+1$ is used.

Inter-message gap	Address 1 character	Function 1 character	Data *n* characters	CRC Check 2 characters

2.5 Supported Modbus Functions

Modbus defines several function types. The following types are supported by this instrument:

Function Code (decimal)	Modbus Meaning	Description
03 / 04	Read Holding/Input registers	Read current binary value of specified number of parameters at given address. Up to 64 parameters can be accessed with one Query.
08	Diagnostics	Used for loopback test only.
16 (0x10 hex)	Write Multiple Registers	Writes up to 253 bytes of data to the specified address range.

2.6 Function Descriptions

The following is interpreted from the Modbus Protocol Description obtainable from http://www.modbus.org/. Refer to that document if clarification is required.

In the function descriptions below, the preceding device address value is assumed, as is the correctly formed two-byte CRC value at the end of the QUERY and RESPONSE frames.

Function 03 / 04 - Read Holding/Input Registers

Reads current binary value of data at the specified word addresses.

QUERY

Function	Address of 1st Word		Number of Words	
03 / 04	HI	LO	HI	LO

RESPONSE

Function	Number of Bytes	First Word		Last Word	
03 / 04		HI	LO	HI	LO

In the response the “Number of Bytes” indicates the number of data bytes read from the instrument. E.g. if 5 words are read, the count will be 10 (A hex). The maximum number of words that can be read is 64. If a parameter does not exist at one of the addresses read, then a value of 0000h is returned for that word.

Function 08 - Loopback Diagnostic Test

QUERY

Function	Diagnostic Code		Value	
08	HI =00	LO=00	HI	LO

RESPONSE

Function	Sub-function		Value	
08	HI=00	LO=00	HI	LO

Note:
The Response normally returns the same data as the loopback Query. Other Diagnostic Codes are not supported.

Function 16 - Write Multiple Registers (*0x10 Hex*)

Writes consecutive word (two-byte) values starting at the specified address.

QUERY

Function	1st Write Address		Number of Words to Write		Number of Query Bytes	1st Query Byte	2nd Query Byte	*etc*	Last Query Byte
10	HI	LO	HI	LO				→	

RESPONSE

Function	1st Word Address		Number of Words	
10	HI	LO	HI	LO

Note:
The number of data bytes that can be written in one message is 253 bytes.

The Modbus parameter register addresses are detailed in the following sections.
The Access column indicates if a parameter is read only (RO) or if it can also be written to (R/W).
Note:
Some parameters that do not apply for a particular configuration will accept reads and writes. Read only parameters will return an exception if an attempt is made to write values to them.

2.7 Data Formats

To allow for larger values than that supported by modbus all parameters are read and written as 32bit intergers. To read a parameter two words have to read to give the complete value. To write a parameter two words have to be written.

Example read operation

QUERY

Function	Address of 1st Word		Number of Words	
0x03	0x00	0x0D	0x00	0x02

RESPONSE

Function	Number of Bytes	First Word		Last Word	
0x03	0x04	0x00	0x00	0x00	0x08

Example write operation

QUERY

Function	1st Write Address		Number of Words to Write		Number of Query Bytes	1st Query Byte	2nd Query Byte	3rd Query Byte	4th Query Byte
10	0x00	0x0D	0x00	0x02	0x04	0x00	0x00	0x00	0x08

RESPONSE

Function	1st Word Address		Number of Words	
10	0x00	0x0D	0x00	0x02

3 Input parameters

<table>
<tr><th>Parameter Name</th><th>Modbus Address (Dec)</th><th>Modbus Address (Hex)</th><th>Access R/W</th><th>Notes</th><th>Default</th></tr>
<tr><td>Process Variable</td><td>1</td><td>0x0001</td><td>R/O</td><td></td><td>n/a</td></tr>
<tr><td>Maximum Process Variable</td><td>2</td><td>0x0002</td><td>R/O</td><td></td><td>n/a</td></tr>
<tr><td>Minimum Process Variable</td><td>3</td><td>0x0003</td><td>R/O</td><td></td><td>n/a</td></tr>
<tr><td>Process Variable Offset</td><td>6</td><td>0x0006</td><td>R/W</td><td>+/- span of the input</td><td>0</td></tr>
<tr><td>Input Filter</td><td>13</td><td>0x000D</td><td>R/W</td><td>0 to 100 seconds</td><td>0.5s</td></tr>
<tr><td>Decimal point position</td><td>14</td><td>0x000E</td><td>R/W</td><td><table><tr><th>Value</th><th>Range</th></tr><tr><td>0</td><td>XXXX 0 DP</td></tr><tr><td>1</td><td>XXX.X 1 DP</td></tr><tr><td>2</td><td>XX.XX 2 DP</td></tr><tr><td>3</td><td>X.XXX 3 DP</td></tr></table></td><td>0</td></tr>
<tr><td>Scale range lower limit</td><td>15</td><td>0x000F</td><td>R/W</td><td></td><td>0</td></tr>
<tr><td>Scale range upper limit</td><td>16</td><td>0x0010</td><td>R/W</td><td></td><td>1000</td></tr>
<tr><td>Input Status</td><td>133</td><td>0x0085</td><td>R/O</td><td></td><td>n/a</td></tr>
<tr><td>Input Range</td><td>2110</td><td>0x083E</td><td>R/W</td><td><table><tr><th>Value</th><th>Range</th></tr><tr><td>0</td><td>B Thermocouple Deg C</td></tr><tr><td>1</td><td>B Thermocouple Deg F</td></tr><tr><td>2</td><td>C Thermocouple Deg C</td></tr><tr><td>3</td><td>C Thermocouple Deg F</td></tr><tr><td>4</td><td>J Thermocouple Deg C
No decimal places</td></tr><tr><td>5</td><td>J Thermocouple Deg F
No decimal places</td></tr><tr><td>6</td><td>J Thermocouple Deg C
1 decimal place</td></tr><tr><td>7</td><td>J Thermocouple Deg F
1 decimal place</td></tr><tr><td>8</td><td>K Thermocouple Deg C
No decimal places</td></tr><tr><td>9</td><td>K Thermocouple Deg F
No decimal places</td></tr><tr><td>10</td><td>K Thermocouple Deg C
1 decimal place</td></tr><tr><td>11</td><td>K Thermocouple Deg F
1 decimal place</td></tr><tr><td>12</td><td>L Thermocouple Deg C
No decimal places</td></tr><tr><td>13</td><td>L Thermocouple Deg F
No decimal places</td></tr><tr><td>14</td><td>L Thermocouple Deg C
1 decimal place</td></tr></table></td><td>40</td></tr>
</table>

				15 L Thermocouple Deg F 1 decimal place 16 N Thermocouple Deg C 17 N Thermocouple Deg F 18 R Thermocouple Deg C 19 R Thermocouple Deg F 20 S Thermocouple Deg C 21 S Thermocouple Deg F 22 T Thermocouple Deg C No decimal places 23 T Thermocouple Deg F No decimal places 24 T Thermocouple Deg C 1 decimal place 25 T Thermocouple Deg F 1 decimal place 26 PtRh 20% vs 40% Deg C 27 PtRh 20% vs 40% Deg F 28 PT100 Deg C No decimal places 29 PT100 Deg F No decimal places 30 PT100 Deg C 1 decimal place 31 PT100 Deg F 1 decimal place 32 0 – 20mA 33 4 – 20mA 34 0 – 50mA 35 10 – 50mA 36 0 – 5V 37 1 – 5V 38 0 – 10V 39 2 – 10V 40 -10 – 50mV (Strain gauge)	
Enable Tare Function	2111	0x083F	R/W	0 = Disabled 1 = Enabled	0
Activate Tare Function (if tare is enabled)	2112	0x0840	W/O	Writing anything to this address causes the tare function to activate	n/a
Raw PV value	2115	0x0843	R/O		n/a
Multi-point scaling enable	2140	0x085C	R/W	0 = Disabled 1 = Enabled	0
Scale point 1	2141	0x085D	R/W	0.1 to 100.0%	100
Display point 1	2151	0x0867	R/W	Span of the input range	1000
Scale point 2	2142	0x085E	R/W	Scale point 1 to 100.0% can only be set when Scale point 1 is not equal to 100.0%	100
Display point 2	2152	0x0868	R/W	Span of the input range	1000
Scale point 3	2143	0x085F	R/W	Scale point 2 to 100.0% can only be set when Scale point 2 is not equal to 100.0%	100

Display point 3	2153	0x0869	R/W	Span of the input range	1000
Scale point 4	2144	0x0860	R/W	Scale point 3 to 100.0% can only be set when Scale point 3 is not equal to 100.0%	100
Display point 4	2154	0x086A	R/W	Span of the input range	1000
Scale point 5	2145	0x0861	R/W	Scale point 4 to 100.0% can only be set when Scale point 4 is not equal to 100.0%	100
Display point 5	2155	0x086B	R/W	Span of the input range	1000
Scale point 6	2146	0x0862	R/W	Scale point 5 to 100.0% can only be set when Scale point 5 is not equal to 100.0%	100
Display point 6	2156	0x086C	R/W	Span of the input range	1000
Scale point 7	2147	0x0863	R/W	Scale point 6 to 100.0% can only be set when Scale point 6 is not equal to 100.0%	100
Display point 7	2157	0x086D	R/W	Span of the input range	1000
Scale point 8	2148	0x0864	R/W	Scale point 7 to 100.0% can only be set when Scale point 7 is not equal to 100.0%	100
Display point 8	2158	0x086E	R/W	Span of the input range	1000
Scale point 9	2149	0x0865	R/W	Scale point 8 to 100.0% can only be set when Scale point 8 is not equal to 100.0%	100
Display point 9	2159	0x086F	R/W	Span of the input range	1000

3.1 Digital inputs

<table>
<tr><th>Parameter Name</th><th>Modbus Address (Dec)</th><th>Modbus Address (Hex)</th><th>Access R/W</th><th>Notes</th><th>Default</th></tr>
<tr><td>Logic input usage</td><td>2241</td><td>0x08C1</td><td>R/W</td><td><table><tr><th>Value</th><th>Function</th></tr><tr><td>0</td><td>Latched relay reset</td></tr><tr><td>1</td><td>Tare</td></tr><tr><td>2</td><td>Reset Min and max PV</td></tr><tr><td>3</td><td>Reset Elapsed time</td></tr><tr><td>4</td><td>Reset Min/Max PV and Elapsed time</td></tr></table></td><td>0</td></tr>
</table>

4 Output parameters

4.1 Option Slot 1 parameters

Parameter Name	Modbus Address (Dec)	Modbus Address (Hex)	Access R/W	Notes	Default
Output usage	2211	0x08A3	R/W	28 = Retransmit PV 29 = 0 – 10V TxPSU	28
Output type	2216	0x08A8	R/W	0 = 0 – 5V 1 = 0 – 10V 2 = 2 – 10V 3 = 0 – 20mA 4 = 4 – 20mA	1
Retransmit output scale maximum	2214	0x08A6	R/W		Range Maximum
Retransmit output scale minimum	2215	0x08A7	R/W		Range Minimum
TX PSU value	2217	0x08A9	R/W	0 to 10	10.0

4.2 Option Slot 2 parameters

Parameter Name	Modbus Address (Dec)	Modbus Address (Hex)	Access R/W	Notes	Default
Output A Usage	2221	0x08AD	R/W	0 = Alarm 1 Direct Acting 1 = Alarm 1 Reverse Acting 2 = Alarm 1 Direct Acting Latched 3 = Alarm 1 Reverse Acting Latched 4 = Alarm 2 Direct Acting 5 = Alarm 2 Reverse Acting 6 = Alarm 2 Direct Acting Latched 7 = Alarm 2 Reverse Acting Latched 20 = Alarm 1 Or Alarm 2 Direct Acting 21 = Alarm 1 Or Alarm 2 Reverse Acting 26 = Any Alarm Active Direct Acting 27 = Any Alarm Active Reverse Acting	0
Output B Usage	2228	0x08B4	R/W	0 = Alarm 1 Direct Acting 1 = Alarm 1 Reverse Acting 2 = Alarm 1 Direct Acting Latched 3 = Alarm 1 Reverse Acting Latched 4 = Alarm 2 Direct Acting 5 = Alarm 2 Reverse Acting 6 = Alarm 2 Direct Acting Latched 7 = Alarm 2 Reverse Acting Latched 20 = Alarm 1 Or Alarm 2 Direct Acting 21 = Alarm 1 Or Alarm 2 Reverse Acting 26 = Any Alarm Active Direct Acting 27 = Any Alarm Active Reverse Acting	4

4.3 Option Slot 3 parameters

Parameter Name	Modbus Address (Dec)	Modbus Address (Hex)	Access R/W	Notes	Default
Output Usage	2231	0x08B7	R/W	0 = Alarm 1 Direct Acting 1 = Alarm 1 Reverse Acting 2 = Alarm 1 Direct Acting Latched 3 = Alarm 1 Reverse Acting Latched 4 = Alarm 2 Direct Acting 5 = Alarm 2 Reverse Acting 6 = Alarm 2 Direct Acting Latched 7 = Alarm 2 Reverse Acting Latched 20 = Alarm 1 Or Alarm 2 Direct Acting 21 = Alarm 1 Or Alarm 2 Reverse Acting 26 = Any Alarm Active Direct Acting 27 = Any Alarm Active Reverse Acting	4

5 Alarm parameters

5.1 Alarm 1

Parameter Name	Modbus Address (Dec)	Modbus Address (Hex)	Access R/W	Notes	Default
Alarm Type	2310	0x0906	R/W	0 = None 1 = High Alarm 2 = Low Alarm	0
Alarm Value	2312	0x0908	R/W	Limited by the input range maximum and minimum.	Range max
Alarm Hysteresis	2313	0x0909	R/W	Limited by the span of the input range	10

5.2 Alarm 2

Parameter Name	Modbus Address (Dec)	Modbus Address (Hex)	Access R/W	Notes	Default
Alarm Type	2320	0x0910	R/W	0 = None 1 = High Alarm 2 = Low Alarm	0
Alarm Value	2322	0x0912	R/W	Limited by the input range maximum and minimum.	Range max
Alarm Hysteresis	2323	0x0913	R/W	Limited by the span of the input range	10

6 Display parameters

6.1 HMI

Parameter Name	Modbus Address (Dec)	Modbus Address (Hex)	Access R/W	Notes	Default
Display stratagy	2500	0x09C4	R/W	0 to 6	0
Setup Lock Code	2511	0x09CF	R/W	Default 10	10
Configuration Lock Code	2512	0x09D0	R/W	Default 10	10