ESYS CONTROLLER

S4965V3250

FUNCTIONAL DESCRIPTION

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$URL::
https://acssvn.honeywell.com/ECC/CombustionEMEA/Root/Projects/P13xxxx/P130015/HW/P
roductionFunctionalDescription/S4965V3250E20.doc                                $
$Revision:: 84776                                                               $
$Author:: Mariscak, Igor                                                        $
$Id:: S4965V3250E20.doc 84776 2016-08-05 11:03:03Z Mariscak, Igor               $
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First issue.	I.Mariscak	0131527	27-Jun-2016	A
SW update and add parameter into list ModBus communication.	I.Mariscak		03-Aug-2016	B

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1. Software revisions

Software	Description	Date	Description of amendments	CRC
32320902-001	C0.01_P0.02_E0.01	09-Jun-2016	Modbus protocol is used instead of MicroCom, possibility to set CH HD and power fan speed via communication.	659B
32320902-002	C0.02_P0.02_E0.02	19-Jul-2016	Fixed bug related to Modbus command for production testing “Control input”.	6259
32320902-003	C0.03_P0.02_E0.03	03-Aug-2016	Mix up "APS switching time" and "APS configuration", add correct parameter.	B21A

2. Reference standards and Approvals

2.1 - Standards

ESYS boiler controller meets the requirements laid down in standards-documents:

- **EN 298:2012**
  Automatic gas burner control systems for gas burners and gas burning appliances with or without fans;

- **EN 55014-1**
  Electromagnetic compatibility - Emissions;

- **EN 60730-1**
  Automatic electric controls for household and similar use;

- Regarding electric safety, the ESYS S4965 can be used in appliances according to European Standards for household electrical requirements **EN 60335** series.

2.2 - Approvals

The boiler control conforms to the following EC - Directives:
- Gas Appliance Directive 2009/142/EC;
- Low Voltage Directive 2014/35/EU;
- Electro Magnetic Compatibility Directive* 2014/30/EU.

* Conformity with Electro Magnetic Compatibility Directive regarding emission for non industrial appliances can be assumed for all selected Ordering Specification (O.S.) numbers.
EMC emission requirements shall be tested after the incorporation of the burner control system into the equipment.
However conformity can only be declared as part of the appliance.
Regarding immunity, all controls comply with the levels for non industrial appliances.

3. Quality assurance statement

Products are manufactured under an ISO 9001 based and certified Quality System.
The quality system is described in the Honeywell Combustion Controls Center Quality Assurance Program and its related operational procedures and instructions.

The quality organization is responsible for defining, maintaining, improving and verification of the quality systems in the field of design, production process and field quality service.

Assembly processes are guided by work instructions.

Patrol inspections form part of the assembly processes.

Assembly inspection is performed by employees of the quality control department, using their own authorized equipment.
All inspections (incoming and assembly) are performed by trained personnel and according inspection procedures.

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4. Identification

To ensure product tracking and identification:
On housing label is:

- Bar code (or 2D code) label with production data
- CE-0063BR1922 printed on the label;
- Customer code (if requested)

And each board shows:

- Paper label with firmware version, type and model burner control, programming batch, production date.
- Laser 2D code label with production data
- Customer code (if requested)

Honeywell part number	Customer part number	Notes
S4965V3250	–	–

5. Product description

5.1 - General

Controller ESYS S4965V3250 is intended to be used for industrial DC-fan applications. It is made for fan assisted, direct burner ignition applications. The ESYS controller operates on 230 Volts, 50-60 Hz and can drive a gas valve and a DC-fan with PWM control input.

The High Limit protection protects the ESYS from overheating the application and is based on a low voltage switch input (normally closed).

The controller can operate in normal heating mode or in Test Mode:

- normal heat demand can be generated by a 230V switch input or is given by special command using external communication port of the ESYS by the appropriate software
- special Test Mode is initiated through external communication port, too

The S4965V3250 burner control operates in conjunction with VK41xxFxxxx or VK41Vxxxxx 1 to 1 premix gas control.

5.2 - Layout

Component side view

Overall dimensions	113 x 100 mm
Board thickness	1,6 mm
Fixing points	n° 3 holes Ø 3 mm
Tolerances	according to STP0015
Protection degree	IP40

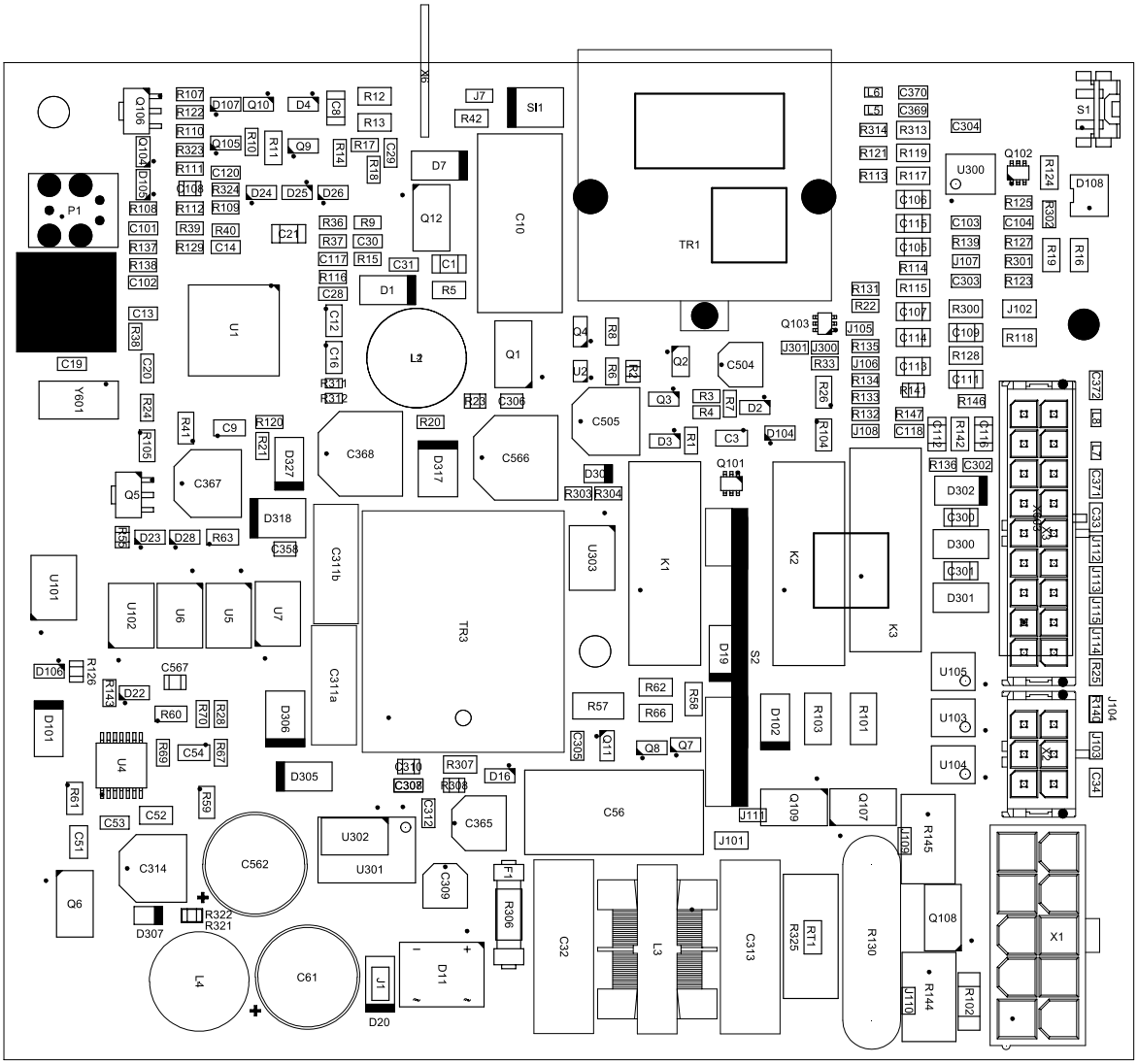

Fig. 1 - Component side view.

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5.3 - Technical features

5.3.1 - Connector and connections

In the diagram below the connection diagram is shown. The Minifit connector contains the high voltage (230 VAC) connections, and the Microfit connectors contain the safety extra low voltage connections.

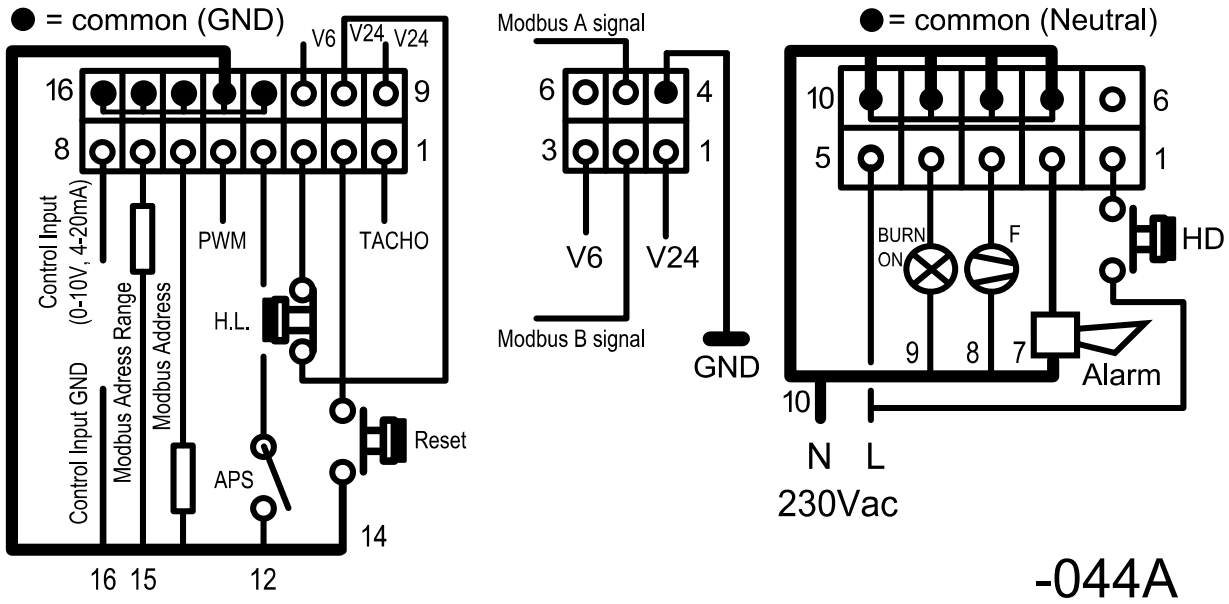

Fig. 2 - Connection diagram.

5.3.1 - Remarks

- If a new heat demand arise during Post purge time, this phase would be interrupted and heat demand is served.

- Earth must be connected to the valve, NOT to signal ground on X3.
- Following notes need to be considered:
  - HL have to be connected to 24V (X3 Pin 10);
  - Pin 9 is no more a GND connection, but 24V;
  - Pin 11 is no more 11 V, but 6V.

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When an EBM fan with 3 wire interface (230 VAC) is being used, an external pull up resistor **MUST** be used.
The connection and value of the pull up resistor is shown on below picture:

- The pull up voltage **MUST** be taken from the ESYS control;
- Resistors must be mounted externally by OEM/Installer;
- No lower resistance values are allowed.

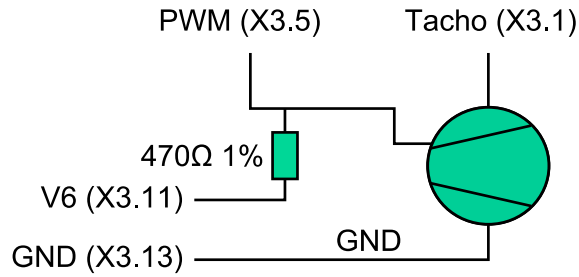
Fan Interface	230VAC DC Fan
3 Wire	

Fig. 3 - PWM pull up connection.

Honeywell premix engine fan interface and EBM fan 4 wire interface (BG3612 – 230 VAC), do not need any external pull up resistor for PWM output signal.
Power supply (24V) for fan interface must be taken from ESYS control (X3 Pin 9).

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5.3.2 - High Voltage Connections

Connector name	Pin	Type of Connection	Description
HIGH VOLTAGE (230 VAC) CONNECTIONS			
X1	1	Molex Minifit	High Voltage Heat Demand
X1	2	Molex Minifit	Alarm output – Phase
X1	3	Molex Minifit	FAN output – Phase
X1	4	Molex Minifit	Burner On output – Phase
X1	5	Molex Minifit	Main Power Line – Phase
X1	6	Molex Minifit	Not used
X1	7	Molex Minifit	Alarm output – Neutral
X1	8	Molex Minifit	FAN output – Neutral
X1	9	Molex Minifit	Burner On output – Neutral
X1	10	Molex Minifit	Main Power Line – Neutral
SPARK IGNITION CONNECTION			
TR1		2.8x0.5mm faston	High voltage Transformer output
FLAME INPUT CONNECTION			
X6		4.8x0.8mm faston	Flame rod detection input
EARTH CONNECTION			

5.3.3 - Communication Connector

Connector name	Pin	Type of Connection	Description
X2	1	Molex Microfit	Modbus communication – 24V
X2	2	Molex Microfit	Modbus communication – B signal
X2	3	Molex Microfit	Modbus communication – 6V
X2	4	Molex Microfit	Modbus communication – ground
X2	5	Molex Microfit	Modbus communication – A signal
X2	6	Molex Microfit	Modbus communication – input (optional)

NOTE: While Modbus Address and Modbus Address Range inputs are opened, device address is set to 1
NOTE: Modbus Communication format 19200 Baud, 8 bits, even parity, 1 stop bit

5.3.4 - Low Voltage Connections

Connector name	Pin	Type of Connection	Description
X3	1	Molex Microfit	Tacho input signal from FAN
X3	2	Molex Microfit	External Reset switch input
X3	3	Molex Microfit	High Limit switch input – HL
X3	4	Molex Microfit	Air Pressure Switch input – APS
X3	5	Molex Microfit	PWM output signal to FAN
X3	6	Molex Microfit	Modbus Address input
X3	7	Molex Microfit	Modbus Address Range input
X3	8	Molex Microfit	Control Input (0-10V, 4-20mA)
X3	9	Molex Microfit	Supply (24V)
X3	10	Molex Microfit	High Limit switch – supply (24V)
X3	11	Molex Microfit	Supply (6V)
X3	12	Molex Microfit	GND – Air Pressure Switch
X3	13	Molex Microfit	GND
X3	14	Molex Microfit	GND – External Reset switch
X3	15	Molex Microfit	GND – Modbus Address & Modbus Address Range
X3	16	Molex Microfit	GND – Control Input

5.3.5 - Specification

Nominal data	Value
Supply voltage	230 VAC +10%, -15%, 47 – 65 Hz
Power consumption	2,5 VA
Humidity	90% RH max at 40°C (no condensing)
Ambient temperature	-20°C – +60°C

Communication	Value
Modbus interface	standard RS485 non insulated (2 wires + GND)
Communication system	Half duplex, asynchronous
Bit rate	19200 Baud
Byte format	1 start, 8 data, 1 stop, even parity
Mode	RTU transmission mode

Electrical rating	Value
Fusing	Ext. fuse 2A slow sand filled
Fan relay output	230 VAC, 0,8 A max, cos φ = 0,6
Burner On relay output	230 VAC, 0,8 A max, cos φ = 0,6
Alarm output	230 VAC, 0,4 A max, cos φ = 0,6
Gas valve output	230 Vrac, 50 mA
High Limit switch input	24 VDC (22 kΩ)
Control Input	0-10 VDC voltage input, 4-20 mA current input
Adress Inputs	10 kΩ NTC linear
Communication cable	max. length: 1200 m, type: J-Y(St)Y 2x2x0,8
Length of wiring for external component	1,0 m max

Ignition	Value
Spark voltage	18 kV
Spark frequency	21,3 Hz +/- 5%
Spark pulse energy	15 µAs
Spark to	ground

Timings	Value
Pre purge/waiting time	10 s (adjustable)
Pre ignition time	2,9 s
Safety time	5 s
Number of ignition trials	3
Flame failure response time	1 s
Stabilization time	10 s (adjustable)
Post purge time	10 s (adjustable)
Pump over run time	-
Anti cycling time	-

Flame sensing	Value
Flame and sparking rod	separate
Flame current (factory parameter setting)	minimum 0,8 µA
Length flame sensing / spark cable	0,5 m max

Product life	Value
For safety and main operator gas valve	500.000 cycles
At rated loads	250.000 cycles
Operations with rated loads	6.000 lock-out

5.4 - Timing diagram

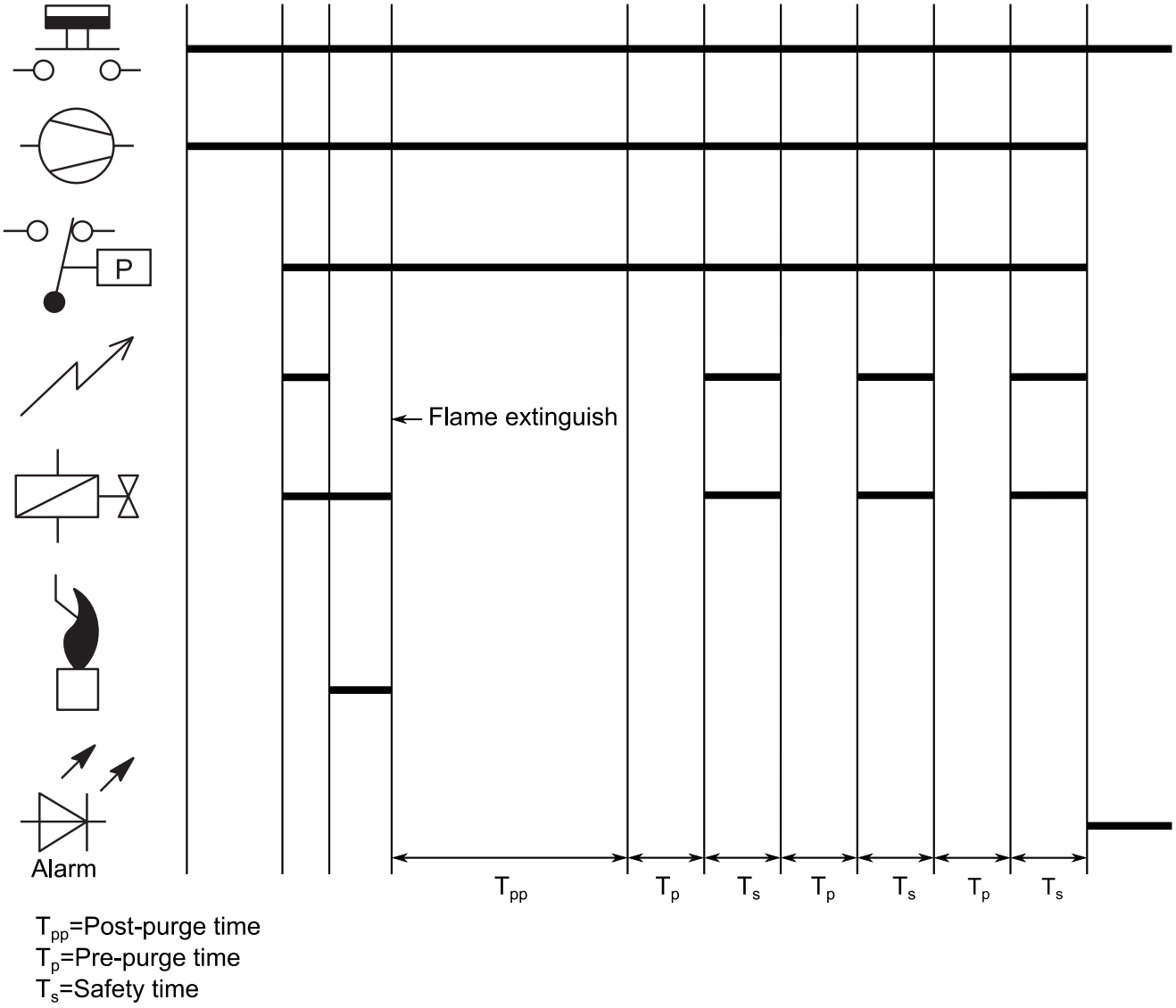

Fig. 4 - Timing diagram.

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5.5 - Recommended peripheral devices

Recommended valve: gas/air 1:1 VK41xxFxxxx or VK41Vxxxxx

Recommended display: N/A

5.6 - System Parameters list (default settings)

The controller has safety parameters and functional parameters:

- The safety parameters cannot be changed by the OEM or end user. They are programmed during the production of the board.

The functional parameters have a predefined value, but can be changed during a later stage. The parameters are stored in EEPROM. They are not intended for daily changes as the limit for the write is 100 000 cycles. If the parameter needs to be changed on daily base it has to be stored in volatile memory.

All the parameters can be accessed with a communication package running on the PC. Some parameters are available by the installer TSP mode on the MMI.

Num.	Description	Unit	Low limit	High limit	Default Value	ID (decimal)
1	Fan Kp up factor, Proportional Gain		0	127	45	1287
2	Fan Ki up factor, Integral Gain		0	255	245	1288
3	Fan Kp down factor, Proportional Gain		0	127	30	1289
4	Fan Ki down factor, Integral Gain		0	255	248	1290
5	Absolute Maximum Fan speed	*50 RPM	6	255	116	1296
6	Absolute Minimum Fan speed	*50 RPM	6	255	30	1297
7	Ignition Fan speed	%	0	100	50	514
8	Continuous Fan speed	*50 RPM	(Abs.Min)	(Abs.Max)	33	1298
9	Slope Control	*50 RPM/sec	0	255	0	1299
10	Pre-purge time	HB:min / LB:sec	0 / 0	255 / 60	0 / 10	1293
11	Post-purge time	HB:min / LB:sec	0 / 0	255 / 60	0 / 10	1294
12	Stabilization time	LB:sec	0	255	10	1295
13	Fan configuration Value: 0 – Continuous: Off – Control type: Modulation – Modulation: 0..10 V Value: 1 – Continuous: On – Control type: Modulation – Modulation: 0..10 V Value: 2 – Continuous: Off – Control type: On/Off – Modulation: N/A Value: 3 – Continuous: On – Control type: On/Off – Modulation: N/A Value: 4 – Continuous: Off – Control type: Modulation – Modulation: 4..20 mA Value: 5 – Continuous: On – Control type: Modulation – Modulation: 4..20 mA		0	255	2	1300
14	APS configuration Value: 0 – APS test: Off – APS test during modulation: - Value: 8 – APS test: On – APS test during modulation: Not checked Value: 24 – APS test: On – APS test during modulation: Checked		0	255	0	1301
15	APS switching time	LB:sec	1	50	50	1302
~~15~~16	Suspend mode		0	255	0	515

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5.7 - Sensors and Actuators

5.7.1 - Safety Cut-off switch (High Limit)

The safety cut-off switch (also called High Limit switch) prevents the system from being damaged by overheat.

- This switch is in fact the last stop to the ignition control if the appliance is overheating itself. Overheating can be caused for example by a bad connected temperature sensor or a low water situation.
- This switch is normally closed and opens only if the overheat condition occurs. The controller reads continuously the status of the switch and immediately activates the lockout state if the switch opens due to whatever reason.

A manual action is required to release the controller from the lockout state. This can be done by the on board reset knob or external reset button or by the Modbus communication message.

5.7.2 - External reset input

Once a non-volatile lockout occurs, reset can be performed (with max.5 reset in the last hour) by using a remote switch.

5.7.3 - On board alarm LED

The on board alarm LED is used to indicate an Error/Fault condition state:

- If there is a blocking error, LED is lighted blinking (1s period).
- If the boiler is in any lockout error, LED is on.
- Otherwise, no error in the system, LED is off.

5.7.4 - On board reset knob

The on board Reset Knob - button can be used to reset the lockout error. There is no limitation in term of lockout resets made by this button.

5.7.5 - Gas Valve

The gas valve which must be connected to the Basic ESYS controller is a CVI-m valve. An example of such a valve is the VK41xxFxxxx or VK41Vxxxxx. There are many other valves which can work together with this ESYS. For more information about gas valves, please contact the appropriate department or your local Honeywell affiliate.

5.7.6 - Alarm output

Alarm output is set whenever a lockout or blocking condition occurs.
The electrical specification for the Alarm output is described in the table below.

Voltage	Current	Special
230 V AC	0.4 A	Cos φ >= 0.6

5.7.7 - Burner On output

Burner On output indicate whenever the boiler is running (gas valve is opened previously, flame read and validated successfully). The electrical specification for the Burner On output is described in the table below.

Voltage	Current	Special
230 V AC	0.8 A	Cos φ >= 0.6

6. Modes of operation

The controller has a number of basic modes of operation (from lowest to highest priority):

- STAND-BY, when there is no heat demand or error present;
- HEATING MODE, when high voltage heat demand input is closed;
- Modbus HD MODE, when external command heat demand is received;
- TEST MODE, when external Test Mode heat demand is given;
- ERROR/FAULT conditions like over temperature conditions, etc.

6.1 - Start Up

After Power On, or manual reset the controller will perform check on safety features (during start-up routines) or 12/24 hours check (not a complete start up routine) depends on whether a heat demand is present:

- When no heat demand is present the control will perform a reset 12 hours after the last one;
- When a heat demand is present, the control will wait until a maximum of 24 hours to perform the reset.

6.2 - Stand-by

In Stand-by mode igniter is off, gas valve is closed and fan is off if fan overrun time is finished and Continuous Fan option is switched off.

6.3 - Heating Mode

The Normal Heating mode is started when the High Voltage Heat Demand input is closed. When ignition is successful, the fan can be controlled in a number of ways depending on parameter setting:

- **0-10 V control**, a DC voltage between zero and ten volts can be applied to connector X3, pins 8 & 16.
  At zero volt the Fan will run on minimum fan speed. At ten volt the Fan will run on maximum fan speed.
- **4-20 mA control**, with an external resistor of 500 Ω 1 % placed between connector X3 pins 8 & 16, the fan speed can be controlled with a current in the range of 4 to 20 mA.
  At 4 mA the Fan will run on minimum fan speed. At 20 mA the Fan will run at maximum fan speed.
- **On/Off control**, when the option On/Off control is selected, the fan speed depends on the fan slope control parameter. When slope control is off (parameter set to zero), the fan speed will immediately go to maximum. Otherwise the fan speed will rise from ignition fan speed to maximum fan speed with (value)*50 RPM/sec.

6.4 - Modbus HD Mode

The heating mode is started immediately when a special command receives by external communication.

Name	Function (hex)	ID (decimal)	Value (hex)		Notes
			High byte	Low byte	
Modbus HD Mode	0x06	512	Not used	0xCC	Heat demand: ON
				0x00	Heat demand: OFF
Power control	0x06	513	Not used	0x00-0x64	Fan speed

The Low byte ***0xCC*** of first message represents this command and second message Low byte defines the power level.
The fan can be controlled between minimum and maximum fan speed by setting a between 0 and 100 % (hexadecimal representation 0x00 – 0x64).
The messages should be repeated at least every 30 seconds to signify none break the burning process. Others way the Modbus HD is stopped.

After the Normal Heating Mode or the Modbus HD Mode is served, post ventilation is performed, based on parameters value fan speed and time duration. If speed is setup to zero and timer extends none zero value it's used last rate of fan rotation in this phase.

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6.5 - Test Mode

The Test Mode can be used to manually control the fan speed of the burner generated through the external communication port. If message is not received in 30 seconds again the Test Mode is cancelled.

Name	Function (hex)	ID (decimal)	Value (hex)		Notes
			High byte	Low byte	
Test Mode heat demand	0x06	512	Not used	0xFF	Test demand: ON
				0x00	Test demand: OFF
Power control	0x06	513	Not used	0 – 100 %	Fan speed

The fan speed can be controlled between minimum and maximum fan speed by setting a test level between 0 and 100 %. When ignition is successful, the fan speed will go to the selected fan speed level according to the following formula:

*minimum fan speed + ((maximum fan speed-minimum fan speed)*test mode level)/100*

6.6 - APS (Air Pressure Switch) function

If the APS is configured by adjusting parameter the ignition is not started until the APS switch has performed an open and close sequence. Also the APS check during modulation can be controlled. Please find in the system parameters table the proper options and descriptions.

Function	Description
No APS	The ignition is started without checking the APS status.
APS	Before the ignition is started the APS must have had first open (during fan off) and then close (during fan on) status.
APS mod. Check (only enabled if APS function is enabled)	The APS is also checked during modulation. If the APS switches off a restart is performed.
No APS mod. Check (only enabled if APS function is enabled)	The APS is not checked during modulation. If the APS switches off nothing will happen, the control remains modulating. At the next heat demand, the APS is checked again.

With the APS switching time parameter the maximum time can be set on which the control may wait until the APS opens or closes. If the expected state of the APS is not fulfilled within this time, a lockout error will be set and a reset is required.

The error code for all APS related errors is ‘Error 4’.

NOTE: If the APS is not configured in the software, but an APS switch is connected to the ESYS and this is closed or closing during operation ‘Error 4’ is also triggered.

6.7 - Fan Speed Control

The following flowchart shows how the fan speed is controlled during a complete burner sequence. The basic states are:

- Stand-by, fan is off or at Continuous fan speed when this option is selected;
- Prepurge;
- Ignition;
- Run state, fan speed is controlled by modulation input, on/off control or test mode fan speed;
- Postpurge.

The desired fan speed in Continuous and Ignition mode can be independently programmed.

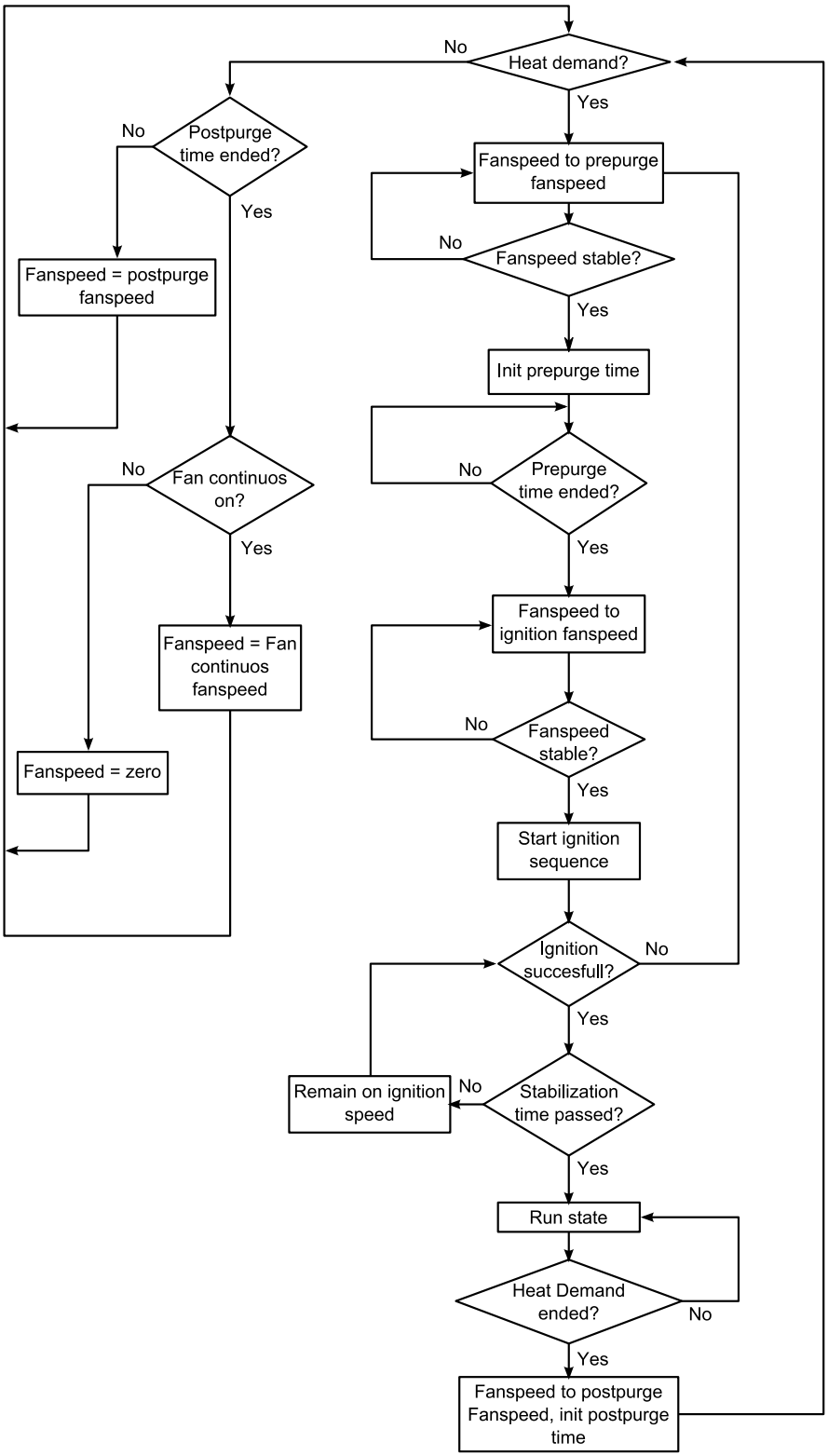

Fig. 5 - Fan Speed control.

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6.8 - Protection and error conditions

Several checks are included to protect the boiler and its environment. High Limit switch is constantly monitored, safety times are constantly compared etc.
Any violation of (programmable) limits (and/or internal thermostat functions) will lead to an error/fault or warning condition. Severe error will cause a lockout condition which can only be cleared by the reset key on the controller itself. Blocking error will be resolved automatically if the cause of the error disappeared.

In case of lockout and blocking conditions, Fan will not operate.

Error codes can be divided in 2 groups:

- Lock-out condition codes;
- Blocking condition codes.

Complete list of errors of the controller is given as following table:

Error Code	Description
LOCK-OUT	
1	Flame lockout after ignition trials
2	False Flame indication
3	High Limit error
4	APS related errors
5	Fan Tacho signal error
8	Flame circuit error
9	Gas valve drive circuit error
13	Remote reset lockout (volatile)
21	ADC error
25	CRC error
BLOCKING	
26	Reset Knob error
34	Low supply voltage error

The meaning / explanation of the error numbers is as following:

Lock-out condition codes:

FAULT 1 = Lockout signal after no flame and all ignition trials are expired. This error condition is stopping the boiler and to get to the normal operation again, manual/remote reset is required. By using the local reset key, number of resets are not limited. However all remote resets (communication) are limited to 5 resets per hour.

FAULT 2 = False Flame indication – error is created if flame current is detected in illegal situations (no heat demand currently present, gas valve closed, safety time passed). This error condition also requires manual reset action.

FAULT 3 = High Limit error – if the safety cut-off switch opens due to an overheat situation in the application, High Limit error will be generated.

FAULT 4 = APS related errors - if the APS is configured and the APS does not open or close within the configured time limits Error 4 is generated. If the APS is not configured but an APS switch is detected on the input Error 4 is also generated.

FAULT 5 = Fan Tacho signal error - if the measured fan speed is not within 900 RPM of the requested fan speed in 20 seconds, error will be generated.

FAULT 8 = Flame circuit error – during normal operation of the ignition controller, flame circuit is regularly checked. This check has predictable behavior and several steps. If check fails, error will be set.

FAULT 9 = Gas valve drive circuit error – during normal operation of the ignition controller, valve drive circuit is regularly checked. This check has predictable behavior and several steps. If check fails, error will be set.

FAULT 13 = All remote resets (communication) – the number limited to 5 of remote resets in an hour is more than allowed. Volatile lockout error is set; the error disappears after power off/on the boiler.

FAULT 21 = ADC error – internal controller error.

FAULT 25 = CRC error – matching error on CRC codes (different software versions).

Blocking condition codes:

The boiler controller recognizes also the fault situations that can block the heat demands but do not lead to lockout condition. When the error condition becomes resolved, error will disappear but will be also written into the history data.

FAULT 26 = Reset Knob error – if the button is switched on for more than 10 seconds, error is set till the Reset Knob will be released.

FAULT 34 = Low Mains voltage (less than 150 +/- 10 VAC) will trigger this error. When Mains brought back (164-176 VAC), error is resolved in 10 seconds.

6.6 - Ignition sequence

In case of valid heat demand request, ignition sequence will be started. In case of failed ignition, controller will try to re-ignite for number of times. If no successful ignition after programmed number of retrials, flame lockout error will be indicated. The number of ignition attempt is defined, also equal after a reset of the burner control.

7. Control Panel for ESYS

This version of ESYS doesn't have its own Control Panel tool.

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8. History information

The controller board has a possibility to register fault codes and to write some additional history information in non-volatile memory:

1. Error codes (buffer of the 8 last errors). Every error code has it's time information (coupled with total hours);
2. Total number of burner switching (successfully finished burner sequence with flame on);
3. Total number of lockouts;
4. Number of burner "on" hours;
5. Total number of hours with power supply on.

The history information can be accessed via external communication port.

9. Other documentation

This chapter contains references for further documentation of the ESYS and the CVI valves which can be used in combination with the ESYS.

Title	Reference
Product Handbook ESYS	EN2R9071
Product Handbook Valves	EN2R9025
Terms used in Honeywell product handbooks	EN2R9039

10. Installation

10.1 - General remarks

- Read the instructions before use.
- This control shall be installed in accordance with the rules in force.
- After installation, ensure total protection equal to at least IP40 level as specified in EN60730-1 (cable bunch is sealed by a proper grommet).
- A high environment temperature affects the operational life of the product. Fit the board in a position with minimum environmental temperature and expose to as little radiation as possible.
- The board does not contain repairable parts. Repair affects device safety and is not permitted.
- The connected devices must display appropriate electrical properties for the loads controlled by the board.
- If an automatic reset safety thermostat is connected in line with the gas valve operators, the reset timer of this device must be greater than the time taken by the burner control to perform a new ignition attempt. This is to ensure that a non-volatile lockout does not take place if the thermostat cuts-in.
- In the event of shutdown with a consequent situation of non-volatile lockout of the burner control, wait at least five seconds before resetting the system.
- To ensure reliable long term operation, mount the boiler control at a position in the appliance with a low ambient temperature and a low radiation.
- The boiler control should be externally fused.
- High temperatures will affect product life.

NOTE 1: When first starting the boiler control has a self check time of about 10 seconds.
NOTE 2: Electrical rating of connected controls should be appropriate for the load that is switched by the boiler control.
NOTE 3: Disconnect the boiler control from mains before performing a dielectric strength test.
NOTE 4: When first starting, the control can be in the lockout condition; reset the boiler control.
NOTE 5: The flame connection pin of all types is **not** protected against electrical shock.
NOTE 6: An automatic return high limit thermostat can be used. Gold contacts for high limit thermostat are required.
NOTE 7: Remote reset function may only be used in applications where a maximum of five resets per 15 minutes is allowed.

WARNING

Honeywell is not responsible for damage and/or injury due to miss-wiring.
After installation boiler control can become wet due to condensation. **Do not connect wet device to mains**.

10.2 - Electrical connection

The device must always be connected with the power turned off.
The device must be connected in accordance with current legislation.
The device manufacturer's instructions (for boiler, etc.) must always be followed.
Check that the type, times and code are always as specified before installing or replacing the device.
Ensure that the combustion chamber is free of gas before turning on the device.
Ensure effective connection between the device earth terminal, the metal burner case and the electrical equipment protective earth.
Carry out a complete final check when the installation is complete.

WARNING

Take care that installer is a trained experienced service person.
Disconnect power supply to prevent electrical shock and/or equipment damage.

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IMPORTANT

Wiring must be in accordance with local regulations.
The appliance manufacturer's instructions should always be followed when provided. If such instructions are not provided see the connection diagrams for typical systems.
Before installing or replacing any control check that type number is correct for the application.
Ensure combustion chamber is free of gas before start up.
Conduct a thorough check out when installation is completed.
At the first start the boiler control can be in lock-out; depress reset button to free control.

CAUTION

Do not connect the boiler control to power supply when it is not connected to the gas control.

Wiring

- Use lead wire which can withstand at least 105 °C ambient.
- Use lead wire which is proven against moisture.
- Wiring between boiler control and spark sensing probe should have good quality insulation, suitable for the temperatures encountered.
- Gas valve should be connected to protective earth.

Fusing

Ext. fuse 2A slow sand filled.

Spark gap

Max. allowable spark gap 3.5 mm (recommended 3 mm.)

10.3 - Cables and wirings

- Respect maximum connection cables length requirements.
- Use connection cables with appropriate insulation, working temperatures and moisture resistance.
- Plan separate routes for cables that connect loads at low voltage (SELV) and loads at mains voltage (HT). Avoid connecting high and low voltage cables together.
- The ignition cable must be laid so that it is separate from all the other connection cables. Use short connections to minimize the emission of electromagnetic interference.
- The flame sensor/ignition output is not protected against the danger of electric shocks. The connection cable and flame sensor must both be protected against direct contact.
- Do not use multiple cables to connect more than one external device using a single cable. The use of a multiple cable to attach several external devices supplied with high and low voltage is expressly prohibited.
- The flame control earth terminal and/or the earth lead of the second spark generator output must be connected to the metal earth of the burner by the shortest route and the path must be different from that followed by the other wiring.

10.4 - Ionization current check

- The current value must be greater than the specified minimum.
- If the ionization current is too low, check that the electrode is fully immersed in the flame and that the burner and the flame control are properly connected to the protection earth.

10.5 - Adjustments and final checkout

WARNING

Adjustments must be made by qualified persons only.
If the appliance manufacturer supplies checkout and/ or service and maintenance instructions carefully follow them.
If these instructions are not provided then use the procedure outlined below.

Checking flame current

- The minimum value should be in accordance with specified value.
- To check flame current connect a DC micro-Ampere meter between flame sensing wire and flame sensing rod. Short micro-Ampere meter during ignition to prevent damage of the micro-Ampere meter in single rod applications.
- Meter connections polluted with e.g. alkaline substances lying close to earth can cause flame current simulation. Make sure no false flame current can flow from meter connections to earth.
- As in normal operation the flame current is measured during 50 % of the time, the read out value is half of the real value. The read out value has to be multiplied by 2 to get the real value.
- If flame current is insufficient check that the flame sensing rod is fully enveloped by the flame and that the burner and the boiler control are reliable grounded.

Final checkout

After installation and any adjustment start the appliance and observe a complete cycle to ensure that all burner components function correctly.

Maintenance and service

Under normal circumstances, no maintenance or service is required.

10.6 - EMC guidelines

- The position of the ignition cable has to be determined for lowest emission. In general conduct ignition cable along metal pipes or shield metal for lowest loop area
- Do not lead ignition cable close to other cabling.
- To suppress Radio Frequency Interference (RFI) the boiler control including spark ignition cable should be mounted in sufficient shielded environment.
- High frequency radiated emission can be reduced by a 1k spark ignition plug.
- Do not lead flame cable close to other cabling.
- Do not lead DC fan commutation cable close to other cabling.
- Keep high voltage spark wire at least 10 cm away from other wires.

Modbus communication

The ESYS controller is a slave in the communication. The ESYS is tested for interconnection with MVC Building controller from Honeywell via C Bus interface. Maximum of 32 devices can be connected on the bus. It means one master (MVC) and up to 31 ESYS controllers.

Modbus address selection

Modbus slave address can be selected by set of resistors or by a parameter in EEPROM.

- If the parameter in EEPROM is set to 0 then address is determined by the resistors value as written below.
- If not, the address from EEEPROM is used.

Adress selected via resistors

The address range from 1 to 247 is supported and can be assigned to the controller. The controller address is defined by a combination of external resistors connected to low voltage inputs on connector X3.

- Modbus Address input (X3 PIN6):
  - The input defines the “base” address (0 - 15)
- Modbus Address Range input (X3 PIN7):
  - The input defines the “offset” of the base address (0 - 15)

The formula to get the final slave address is:

Modbus slave address = Modbus base address + Modbus address offset x 16

If calculated address is 0, the address 1 is set. If calculated address is higher than 247, the address 247 is set.
The resistor table for proper address selection is here:

Address base / offset	Resistor value [Ω]
0	< 620
1	1 300
2	2 200
3	3 300
4	4 300
5	5 600
6	7 500
7	9 100
8	12 000
9	15 000
10	20 000
11	27 000
12	36 000
13	51 000
14	91 000
15	240 000
0	> 560 000

For proper address selection the resistors from the E24 series with 5% or better tolerance are suitable.

Adress selected via EEPROM

The absolute slave address is saved in EEPROM (see Modbus Slave Address) and could be changed by High byte of message **ID 1537**. The effect for next communication with ESYS controller is available immediately after value written.

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Modbus communication format

Modbus communication format is selected by the value in EEPROM (see Modbus Communication Format). Actually the format realized via RS485 is implemented using High byte of message **ID 1536** in these ways only. The rest bits are reserved for future use.

Bit_1	Bit_0	Value	Speed	Format used
0	0	0x00	19200 bps	**8N1** = 8 data bits, no parity, 1 stop bit
0	1	0x01	19200 bps	**8N2** = 8 data bits, no parity, 2 stop bits
1	0	0x02	19200 bps	**8E1** = 8 data bits, even parity, 1 stop bit
1	1	0x03	19200 bps	**8N1** = 8 data bits, odd parity, 1 stop bit

Default communication format rate: *19200 Baud, 8E1 = 8 data bits, even parity, 1 stop bit*

Modbus supported commands

The Modbus implementation supports following commands:

- 0x03 = Read Holding Registers
- 0x04 = Read Input Registers
- 0x06 = Write Single Register
- 0x10 = Write Multiple Registers

Modbus available register map

Register ID	R/W	CMD	Name	Type	Range	Notes
0	R/-	0x04	HB: Esys flags	U8	0-255	Bit: description 0: CH Mode 2: Test Mode 3: Flame
			LB: Esys flags	U8	0-255	Bit: description 0: Fault/Error 3: APS 4: Fan
1	R/-	0x04	HB: Esys error flags	U8	0-255	Bit: description 0: Lockout error
			LB: Esys error code	U8	0-255	OEM specific error number
3	R/-	0x04	HB: Reserved			
			LB: Comfort state	U8	0-255	Esys comfort state: 0 = Wait for HD 1 = Test Init 2 = Test Run 5 = CH Init 6 = CH Run
[4]..[11]	R/-	0x04	HB: Reserved			
			LB: Error history 0..7	U8	0-255	OEM Specific error number
[13]..[20]	R/-	0x04	Error history time 0..7	U16	0-65535	History error time 0..7

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Register ID	R/W	CMD	Name	Type	Range	Notes
22	R/-	0x04	Burner cycles	U16	0-65535	Burner cycles count
23	R/-	0x04	Lockout errors	U16	0-65535	Count of Lockout errors
24	R/-	0x04	Burner running hours	U16	0-65535	Burner running total hours
25	R/-	0x04	Burner hours	U16	0-65535	Burner total hours
256	-/W	0x06	Reset status command	U16	0-65535	Write 0xAA55 to reset Lockout error
512	R/W	0x03 0x06 0x10	HB: Reserved			
			LB: Heat demand	U8	0-255	0x00 = No heat demand 0xCC = Heat demand 0xFF = Test demand
513	R/W	0x03 0x06 0x10	HB: Reserved			
			LB: Power control	U8	0-100	Fan speed
514	R/W	0x03 0x06	HB: Reserved			
			LB: Ignition Fan speed	U8	0-100	%
515	R/W	0x03 0x06	HB: Reserved			
			LB: Suspend mode	U8	0-255	0-254 = Off, 255 = On
774	R/-	0x04	Flame current [µA]	U16	0-65535	Flame current in value * 0,1 µA Example: 278 = 27,8 µA
1287	R/W	0x03 0x06	HB: Reserved			
			LB: Fan Kp up factor	U8	0-127	
1288	R/W	0x03 0x06	HB: Reserved			
			LB: Fan Ki up factor	U8	0-255	
1289	R/W	0x03 0x06	HB: Reserved			
			LB: Fan Kp down factor	U8	0-127	
1290	R/W	0x03 0x06	HB: Reserved			
			LB: Fan Ki down factor	U8	0-255	
1293	R/W	0x03 0x06	HB: Pre-purge time	U8	0-255	min [default: 0]
			LB: Pre-purge time	U8	0-60	sec [default: 10]
1294	R/W	0x03 0x06	HB: Post-purge time	U8	0-255	min [default: 0]
			LB: Post-purge time	U8	0-60	sec [default: 10]
1295	R/W	0x03 0x06	HB: Reserved			
			LB: Stabilization time	U8	0-255	sec [default: 10]

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Register ID	R/W	CMD	Name	Type	Range	Notes
1296	R/W	0x03 0x06	HB: Reserved			
			LB: Absolute Maximum Fan speed	U8	6-255	*50 RPM
1297	R/W	0x03 0x06	HB: Reserved			
			LB: Absolute Minimum Fan speed	U8	6-255	*50 RPM
1298	R/W	0x03 0x06	HB: Reserved			
			LB: Continuous Fan speed	U8	6-255	*50 RPM
1299	R/W	0x03 0x06	HB: Reserved			
			LB: Slope Control	U8	0-255	*50 RPM/sec
1300	R/W	0x03 0x06	HB: Reserved			
			LB: Fan configuration	U8	0-255	[default: 2]
1301	R/W	0x03 0x06	HB: Reserved			
			LB: APS configuration	U8	0-255	[default: 0]
1302	R/W	0x03 0x06	HB: Reserved			
			LB: APS switching time	U8	1-50	sec [default: 50]
1536	R/W	0x03 0x06 0x10	HB: Modbus Communication Format	U8	0-255	[default: 0x02]
			LB: Reserved			
1537	R/W	0x03 0x06 0x10	HB: Modbus Slave Address	U8	0-247	[default: 0x00]
			LB: Reserved			
2305	R/-	0x03	PLATFORM version	U16	0-65535	Esys Platform version
2306	R/-	0x03	CUSTOM version	U16	0-65535	Esys Custom version
2307	R/-	0x03	EEPROM version	U16	0-65535	Esys EEPROM version