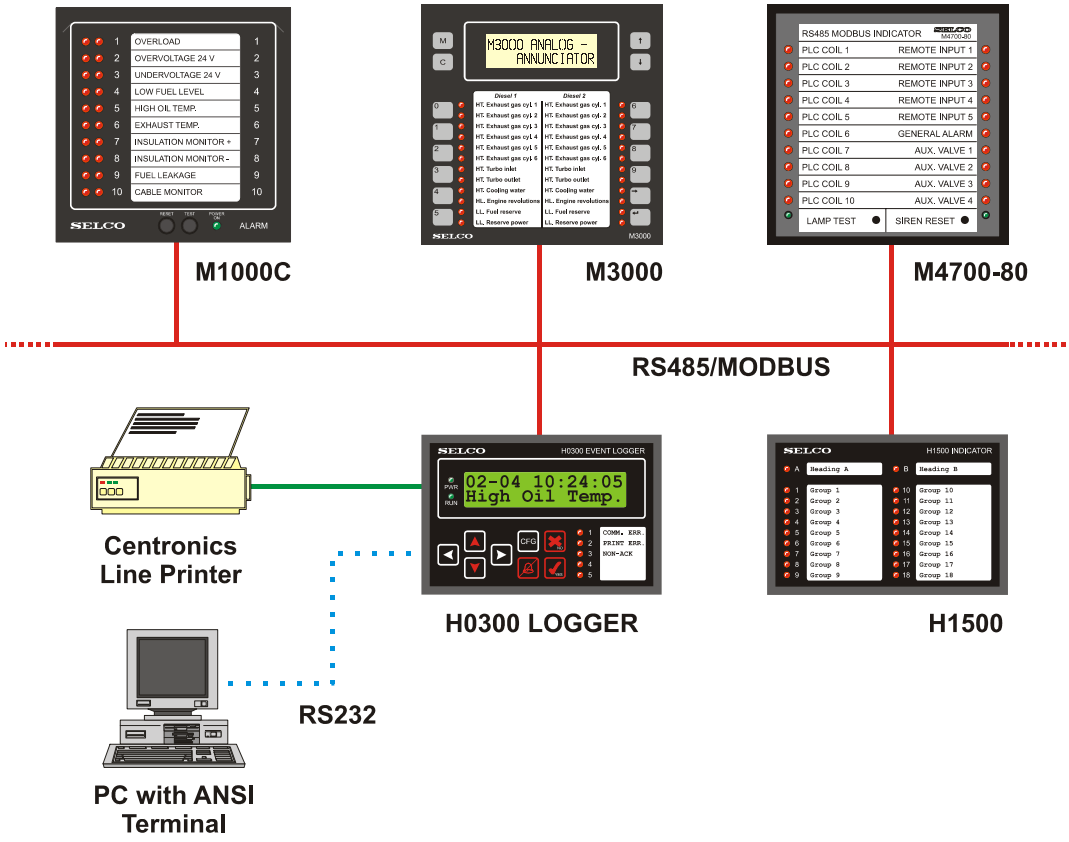
MODBUS Protocol



User's Manual

Revision: 050714

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1 Preface

This document describes the features and functions of the RS485 based serial communication interface of the SELCO M1000C Alarm Annunciator (new edition), the SELCO M2000C Engine Controller (new edition), the SELCO M3000 Analog Alarm Annunciator (new edition), the SELCO M4700-80 Indicator Panel, the SELCO H1500 Indicator Panel and the SELCO H3000 Analog Alarm Annunciator.

The serial communication interface is RS485 and the communication protocol is MODBUS RTU.

2 Physical Interface

The physical interface consists of a two wire half-duplex RS485 interface. The connection terminals of the RS485 interface plug are marked “A” and “B”. Terminal “A” is positive, while terminal “B” is negative.

RS485 works with a single master (e.g. a PLC or a PC). The master controls all communication on the bus. The SELCO units operate as slaves and will simply respond to commands issued by the master.

The two-wire RS485 bus is working in half-duplex mode. As half duplex does not allow simultaneous transmission and reception, it’s required that the master control direction of the data flow.

It is also possible to use a master with a full duplex RS485 interface; however it is necessary to connect the two positive and negative signals together. Thus Tx+ and Rx+ become “A”, while Tx- and Rx- becomes “B”.

2.1 RS485 Configuration

In order for the communication to work between the master and slave units, the communication setting must be adjusted to match.

The following communication settings are applicable.

Baud Rate	Parity	Data Bits	Stop Bits
1200	**None**	7	**1**
2400		**8**	2
4800			
9600			
19200			

Upon delivery the SELCO units are configured as follows:

9600 Baud, None parity, 8 data bits and 1 stop bits.

3 MODBUS Protocol

The communication protocol used on the RS485 bus is MODBUS RTU. Modicon originally defined the MODBUS protocol.

MODBUS RTU is a simple bit based protocol. A MODBUS system consists of a single master, which in turn interrogates each slave connected to the bus. All SELCO units operate as slaves on the MODBUS. The master unit is typically the SELCO H0300 Logger, a PLC or PC equipped with an RS485 Interface card.

A MODBUS message (a MODBUS frame) consists of the following elements.

Element	Meaning
Start (SOM)	Signals the start of a new message. A silent period
Address	Address of the recipient (slave address)
Function	Function (e.g. Read bit/word)
Data (n bytes)	Data used for the particular function
CRC Check	Checksum (used for validation)
End (EOM)	Signals the end of a message. A silent period

The MODBUS protocol can be used in two different modes - ASCII and RTU. ASCII stands for *American Standard Code of Information Interchange*. RTU stands for *Remote Terminal Mode*.

MODBUS ASCII is a clear text protocol, which means that frames are made up from a string of ASCII characters which can be transmitted directly from a standard terminal (e.g. Windows HyperTerminal). The advantage of ASCII mode is that messages are easy to generate, the disadvantage is that the frames are relatively large and inefficient.

In RTU mode every element is represented by 8 bits - except Data, which can consist of a variable number of successive bytes). RTU mode provides far better efficiency compared to ASCII, as frames are shorter and thus requires fewer bits. The drawback is that data cannot easily be entered from a standard terminal. RTU mode also requires that the elements be provided in a continuous and steady flow. SELCO unit works only in the bit based RTU mode.

Start (SOM)	Address	Function	Data	CRC Check	End (EOM)
>= 3.5 bytes of “Silence”	00000001	00011111	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	???????? ????????	>= 3.5 bytes of ”Silence”

Notice that the above message is started and ended by 3.5 bytes of silence. The silent period enables the master or slave to identify the start and end of a frame.

The Address and Function elements each consist of 8 bits (1 byte). The Data element is typically made up from a variable number of bytes, depending on the Function of the frame. The CRC element consists of two bytes (16 bits) and it is used to validate the contents of the frame.

3.1 Addresses

With MODBUS every slave must have an address (a number). The master uses the address to target a specific slave from interrogation. SELCO units can be addressed from 1 to 64 (01h – 40h).

Address 0 (00h) is used for broadcast frames (e.g. LED test on all connected units). Broadcast messages targets all slaves on the MODBUS simultaneously. Broadcast frames works without reply, as a reply from multiple units would cause collision on the bus.

4 MODBUS Frames

4.1 Syntax

Below is an example of the MODBUS frame syntax. Please note that the Data element can consist of a variable number of bytes, while the length of the Address, Function and CRC elements are fixed to one or two bytes.

Address	Function	Data	CRC
1 Byte	1 Byte	n Bytes	2 Bytes

4.2 Error Codes

Value	Decryption
01h	Unknown Function
02h	Unknown Address

Error codes are only returned if the CRC is correct. The SELCO units will only report errors under the conditions described above.

An error code response frame will have the following syntax.

Response:

Address	Function	Data	CRC
Panel	Recognised Function + 128	Error Code Value	CRC16

4.3 Functions

Value	Description
01h and 02h	Read a Bit
03h and 04h	Read words
05h	Write a Bit
06h	Write a Word
07h	Speed read 8 Bits
10h	Write n Words

It is possible to read and write the contents of any address in the MODBUS Memory Map, provided that the operation is allowed (e.g. the contents of the address is not write protected).

4.4 Exception Status

The Speed read 8 bits function can be used to read the unit exception status.

The unit exception status provides information on the unit type plus a single bit that show whether or not new events have been detected since then last request for exception status. A logging master can use this feature to determine whether or not it is necessary to read the unit indications/alarms.

Reading the exception status will reset the new events bit.

Request:

Address	Function	CRC
01h	07h	41h E2h

Reply:

Address	Function	Data	CRC
01h	07h	Unit Status & Type	??h ??h

Unit Status:

Bit	Meaning
7 (MSB)	1 = New events since last read 0 = No new events since last read
6	1 = No logging of new events 0 = Logging of new events
5	Not used (for future use)
4 – 0	Unit type: 00000 = H0300 (when used as a Slave) 00001 = M1000 00010 = M2000 00100 = M3000 00101 = H3000/H3010 01000 = M4700-80 01001 = H1500

4.5 LED States

Three bits describe the state of a LED.

LED State	Bit Code
Off	000
Steady Light	001
Short Flash (Cable Failure)	010
Quick Flash	011
Flash	100

Writing the state of a LED directly through the MODBUS will always overwrite the LED indication of a contact input (a physical alarm). The MODBUS controlled LED state will remain until it is again changed with another MODBUS message. The indication of the related contact input will not show unless the LED is turned off through the MODBUS.

LED states can be read and written on the SELCO M4700-80 Indicator Panel. On the remaining SELCO units it is only possible to read the state of the LEDs.

Please note that the M3000 and H3000 presents the individual alarms as opposed to the specific LEDs. On the M3000 and H3000 alarm states are described similar to LED states, despite that an alarm may not be allocated to a LED.

4.6 VIRINP States

Three bits are describes the status of a virtual input (VIRINP). The virtual inputs exist only in software; however a virtual input works as a contact connected in parallel to the sensor present at the physical input. An OR relation exist among the physical input and its virtual counterpart, however the state of a virtual input is solely determined though a controlling frame transmitted on the MODBUS.

VIRINP State	Bit Code
Deactivated	000
Activated	001

It is possible to control virtual inputs on both the SELCO M1000 and the SELCO M4700-80. Other SELCO units do not support virtual inputs.

4.7 Alarm Control

For security reasons it is not possible to write the state of a LED or alarm on an alarm annunciator, thus the LED or alarm state is read only.

It is however possible to write to the address of a given alarm. The write operation will not alter the state of the alarm but it will alter its function and/or operation (e.g. reset or block on/off).

The following write operations are valid on the SELCO MODBUS capable alarm annunciators:

Address	Function	Data	CRC
Panel	06h	Alarm address Alarm function	CRC16

Example: send alarm function 0Ah to alarm 3 of unit 5.

Address	Function	Data	CRC
05h	06h	00h 03h 00h 0Ah	CRC16

The following alarm functions are valid:

Alarm function	Value
Reset Alarm	0Ah
Block Alarm	0Bh
Unblock Alarm	0Ch

Please note that alarms and LEDs are directly related on the M1000, while they are separated on the M3000 and H3000. Alarm functions are addressed through the LEDs on the M1000, while the alarms are addressed directly on the M3000. The writable alarms are marked by a (*) on the memory map of the unit.

4.8 5-LED Addressing

A total of 24 LEDs can be addressed through a single MODBUS message by reading and writing to address 19h – 1Dh.

Address	LEDs
19h	1, 2, 3, 4 and 5
1Ah	6, 7, 8, 9 and 10
1Bh	11, 12, 13, 14 and 15
1Ch	16, 17, 18, 19 and 20
1Dh	21, 22, 23 and 24

Each address consists of 16 bits (a Word). The final value of each address is calculated from the sum of the binary value of the address contents (the sum of the bit values). Please notice that the most significant bit (MSB) is not used (must be set to zero).

The value of each bit is described in the table below.

	Word (16 bits)															
	Byte (8 bits)								Byte (8 bits)							
LED	NA	N+4			n+3				n+2				n+1			
Word	0	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
Byte	0	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
Example	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**1**

The above 16 bits can be used to set the state of 5 LEDs. Transmitting five successive words in a row will set a total of 24 LEDs.

4.9 Analog Readings

Analog Readings are requested and read using the read word functions (03h and 04h).

The slave device will supply the analog value as an unsigned and non-scaled word value. The master device is required to scale and sign (+/-) the word value so that it fits the required range.

5 Examples

5.1 Read Bit (Function 01h or 02h)

Request:

Address	Function	Data	CRC
Unit	Read Bits	Address of first bit Number of bits to read	CRC16

Reply:

Address	Function	Data	CRC
Unit	Read Bits	Number of Bytes Read (always 1) Byte with returned bits	CRC16

5.1.1 Read the state of the siren relay on unit 1 (which is inactive)

Request:

Address	Function	Data	CRC
01h	01h	00h 40h 00h 01h	FCh 1Eh

Reply:

Address	Function	Data	CRC
01h	01h	01h 00h	51h 88h

5.2 Read Words (Function 03h or 04h)

Request:

Address	Function	Data	CRC
Unit	Read Words	Address of first word Number of words to read	CRC16

Reply:

Address	Function	Data	CRC
Unit	Read words	Number of bytes read Value of word 1 ….. ….. Value of word n	CRC16

5.2.1 Read the state of LED 8 on unit 1 (which is flashing)

Request:

Address	Function	Data	CRC
01h	03h	00h 08h 00h 01h	05h C8h

Reply:

Address	Function	Data	CRC
01h	03h	02h 00h 02h	39h 85h

5.3 Write a Bit (Function 05h)

Request:

Address	Function	Data	CRC
Unit	Write Bit	Address of the bit New value of the bit	CRC16

The address of a bit is expressed by two bytes. The state of the bit is returned in the most significant of the two following bytes (Bit on = FFh, Bit off = 00h).

Reply:

Address	Function	Data	CRC
Unit	Write Bit	Address of the bit New value of the bit	CRC16

5.3.1 Do a LED test on unit 1

Request:

Address	Function	Data	CRC
01h	05h	00h 42h FFh 00h	2Ch 2Eh

Reply:

Address	Function	Data	CRC
01h	05h	00h 42h FFh 00h	2Ch 2Eh

5.4 Write a Word (Function 06h)

Request:

Address	Function	Data	CRC
Unit	Write Word	Address of the word New value of the word	CRC16

Reply:

Address	Function	Data	CRC
Unit	Write Word	Address of the word New value of the word	CRC16

5.4.1 Write short flash (cable failure) to all LEDs on unit 1

Request:

Address	Function	Data	CRC
01h	06h	00h 00h 00h 02h	08h 0Bh

Reply:

Address	Function	Data	CRC
01h	06h	00h 00h 00h 02h	08h 0Bh

5.4.2 Set LED 14 (0Eh) on unit 1 to quick flash

Request:

Address	Function	Data	CRC
01h	06h	00h 0Eh 00h 03h	A8h 08h

Reply:

Address	Function	Data	CRC
01h	06h	00h 0Eh 00h 03h	A8h 08h

5.5 Read Exception Status (Function 07h)

Request:

Address	Function	CRC
Unit	Speed read 8 bits	CRC16

Reply:

Address	Function	Data	CRC
Unit	Read Exception Status	Unit Status	CRC16

5.5.1 Check if unit 1 responds (check communication to unit 1 of type 01)

Request:

Address	Function	CRC
01h	07h	41h E2h

Reply:

Address	Function	Data	CRC
01h	07h	01h	E3h F0h

5.6 Write n Words (Function 10h)

Request:

Address	Function	Data	CRC
Unit	Write n words	Address of the first word Number of words Number of bytes New value of word 1 ….. ….. New value of word n	CRC16

Reply:

Address	Function	Data	CRC
Unit	Write n words	Address of first word Number of words	CRC16

5.6.1 Set all 24 LEDs (and the siren relay) to a mixed pattern

This is the desired result:

LED State	LEDs
Off	1, 4, 6, 10, 20 and 22
Steady Light	2, 5, 9, 15 and 23
Short Flash (Cable failure)	3, 7, 8, 14 and 21
Quick Flash	11, 13, 16 and 18
Flash	12, 17, 19 and 24

And the siren relay shall be deactivated.

The value of each address can be calculated as follows (MSB is not used).

Address 19h

19h	X	LED number						Address value		
LED		5	4	3	2	1		Binary	Hex (byte)	Hex (word)
State	0	001	000	010	001	000	=	00010000 10001000	10h 88h	1088h

Address 1Ah

1Ah	X	LED number						Address value		
LED		10	9	8	7	6		Binary	Hex (byte)	Hex (word)
State	0	000	001	010	010	000	=	00000010 10010000	02h 90h	0290h

Address 1Bh

1Bh	X	LED number						Address value		
LED		15	14	13	12	11		Binary	Hex (byte)	Hex (word)
State	0	001	010	011	100	011	=	00010100 11100011	14h E3h	14E3h

Address 1Ch

1Ch	X	LED number						Address value		
LED		20	19	18	17	16		Binary	Hex (byte)	Hex (word)
State	0	000	100	011	100	011	=	00001000 11100011	08h E3h	08E3h

Address 1Dh

1Dh	X	LED number						Address value		
LED		Rely	24	23	22	21		Binary	Hex (byte)	Hex (word)
Status	0	001	100	001	000	010	=	00011000 01000010	18h 42h	1842h

Thus the complete request follows.

Request:

Address	Function	Data	CRC
01h	10h	00h 19h 00h 05h 0Ah 10h 88h 02h 90h 14h E3h 08h E3h 18h 42h	B0h 07h

Reply:

Address	Function	Data	CRC
01h	10h	00h 19h 00h 05h	D1h CDh

6 MODBUS Memory Maps

6.1 M1000 Alarm Annunciator

I/O Address	Parameter Type	Access Read/Write	Description
01h	Word	R/W*	Status of LED 1
02h	Word	R/W*	Status of LED 2
03h	Word	R/W*	Status of LED 3
04h	Word	R/W*	Status of LED 4
05h	Word	R/W*	Status of LED 5
06h	Word	R/W*	Status of LED 6
07h	Word	R/W*	Status of LED 7
08h	Word	R/W*	Status of LED 8
09h	Word	R/W*	Status of LED 9
0Ah	Word	R/W*	Status of LED 10
19h	Word	R	Status of LED 1, 2, 3, 4 & 5
1Ah	Word	R	Status of LED 6, 7, 8, 9 & 10
40h	Bit	R	Siren Relay 00h = Deactivated FFh = Activated
42h	Bit	R/W	LED Test FFh = Do LED Test Read: Returned value=00h
43h	Bit	R/W	Reset FFh = Do Reset Read: Returned value=00h
50h	Word	R/W	Dimming 01h – FFh (1 – 100%)
51h	Bit	R/W	LED Synchronization FFh = Synchronize LEDs Read: Returned value=00h
82h	Word	R	Slave Address 01h – 3Fh
A1h	Word	R/W	Status of VIRINP 1
A2h	Word	R/W	Status of VIRINP 2
A3h	Word	R/W	Status of VIRINP 3
A4h	Word	R/W	Status of VIRINP 4
A5h	Word	R/W	Status of VIRINP 5
A6h	Word	R/W	Status of VIRINP 6
A7h	Word	R/W	Status of VIRINP 7
A8h	Word	R/W	Status of VIRINP 8
A9h	Word	R/W	Status of VIRINP 9
AAh	Word	R/W	Status of VIRINP 10
B9h	Word	R/W	Status of VIRINP 1, 2, 3, 4 & 5
BAh	Word	R/W	Status of VIRINP 6, 7, 8, 9 & 10

* It is not possible to write the state of an alarm. However, the write operation can be used to alter the function of the alarm or to command, e.g. a channel specific reset.

6.2 M2000 Engine Controller

I/O Address	Parameter Type	Access Read/Write	Description
01h	Word	R	Status of LED 1
02h	Word	R	Status of LED 2
03h	Word	R	Status of LED 3
04h	Word	R	Status of LED 4
05h	Word	R	Status of LED 5
06h	Word	R	Status of LED 6
07h	Word	R	Status of LED 7
08h	Word	R	Status of LED 8
09h	Word	R	Status of LED 9
0Ah	Word	R	Status of LED 10
19h	Word	R	Status of LED 1, 2, 3, 4 & 5
1Ah	Word	R	Status of LED 6, 7, 8, 9 & 10
40h	Bit	R	Siren Relay 00h = Deactivated FFh = Activated
42h	Bit	R/W	LED Test FFh = Do LED Test Read: Returned value=00h
43h	Bit	R/W	Reset FFh = Do Reset Read: Returned value=00h
44h	Bit	R/W	Start FFh = Start Read: Returned value=00h
45h	Bit	R/W	Stop FFh = Stop Read: Returned value=00h
50h	Word	R/W	Dimming 01h – FFh (1 – 100%)
82h	Word	R	Slave Address 01h – 3Fh
A1h	Word	R	Status of OUT 1
A2h	Word	R	Status of OUT 2
A3h	Word	R	Status of OUT 3
A4h	Word	R	Status of OUT 4
A5h	Word	R	Status of OUT 5
A6h	Word	R	Status of OUT 6
A7h	Word	R	Status of OUT 7
A8h	Word	R	Status of OUT 8
A9h	Word	R	Status of OUT 9
AAh	Word	R	Status of OUT 10
B9h	Word	R	Status of OUT 1, 2, 3, 4 & 5
BAh	Word	R	Status of OUT 6, 7, 8, 9 & 10

6.3 M3000 Alarm Annunciator

I/O Address	Parameter Type	Access Read/Write	Description
01h	Word	R/W*	Status of Alarm 1
02h	Word	R/W*	Status of Alarm 2
03h	Word	R/W*	Status of Alarm 3
04h	Word	R/W*	Status of Alarm 4
05h	Word	R/W*	Status of Alarm 5
06h	Word	R/W*	Status of Alarm 6
07h	Word	R/W*	Status of Alarm 7
08h	Word	R/W*	Status of Alarm 8
09h	Word	R/W*	Status of Alarm 9
0Ah	Word	R/W*	Status of Alarm 10
0Bh	Word	R/W*	Status of Alarm 11
0Ch	Word	R/W*	Status of Alarm 12
0Dh	Word	R/W*	Status of Alarm 13
0Eh	Word	R/W*	Status of Alarm 14
0Fh	Word	R/W*	Status of Alarm 15
10h	Word	R/W*	Status of Alarm 16
11h	Word	R/W*	Status of Alarm 17
12h	Word	R/W*	Status of Alarm 18
13h	Word	R/W*	Status of Alarm 19
14h	Word	R/W*	Status of Alarm 20
15h	Word	R/W*	Status of Alarm 21
16h	Word	R/W*	Status of Alarm 22
17h	Word	R/W*	Status of Alarm 23
18h	Word	R/W*	Status of Alarm 24
19h	Word	R	Status of Alarm 1, 2, 3, 4 & 5
1Ah	Word	R	Status of Alarm 6, 7, 8, 9 & 10
1Bh	Word	R	Status of Alarm 11, 12, 13, 14 & 15
1Ch	Word	R	Status of Alarm 16, 17, 18, 19 & 20
1Dh	Word	R	Status of Alarm 21, 22, 23 & 24
1Eh	Word	R/W*	Status of Alarm 25
1Fh	Word	R/W*	Status of Alarm 26
20h	Word	R/W*	Status of Alarm 27
21h	Word	R/W*	Status of Alarm 28
22h	Word	R/W*	Status of Alarm 29
23h	Word	R/W*	Status of Alarm 30
24h	Word	R/W*	Status of Alarm 31
25h	Word	R/W*	Status of Alarm 32
26h	Word	R/W*	Status of Alarm 33
27h	Word	R/W*	Status of Alarm 34
28h	Word	R/W*	Status of Alarm 35
29h	Word	R/W*	Status of Alarm 36
2Ah	Word	R/W*	Status of Alarm 37
2Bh	Word	R/W*	Status of Alarm 38
2Ch	Word	R/W*	Status of Alarm 39
2Dh	Word	R/W*	Status of Alarm 40
2Eh	Word	R/W*	Status of Alarm 41
2Fh	Word	R/W*	Status of Alarm 42
30h	Word	R/W*	Status of Alarm 43
31h	Word	R/W*	Status of Alarm 44
32h	Word	R/W*	Status of Alarm 45
33h	Word	R/W*	Status of Alarm 46
34h	Word	R/W*	Status of Alarm 47
35h	Word	R/W*	Status of Alarm 48
36h	Word	R	Status of Alarm 25, 26, 27, 28 & 29

I/O Address	Parameter Type	Access Read/Write	Description
37h	Word	R	Status of Alarm 30, 31, 32, 33 & 34
38h	Word	R	Status of Alarm 35, 36, 37, 38 & 39
39h	Word	R	Status of Alarm 40, 41, 42, 43 & 44
3Ah	Word	R	Status of Alarm 45, 46, 47 & 48
40h	Bit	R	Siren Output 00h = Deactivated FFh = Activated
42h	Bit	R/W	LED Test FFh = Do LED Test Read: Returned value = 00h
43h	Bit	R/W	Reset FFh = Do Reset Read: Returned value = 00h
50h	Word	R/W	Dimming 01h – FFh (1 – 100%)
51h	Bit	R/W	LED Synchronization FFh = Synchronize LEDs Read: Returned value = 00h
82h	Word	R	Slave Address 01h – 3Fh
A1h	Word	R	Status of OUT 1
A2h	Word	R	Status of OUT 2
A3h	Word	R	Status of OUT 3
A4h	Word	R	Status of OUT 4
A5h	Word	R	Status of OUT 5
A6h	Word	R	Status of OUT 6
A7h	Word	R	Status of OUT 7
A8h	Word	R	Status of OUT 8
A9h	Word	R	Status of OUT 9
AAh	Word	R	Status of OUT 10
ABh	Word	R	Status of OUT 11
ACh	Word	R	Status of OUT 12
ADh	Word	R	Status of OUT 13
AEh	Word	R	Status of OUT 14
AFh	Word	R	Status of OUT 15
B0h	Word	R	Status of OUT 16
B9h	Word	R	Status of OUT 1, 2, 3, 4 & 5
BAh	Word	R	Status of OUT 6, 7, 8, 9 & 10
BBh	Word	R	Status of OUT 11, 12, 13, 14 & 15
BCh	Word	R	Status of OUT 16
D0h	Word	R	Analog Value IN1 **
D1h	Word	R	Analog Value IN2 **
D2h	Word	R	Analog Value IN3 **
D3h	Word	R	Analog Value IN4 **
D4h	Word	R	Analog Value IN5 **
D5h	Word	R	Analog Value IN6 **
D6h	Word	R	Analog Value IN7 **
D7h	Word	R	Analog Value IN8 **
D8h	Word	R	Analog Value IN9 **
D9h	Word	R	Analog Value IN10 **
DAh	Word	R	Analog Value IN11 **
DBh	Word	R	Analog Value IN12 **
DCh	Word	R	Analog Value IN13 **
DDh	Word	R	Analog Value IN14 **
DEh	Word	R	Analog Value IN15 **
DFh	Word	R	Analog Value IN16 **

I/O Address	Parameter Type	Access Read/Write	Description
E0h	Word	R	Analog Value IN17 **
E1h	Word	R	Analog Value IN18 **
E2h	Word	R	Analog Value IN19 **
E3h	Word	R	Analog Value IN20 **
E3h	Word	R	Analog Value IN20 **
E4h	Word	R	Analog Value IN21 **
E5h	Word	R	Analog Value IN22 **
E6h	Word	R	Analog Value IN23 **
E7h	Word	R	Analog Value IN24 **
90h	Word	R	Status of OUT 1, 2, 3, 4 & 5 ***
91h	Word	R	Status of OUT 6, 7, 8, 9 & 10 ***
92h	Word	R	Status of OUT 11, 12, 13, 14 & 15 ***
93h	Word	R	Status of OUT 16 ***
94h	Word	R	Status of Alarm 1, 2, 3, 4 & 5 ***
95h	Word	R	Status of Alarm 6, 7, 8, 9 & 10 ***
96h	Word	R	Status of Alarm 11, 12, 13, 14 & 15 ***
97h	Word	R	Status of Alarm 16, 17, 18, 19 & 20 ***
98h	Word	R	Status of Alarm 21, 22, 23 & 24 ***
99h	Word	R	Status of Alarm 25, 26, 27, 28 & 29 ***
9Ah	Word	R	Status of Alarm 30, 31, 32, 33 & 34 ***
9Bh	Word	R	Status of Alarm 35, 36, 37, 38 & 39 ***
9Ch	Word	R	Status of Alarm 40, 41, 42, 43 & 44 ***
9Dh	Word	R	Status of Alarm 45, 46, 47 & 48 ***

* It is not possible to write the state of an alarm. However, the write operation can be used to alter the function of the alarm or to command, e.g. a channel specific reset.

** Analog values are read out as words.

20mA corresponds to:	744h (1860 decimal).	Max. is 7FFh (2047 decimal), equal to: 22mA.
10V DC corresponds to:	6AAh (1706 decimal).	Max. is 7FFh (2047 decimal), equal to: 12V DC.
24V DC corresponds to:	5A5h (1445 decimal)	Max. is 7FFh (2047 decimal), equal to: 34V DC.

*** The maximum block you can read out at the time is 12 words. Therefore the packed data is repeated in one block at this position (90h – 9Dh).

With the 12 word read block limit you can now decide to read in one block:

1. Read outputs 1-16 and alarms 1-39 - 12 words.
2. Read outputs 6-16 and alarms 1-44 - 12 words.
3. Read outputs 11-16 and alarms 1-48 - 12 words.

6.4 M4700-80 Indicator Panel

I/O Address	Parameter Type	Access Read/Write	Description
01h	Word	R/W	Status of LED 1
02h	Word	R/W	Status of LED 2
03h	Word	R/W	Status of LED 3
04h	Word	R/W	Status of LED 4
05h	Word	R/W	Status of LED 5
06h	Word	R/W	Status of LED 6
07h	Word	R/W	Status of LED 7
08h	Word	R/W	Status of LED 8
09h	Word	R/W	Status of LED 9
0Ah	Word	R/W	Status of LED 10
0Bh	Word	R/W	Status of LED 11
0Ch	Word	R/W	Status of LED 12
0Dh	Word	R/W	Status of LED 13
0Eh	Word	R/W	Status of LED 14
0Fh	Word	R/W	Status of LED 15
10h	Word	R/W	Status of LED 16
11h	Word	R/W	Status of LED 17
12h	Word	R/W	Status of LED 18
13h	Word	R/W	Status of LED 19
14h	Word	R/W	Status of LED 20
19h	Word	R/W	Status of LED 1, 2, 3, 4 & 5
1Ah	Word	R/W	Status of LED 6, 7, 8, 9 & 10
1Bh	Word	R/W	Status of LED 11, 12, 13, 14 & 15
1Ch	Word	R/W	Status of LED 16, 17, 18, 19 & 20
40h	Bit	R/W	Siren Relay 00h = Deactivated FFh = Activated
41h	Bit	R/W	Alarm Relay 00h = Deactivated FFh = Activated
42h	Bit	R/W	LED Test FFh = Do LED Test Read: Returned value = 00h
43h	Bit	R/W	Reset FFh = Do Reset Read: Returned value = 00h
50h	Word	R/W	Dimming 01h – FFh (1 – 100%)
51h	Bit	R/W	LED Synchronization FFh = Synchronize LEDs Read: Returned value = 00h
A1h	Word	R/W	Status of VIRINP 1
A2h	Word	R/W	Status of VIRINP 2
A3h	Word	R/W	Status of VIRINP 3
A4h	Word	R/W	Status of VIRINP 4
A5h	Word	R/W	Status of VIRINP 5
A6h	Word	R/W	Status of VIRINP 6
A7h	Word	R/W	Status of VIRINP 7
A8h	Word	R/W	Status of VIRINP 8
A9h	Word	R/W	Status of VIRINP 9
AAh	Word	R/W	Status of VIRINP 10
ABh	Word	R/W	Status of VIRINP 11
ACh	Word	R/W	Status of VIRINP 12

I/O Address	Parameter Type	Access Read/Write	Description
ADh	Word	R/W	Status of VIRINP 13
AEh	Word	R/W	Status of VIRINP 14
AFh	Word	R/W	Status of VIRINP 15
B0h	Word	R/W	Status of VIRINP 16
B1h	Word	R/W	Status of VIRINP 17
B2h	Word	R/W	Status of VIRINP 18
B3h	Word	R/W	Status of VIRINP 19
B4h	Word	R/W	Status of VIRINP 20
B9h	Word	R/W	Status of VIRINP 1, 2, 3, 4 & 5
BAh	Word	R/W	Status of VIRINP 6, 7, 8, 9 & 10
BBh	Word	R/W	Status of VIRINP 11, 12, 13, 14 & 15
BCh	Word	R/W	Status of VIRINP 16, 17, 18, 19 & 20

6.5 H1500 Indicator Panel

I/O Address	Parameter Type	Access Read/Write	Description
01h	Word	R/W	Status of LED 1
02h	Word	R/W	Status of LED 2
03h	Word	R/W	Status of LED 3
04h	Word	R/W	Status of LED 4
05h	Word	R/W	Status of LED 5
06h	Word	R/W	Status of LED 6
07h	Word	R/W	Status of LED 7
08h	Word	R/W	Status of LED 8
09h	Word	R/W	Status of LED 9
0Ah	Word	R/W	Status of LED 10
0Bh	Word	R/W	Status of LED 11
0Ch	Word	R/W	Status of LED 12
0Dh	Word	R/W	Status of LED 13
0Eh	Word	R/W	Status of LED 14
0Fh	Word	R/W	Status of LED 15
10h	Word	R/W	Status of LED 16
11h	Word	R/W	Status of LED 17
12h	Word	R/W	Status of LED 18
19h	Word	R/W	Status of LED 1, 2, 3, 4 & 5
1Ah	Word	R/W	Status of LED 6, 7, 8, 9 & 10
1Bh	Word	R/W	Status of LED 11, 12, 13, 14 & 15
1Ch	Word	R/W	Status of LED 16, 17, 18
42h	Bit	W	LED Test FFh = Do LED Test Read: Returned value = 00h
50h	Word	W	Dimming 01h – FFh (1 – 100%)
51h	Bit	W	LED Synchronization FFh = Synchronize LEDs Read: Returned value = 00h

6.6 H3000 Analog Alarm Annunciator

I/O Address	Parameter Type	Access Read/Write	Description
01h	Word	R	Status of Alarm 1
02h	Word	R	Status of Alarm 2
03h	Word	R	Status of Alarm 3
04h	Word	R	Status of Alarm 4
05h	Word	R	Status of Alarm 5
06h	Word	R	Status of Alarm 6
07h	Word	R	Status of Alarm 7
08h	Word	R	Status of Alarm 8
09h	Word	R	Status of Alarm 9
0Ah	Word	R	Status of Alarm 10
0Bh	Word	R	Status of Alarm 11
0Ch	Word	R	Status of Alarm 12
0Dh	Word	R	Status of Alarm 13
0Eh	Word	R	Status of Alarm 14
0Fh	Word	R	Status of Alarm 15
10h	Word	R	Status of Alarm 16
11h	Word	R	Status of Alarm 17
12h	Word	R	Status of Alarm 18
13h	Word	R	Status of Alarm 19
14h	Word	R	Status of Alarm 20
15h	Word	R	Status of Alarm 21
16h	Word	R	Status of Alarm 22
17h	Word	R	Status of Alarm 23
18h	Word	R	Status of Alarm 24
19h	Word	R	Status of Alarm 25
1Ah	Word	R	Status of Alarm 26
1Bh	Word	R	Status of Alarm 27
1Ch	Word	R	Status of Alarm 28
1Dh	Word	R	Status of Alarm 29
1Eh	Word	R	Status of Alarm 30
1Fh	Word	R	Status of Alarm 31
20h	Word	R	Status of Alarm 32
21h	Word	R	Status of Alarm 1, 2, 3, 4 & 5
22h	Word	R	Status of Alarm 6, 7, 8, 9 & 10
23h	Word	R	Status of Alarm 11, 12, 13, 14 & 15
24h	Word	R	Status of Alarm 16, 17, 18, 19 & 20
25h	Word	R	Status of Alarm 21, 22, 23, 24 & 25
26h	Word	R	Status of Alarm 26, 27, 28, 29 & 30
27h	Word	R	Status of Alarm 31 & 32
40h	Bit	R	Siren Relay 00h = Deactivated FFh = Activated
42h	Bit	R/W	LED Test FFh = Do LED Test Read: Returned value = 00h
43h	Bit	R/W	Reset FFh = Do Reset Read: Returned value = 00h
50h	Word	R/W	Dimming 01h – FFh (1 – 100%)

I/O Address	Parameter Type	Access Read/Write	Description
D0h	Word	R	Analog Value IN1
D1h	Word	R	Analog Value IN2
D2h	Word	R	Analog Value IN3
D3h	Word	R	Analog Value IN4
D4h	Word	R	Analog Value IN5
D5h	Word	R	Analog Value IN6
D6h	Word	R	Analog Value IN7
D7h	Word	R	Analog Value IN8
D8h	Word	R	Analog Value IN9
D9h	Word	R	Analog Value IN10
DAh	Word	R	Analog Value IN11
DBh	Word	R	Analog Value IN12
DCh	Word	R	Analog Value IN13
DDh	Word	R	Analog Value IN14
DEh	Word	R	Analog Value IN15
DFh	Word	R	Analog Value IN16

6.7 H3010 Smoke Alarm Annunciator

I/O Address	Parameter Type	Access Read/Write	Description
01h	Word	R	Status of Alarm 1
02h	Word	R	Status of Alarm 2
03h	Word	R	Status of Alarm 3
04h	Word	R	Status of Alarm 4
05h	Word	R	Status of Alarm 5
06h	Word	R	Status of Alarm 6
07h	Word	R	Status of Alarm 7
08h	Word	R	Status of Alarm 8
09h	Word	R	Status of Alarm 9
0Ah	Word	R	Status of Alarm 10
0Bh	Word	R	Status of Alarm 11
0Ch	Word	R	Status of Alarm 12
0Dh	Word	R	Status of Alarm 13
0Eh	Word	R	Status of Alarm 14
0Fh	Word	R	Status of Alarm 15
10h	Word	R	Status of Alarm 16
11h	Word	R	Main Power Supply (Off-On-Fail)
12h	Word	R	Emerg Power Supply (Off-On-Fail)
13h	Word	R	Fan 1 (Off-On-Fail)
14h	Word	R	Fan 2 (Off-On-Fail)
19h	Word	R	Status of Alarms 1, 2, 3, 4 & 5
1Ah	Word	R	Status of Alarms 6, 7, 8, 9 & 10
1Bh	Word	R	Status of Alarms 11, 12, 13, 14 & 15
1Ch	Word	R	Status of Alarms 16, 17, 18, 19 & 20
40h	Bit	R	Siren Relay 00h = Deactivated FFh = Activated
42h	Bit	R/W	LED Test FFh = Do LED Test
43h	Bit	R/W	Reset FFh = Do Reset
50h	Word	R/W	Dimming 01h – FFh (1 – 100%)
A1h	Word	R	Status of Output 1
A2h	Word	R	Status of Output 2
A3h	Word	R	Status of Output 3
A4h	Word	R	Status of Output 4
A5h	Word	R	Status of Output 5
A6h	Word	R	Status of Output 6
A7h	Word	R	Status of Output 7
A8h	Word	R	Status of Output 8
B9h	Word	R	Status of Outputs 1, 2, 3, 4 & 5
BAh	Word	R	Status of Outputs 6, 7, & 8