Honeywell

Functional specification

OpenTherm Monitor

1.   History

Version	Date	Author	Description of the changes
1.0	20-04-2000	BK	• action can changed in read, write, data_invalid and (unknown_id) • new options in slave tester: minimal request time, repeat when incorrect. • Filter on active messages in test slave • Current data can saved in otm file • new option in master tester: Response time (replaces auto response) • Autoresponse mode is removed • All timings are implemented in ottesttool

2. Index

3.   Introduction

3.1.   Product description

The OpenTherm monitor consists off a program for Windows'95 or Windows NT and a special OpenTherm interface control. With this the communication between a OpenTherm master and a OpenTherm slave can be monitored. Also this system can act as a OpenTherm master or a OpenTherm slave control. For presentation, and program flow in case master mode, a ASCII file with OpenTherm ID definitions is used. The PC has to be connected via a RS232 communication port to a special interface control (OTM)

4.   Software and hardware requirements

For the OpenTherm test is needed:
- a PC with windows and the OpenTherm Monitor 2.1 software
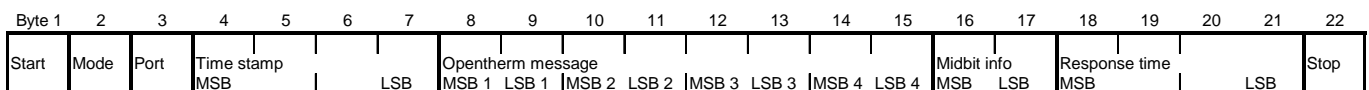- a Monitor with PIC-Processor software version 2.1

5.   Connections

L	Power supply 230VAC
N	Power supply 230VAC
1,2	OpenTherm slave tester
7,8	OpenTherm Master tester

6.   Communication interface

6.1.   Monitor, Master, Slave mode

All messages send have the same format and length. Start- and stop characters will be used to determine the begin and end of the message. The message is build in such a manner that it is readable with a terminal program. This is realised by sending all bytes, except the start and stop byte, in readable ASCII format. The maximum message length is 22 byte. The format structure is as follows:

byte 1:	Start character (0x02)
byte 2:	Mode
byte 3:	Port / Status code (optional)
byte 4..7:	Time stamp (optional)
byte 8..15:	OpenTherm message (optional)
byte 16..17:	Midbit info (optional)
byte 18..21	Response time (optional)
byte 22:	Stop character (0x03)

Byte 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Start	Mode	Port	Time stamp MSB			LSB	Opentherm message MSB 1	LSB 1	MSB 2	LSB 2	MSB 3	LSB 3	MSB 4	LSB 4	Midbit info MSB	LSB	Response time MSB			LSB	Stop

Elements of the format structure are described below.

6.1.1. Mode

This byte indicates in which mode the OpenTherm control is or should be. The OpenTherm monitor program sends the requested mode to the control. The control will answer with a acknowledge. When no communication is performed for 5 seconds then PC checks if the control is still on line.

When the control receives a Opentherm message from the master or slave interface a message (as defined) will be send. Defined values:

'0'= OpenTherm Monitor mode
'1'= OpenTherm Master mode
'2'= OpenTherm Slave mode
'3'= OpenTherm Autoslave mode (no longer used)
'4'= OpenTherm Lite Master mode
'5'= OpenTherm Lite Slave mode
'6'= Testing 'control is still live'
'7'= Stop, the monitor stops receiving or sending message on the OT-bus

'8'= Acknowledge OpenTherm Monitor mode
'9'= Acknowledge OpenTherm Master mode
'A'= Acknowledge OpenTherm Slave mode
'B'= Acknowledge OpenTherm Autoslave mode (no longer used)
'C'= Acknowledge OpenTherm Lite Master mode
'D'= Acknowledge OpenTherm Lite Slave mode
'E'= Acknowledge 'control is still live', also provides the windows application with status information
'F'= Acknowledge stopping

6.1.2. Port.

The port byte indicates from which port the message has been send or received.

'0'   From or towards the Master port.
'1'   From or towards the Slave port.

6.1.3. Time stamp

When the control sends a received OpenTherm message from the master or slave the time stamp is the time in 500 usec steps, when the first flank of a message (from master or slave) is received. After each request from the master the time stamp is cleared. The time is presented as a 4 byte ASCII string.

When the PC sends a message to the control the time stamp is the bittime in usec divided by 6,5.

6.1.4. OpenTherm message

This field contains a OpenTherm message. The 4 byte hex code of the message is presented as a 8 byte ASCII string (message 0x90 0x01 0x4B 0x60 is written as '90014B60').

6.1.5. Midbit info

When the control is in Master or Slave mode and the PC sends a message to the control, this data field contains the value of the bit where a midbit fault must occur. No midbit fault occurs when the value is equal to zero.

When the control is in Monitor, Master or Slave mode and it sends a received OpenTherm message to the PC, the data field holds the number of correctly received bits.

6.1.6. Response time

When the control is in Monitor or Master mode, and the control sends a received OpenTherm slave message to the PC, this 4 byte data field holds the response time in 500 usec steps, between the master request and the slave answer.

When the control is in Autoslave mode and the PC sends a message to the control this data field contains the response time, in 500 usec steps, in which the control must auto answer the OpenTherm message received from the Master. The time is presented as a 4 byte ASCII string.

6.2.   OpenTherm Lite Master and Slave mode

byte 1:   Start character (0x02)
byte 2:   Mode
byte 3:   Port
byte 4:   Status
byte 5..8:   Time High
byte 9..12:   Time Low
byte 13:   Stop character (0x03)

Byte 1	2	3	4	5	6	7	8	9
Start	Mode	Port	Status	Time High MSB	LSB	Time Low MSB	LSB	Stop
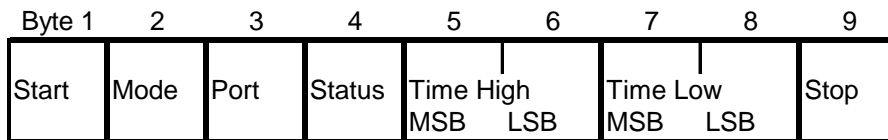
Elements of the format structure are described below.

6.2.1. Mode and Port

The format of these two bytes are the same as discussed in paragraphs 7.1.1 and 7.1.2.

6.2.2. Status

This byte indicates the status of the slave. When in OpenTherm master lite the control sends a message to the PC containing the status of the slave, ie. normal operation or boiler lock-out fault.

When in OpenTherm Lite slave mode, the PC sends the selected slave status to the control.
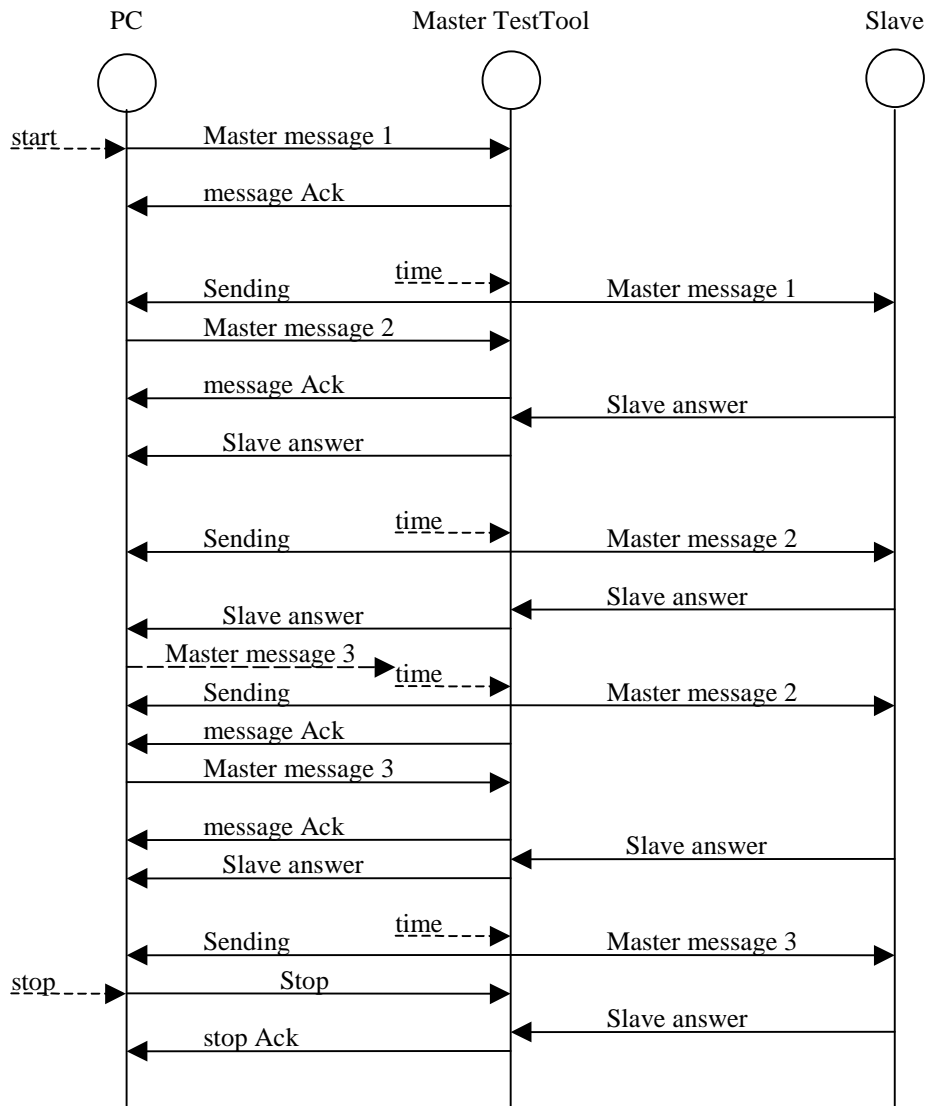
6.2.3. Time High

These bytes contain de time in 50usec steps in which the output is/ must be High. It is a byte value, presented as a 2 byte ASCII string.

6.2.4. Time low

These bytes contain de time in 50usec steps in which the output is/ must be Low. It is a byte value, presented as a 2 byte ASCII string.

6.3.   Communication in master mode

After pressing the start button a message is send to the monitor so it will go in master mode and sending the first message to the slave in several milliseconds. When the message is send to the slave the PC will be informed about this with a message in the form: '☺EExxxx♥'. xxxx stands for a timestamp of the message. When the computer is too late with a message the Monitor re-send the same message (message 2). The computer knows it because the sending message come before the acknowledge.

6.4. Communication in slave mode
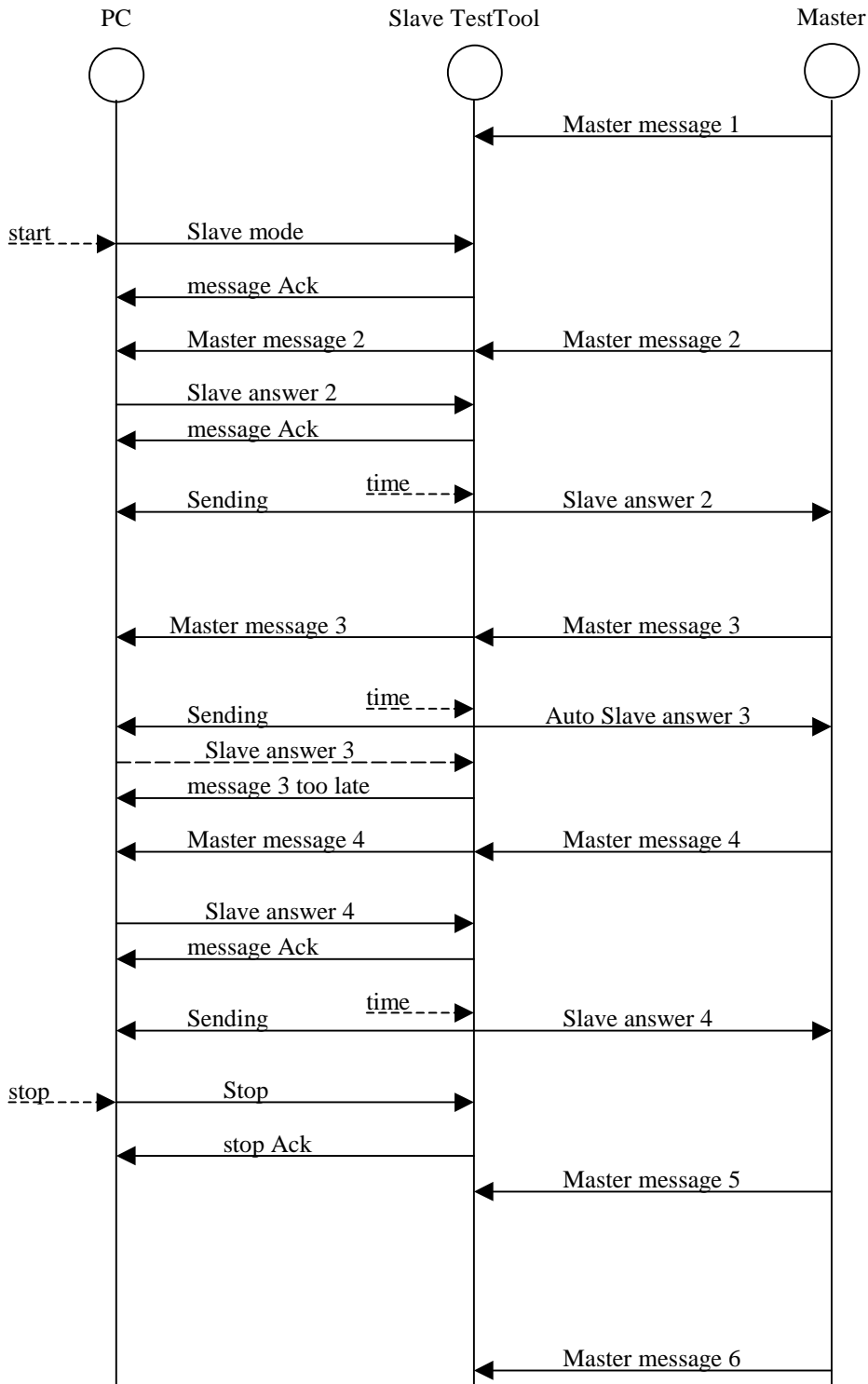
After pressing on the start button the Monitor is placed in slave mode, before it will not react on any message from the master. After it's in slave mode it will send the message from the master thru to the pc. The pc will response as quick as it can. After the response time the slave answer is send to the master. When the pc didn't send a message on time the monitor send a acknowledgement to the master and tells the pc that the message was too late. The sending message looks the same as in master mode. The too late message has the form: '●ED♥'

6.5. OpenTherm ID file (*.otm)

In each mode a OpenTherm ID file is used. This file is a ASCII file. Each line starts with 3 fixed data fields (id, id description and messagetype), followed by format (F8.8, U16, S16, flag8, U8 and S8), minimum, maximum and default value of the 2 databytes in the OpenTherm message and as last item request.

In case of a message with two 1 byte formats (flag8, u8 or s8) the line consists of two formats, minima, maxima and defaults. In case of format flag8 no minimum and maximum is given.

Empty lines and comment lines starting with a semicolon are allowed in the OpenTherm ID file.

Example:

"0","STATUS","READ","FLAG","00000000","FLAG","00000000","yes"

"1","CONTROL SETPOINT","WRITE","F8.8","0","100","50","no"

"2","MASTER","WRITE","FLAG","00000000","U8","0","255","50","yes"

"3","SLAVE","READ","FLAG","00000000","U8","0","255","50","yes"

;comment

"4","COMMAND","READWRITE","U8","0","255","50","U8","0","255","50","no"

6.6. OpenTherm log file (*.log)

All listed/read messages can be saved as OpenTherm log files to disk. Also the stream function writes the messages to disc as OpenTherm log files. The OpenTherm log file is a ASCII file.

Each line starts with 5 fixed data fields (sender, time stamp, message type, id and description), followed by the data in the defined format and the data in hex value. In case of a message with two 1 byte formats (flag8, u8 or s8) the line consists of two formatted data values and the data in hex value.

Example:

"M ->","00:00:00:997.5","READ_DATA","0","STATUS","00000000-00000000","0x00","0x00","-5986"

"M ->","00:00:01:996.5","READ_DATA","0","STATUS","00000000-00000000","0x00","0x00","999"

7.   Functions

7.1.   Monitor mode

- An OpenTherm Master and OpenTherm Slave device are connected to the OpenTherm bus monitor. The master is connected to terminals 7 and 8, the slave is connected to terminals 1 and 2. When the slave polarity does not match the internal circuitry, this will be indicated by the red LED just right of the terminals
- All messages between master and slave are read and listed in a window with time stamps. The reading of the messages can be started and stopped. Only OpenTherm/plus can monitored.
- The messages are translated/decoded using a OpenTherm ID file (*.otm). See section 4.
- The parity of each message is checked and displayed on screen.
- Master and slave messages can be viewed separated (split mode) or combined (mixed mode).
- Statistics are held of the minimum and maximum communication time of the master (the inter-message conversation time) and the response time of the slave.
- The listed messages can be saved as a OpenTherm log file (*.log).
- Standard functions for the log files (new, open, save, save as, print)
- With the stream function all sent and received messages, when running, are written as OpenTherm log files directly to disk.

7.2.   Master mode

- An OpenTherm slave device is connected to the OpenTherm slave tester, terminals 1 and 2. When the slave polarity does not match the internal circuitry, this will be indicated by the red LED just right of the terminals
- The OpenTherm ID file defined in settings is listed in a window.
- Each messages can be set to sent (yes or no).
- The messages with sent set to yes are sequential sent by the master. Sending can be started and stopped.
- The parity of each messages from the slave is checked and displayed. It is possible to generate a parity fault in a selected message from the master
- In a separate column the number of correctly received bits of a OpenTherm message are listed. If a midbit fault was detected, the number displayed is the bit where the error occurred.
- While running, data can be changed.
- The time between requests can be adjusted.
- The transmission bittime can be adjusted.
- A midbit fault can be generated, the bit where the fault should occur can be adjusted
- With the stream function all sent and received messages, when running, are written as OpenTherm log files directly to disk.
- The message action can be changed from read to write, data invalid.

7.3.   Slave mode

- An OpenTherm master device is connected to the OpenTherm master tester, terminals 7 and 8.
- The OpenTherm ID file defined in settings is listed in a window.
- Answering can be started and stopped.
- The parity of each message from the Master is checked and displayed. It is possible to generate a parity fault in the message from the slave.
- In a separate column the number of correctly received bits of a OpenTherm message are listed. If a midbit fault was detected, the number displayed is the bit where the error occurred.
- While running data can be changed.
- The transmission bittime can be adjusted.
- A midbit fault can be generated, the bit where the fault should occur can be adjusted
- With the stream function all sent and received messages, when running, are written as OpenTherm log files directly to disk.
- The message action can be changed from read to write, data invalid, data unknown.

7.4.   OpenTherm Lite Master mode

- An OpenTherm slave device is connected to the OpenTherm slave tester, terminals 1 and 2. When the slave polarity does not match the internal circuitry, this will be indicated by the red LED just right of the terminals
- The status of the slave is displayed, ie. normal operation or boiler lock-out fault. The status is updated every second.
- The control setpoint can be adjusted. The control converts the setpoint to a PWM signal
- The period of the PWM signal can be adjusted

7.5.   OpenTherm Lite Slave mode

- An OpenTherm master device is connected to the OpenTherm master tester, terminals 7 and 8.
- The control setpoint is shown on the PC. The value is updated every second.
- The status of the slave can be adjusted, ie. normal operation or boiler lock-out fault.

8.   user interface

8.1.   Windows Opentherm Monitor

8.1.1. Menu

After starting the program a menu will appear. There are several possibilities :
- Test Master
- Test Slave
- Monitor
- Test Master Lite
- Test Slave Lite
- Settings (menu)

8.1.2. Settings

On the first tab-page is the possibility to select a OpenTherm ID file for every mode. When there isn't a file selected the mode will be disabled in the menu. For the layout of the file see '6.5 OpenTherm ID file'.

On the second tab-page the communication port can be selected for the OpenTherm monitor. Connect the OpenTherm monitor to the selected com-port.

8.1.3. Test Master

A OpenTherm Slave window will appear. There are several things you can change or select:

1. Bit-time — This item will change the length of a bit, default is 1 ms (1000 us)
2. Response Time — after how many milliseconds the slave answer will send to the master, when the computer can't answer the message quick enough then the OpenTherm monitor will auto-answer with a acknowledgement. This means a write-action will be answered with a write-ack and a read with a read-ack.
3. Mitbit error location — at this position will the message have a bitfault.
4. Send Parity Error — will make a message with a parity fault

Actions:

1. Start — This will start the slave, the slave now receives messages and answers the messages
2. Stop — This will stop the slave, the slave will no longer receive any message
3. Stream — All received and sent messages will be saved to a log file
4. Refresh — All received message/answers are removed from the window
5. Changing actions — By double-clicking on a action it will change from read⇒write⇒invalid⇒unknown⇒read.
6. Changing values — By typing new values the answering values can be changed.
7. Exit — Slave will disappear and the menu will come back

8.1.4. Test Slave

A OpenTherm Master window will appear. There are several things you can change or select:

1. Request time period — with which interval the master will send a message to the slave, when the computer can't deliver a message quick enough then the OpenTherm monitor while re-send the previous one.
2. Minimal Request time — with this distance the master will send the next message after the slave answer, when the computer can't deliver a new message quick enough the OpenTherm monitor will re-send the last message again. When there is no answer from the slave the next message will be send after 1 second after the previous one.
3. Bit-time — This item will change the length of a bit, default is 1 ms (1000 us)
4. Mitbit error location — at this position will the message have a bitfault.
5. Send Parity Error — when selected it will make a message with a parity fault
6. Repeat when incorrect answer — if this option is activated the same message will be repeated until there is an answer with no mitbit-faults or parity-faults in it, if the message are programmed to send quickly after the previous one there is a possibility that the computer can't change the next message to be send and the next one will already be send to the slave.

Actions:

1.	Start	This will start the master, the master will start sending messages to the slave
2.	Stop	This will stop the master, the master will no longer receive or send any message
3.	Stream	All received and sent messages will be saved to a log file
4.	Refresh	All received answers and there response times will removed from the window
5.	Req(uest)	by double clicking in this field the item will change for yes to no to yes, when the item is 'no' the message in this row will not be send to the slave.
6.	Changing mode	By selecting one of the radio-buttons you can switch between a constant delay between the master-message or a delay between the slave answer and next master message
7.	Changing actions	By double-clicking on a action it will change from read⇒write⇒invalid⇒read
8.	Changing values	By typing new values the values for the message to send can be changed
9.	Saving to otm-file	The change in the values and request can be saved to the same otm-file or to a new one by clicking on file→save OTM or file→save as OTM… (the changes in actions will not be saved)
10.	Filter items	In the view-menu there are to options, to show all items or only the available items for sending.
11.	Exit	Master will disappear and the menu will come back

8.1.5. Monitor

The monitor window will appear this contain to parts one for the master message and one for the slave, both contain the same things. Room for a timing-graphic that shows the timings of the messages and indicator of the maximum and minimum time and a button to reset these. Beneath them is a table for the received message from the master or slave. The monitor can only monitor OpenTherm/plus.

Actions:

1.	New	Clears the tables and statistics
2.	Open	Opens a file with saved monitored messages from a previous time
3.	Save	Save the current monitored message to a log-file, so you can later open it again for continuing or analysis.
4.	Print	Prints a list of the monitored message, slave and master message are placed in order of receiving, same as in mixed mode.
5.	Start	Starts the monitor
6.	Stop	Stop the monitor
7.	Stream	Streams the received message immediately to a log-file
8.	view mode	In the view menu there are to options view message split up (default) or mixed. In mixed mode all message are displayed in one table in order of receiving.
9.	Exit	Closes the monitor and the menu will come back

8.1.6. Test slave lite

The Master lite will appear on the screen. There are two items time low and time high these controls the setpoint of the master, displayed in the gauge. 'Boiler lock-out fault' displays the current state of the boiler when there is a check in the checkbox the boiler has a 'Boiler lock-out'.

8.1.7. Test master lite

The Slave lite window will appear. Only control is the 'Boiler lock-out fault', this simulates the a boiler fault. The indicators below give the high and low time of the signal generated by the tested master, the gauge indicates the setpoint.

8.2.   OT Monitor

8.2.1. Power indication

The power LED indicates the correct function of the OpenTherm monitor. When the power supply is switched on the LED is blinking rapidly during initialisation. After 30 seconds the blinking slows down, indicating normal operation.