

ESYS CONTROLLER

S4965A3025

FUNCTIONAL DESCRIPTION

```

$URL::
https://acssvn.honeywell.com/ECC/CombustionEMEA/Root/Projects/P13xxxx/P130015/HW/P
roductionFunctionalDescription/S4965A3025E20.doc
$Revision:: 77641
$Author:: Mariscak, Igor
$Id:: S4965A3025E20.doc 77641 2015-08-25 12:42:50Z Mariscak, Igor
    
```

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

Table of Contents

1. Software revisions 3

2. Reference standards and Approvals 4

 2.1 - Standards 4

 2.2 - Approvals 4

3. Quality assurance statement 5

4. Identification 6

5. Product description 7

 5.1 - General 7

 5.2 - Layout 8

 5.3 - Technical features 9

 5.3.1 - Connector and connections 9

 5.3.2 - High Voltage Connections 10

 5.3.3 - Communication Connector 10

 5.3.4 - Low Voltage Connections 11

 5.3.5 - Specification 11

 5.4 - Timing diagram 13

 5.5 - Recommended peripheral devices 14

 5.6 - Sensors and actuators 14

 5.6.1 - Safety Cut-off Switch 14

 5.6.2 - Alarm/Error Led 14

 5.6.3 - Error Output to Esys 2 14

 5.6.4 - Gas Valve 14

6. Modes of operation 15

 6.1 - Stand-by 15

 6.2 - Heat Demand 15

 6.3 - Protection and error conditions 15

 6.4 - Ignition sequence 16

7. Control Panel for ESYS 17

8. History information 18

9. Other documentation 19

10. Installation 20

 10.1 - General remarks 20

 10.2 - Electrical connection 20

 10.3 - Cables and wirings 21

 10.4 - Ionization current check 21

 10.5 - Adjustments and final checkout 22

 10.6 - EMC guidelines 22

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

Heating & Cooling Appliance Controls

Title: Functional description S4965A3025

Doc.: S4965A3025E20

1. Software revisions

Software	Description	Date	Description of amendments	CRC
45007997-005 45007998-005	C0.05_P0.19 E0.05	03-Nov-2011		78FE
45007997-006 45007998-006	C0.06_P2.19 E0.06	03-Oct-2014	Platform update: -repaired exceeded safety time + flame-off time -repaired error E08 -repaired error E21 (band gap shift)	4931
45007997-009 45007998-009	C0.09_P2.19 E0.09	06-Mar-2015	Added custom: -postpurge time class 5, 0x0CC1, default 0 Changed possibility postpurge break at HD. Revised timing spark time, safety time, flame failure response time.	E9BD

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

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 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 2006/95/EC;
- Electro Magnetic Compatibility Directive 2004/108/EC*.

* Conformity with Electro Magnetic Compatibility Directive regarding emission for non industrial appliances can be assumed for all selected Ordering Specification (O.S.) numbers.

However conformity can only be declared as part of the appliance.

Regarding immunity, all controls comply with the levels for non industrial appliances.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

3. Quality assurance statement

Products are manufactured under an ISO 9001:2008 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 system is approved by SAI GLOBAL against certificate number CERT-0077998.

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.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

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
S4965A3025	-	-

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

5. Product description

5.1 - General

Controller S4965A3025 is intended to be used for ON/OFF applications. It is made for direct burner ignition applications. The controller can drive a gas valve. High Limit switch ensures additional safety level. A Heat Demand (HD) can be generated by the high voltage or low voltage switches. A special test mode heat demand can be controlled through the communication port of the ESYS and the appropriate software or through the MMI.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

Heating & Cooling Appliance Controls

Title: Functional description S4965A3025

Doc.: S4965A3025E20

5.2 - Layout

Component side view

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

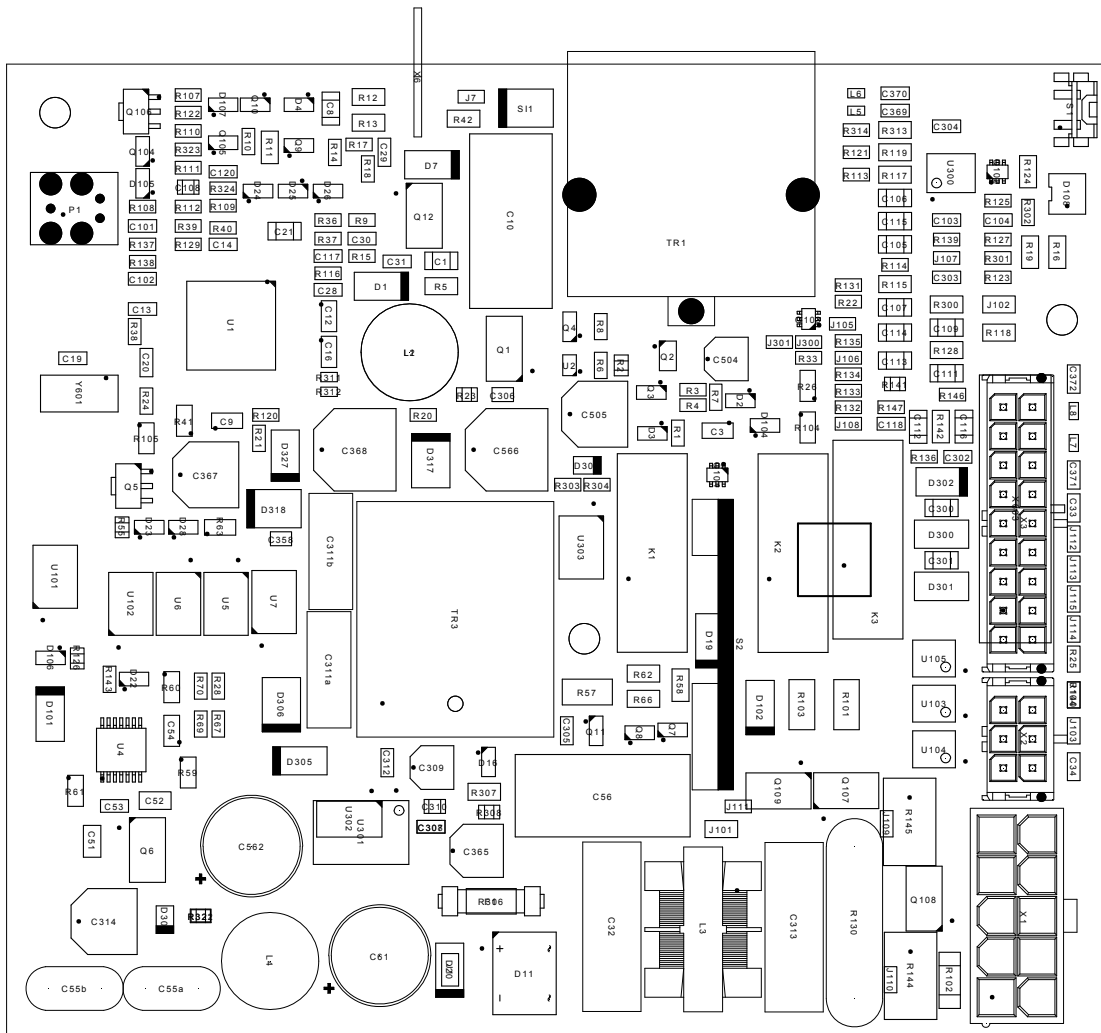


Fig. 1 - Component side view.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

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.

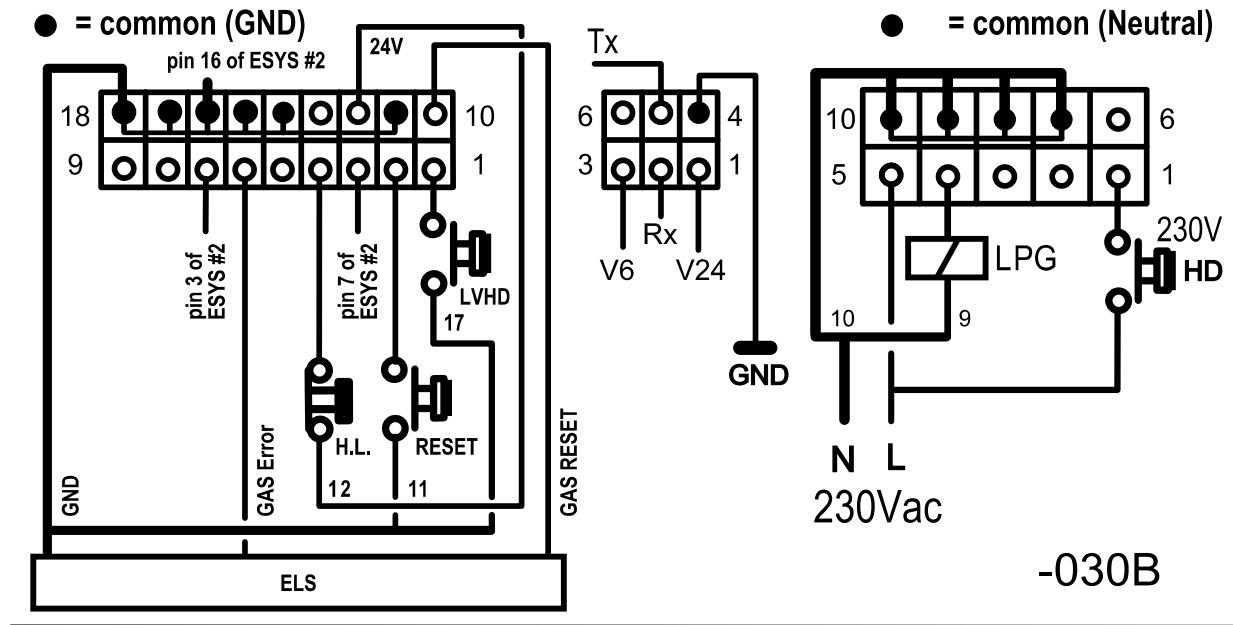


Fig. 2 - Connection diagram.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

Heating & Cooling Appliance Controls

Title: Functional description S4965A3025

Doc.: S4965A3025E20

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	Not used
X1	3	Molex Minifit	Not used
X1	4	Molex Minifit	LPG output – Phase
X1	5	Molex Minifit	Main Power Line – Phase
X1	6	Molex Minifit	Not used
X1	7	Molex Minifit	Neutral
X1	8	Molex Minifit	Neutral
X1	9	Molex Minifit	LPG 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	MicroCom connection – 24V
X2	2	Molex Microfit	MicroCom connection – Rx
X2	3	Molex Microfit	MicroCom connection – 6V
X2	4	Molex Microfit	MicroCom connection – ground
X2	5	Molex Microfit	MicroCom connection – Tx
X2	6	Molex Microfit	MicroCom connection – input

NOTE: UART Connection 2400 or 19200 Baud, 8 bits, no parity, 1 stop bit

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

Heating & Cooling Appliance Controls

Title: Functional description S4965A3025

Doc.: S4965A3025E20

5.3.4 - Low Voltage Connections

Connector name	Pin	Type of Connection	Description
X3	1	Molex Microfit	Heat Demand (LV) switch input
X3	2	Molex Microfit	External Reset switch input
X3	3	Molex Microfit	Error Output (to Esys 2)
X3	4	Molex Microfit	High Limit switch input
X3	5	Molex Microfit	NC
X3	6	Molex Microfit	Alarm LED / GAS Error (to ELS*) [out]
X3	7	Molex Microfit	Error Input (from Esys 2)
X3	8	Molex Microfit	NC
X3	9	Molex Microfit	NC
X3	10	Molex Microfit	GAS Reset (from ELS*) [in]
X3	11	Molex Microfit	GND – External Reset switch
X3	12	Molex Microfit	High Limit switch – supply (24V)
X3	13	Molex Microfit	NC
X3	14	Molex Microfit	GND
X3	15	Molex Microfit	GND
X3	16	Molex Microfit	GND – (from Esys 2)
X3	17	Molex Microfit	GND – Heat Demand (LV) switch
X3	18	Molex Microfit	GND – (from ELS*)

NOTE: *ELS - External Lockout System / Switch

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
Bit rate	2400 or 19200 Baud
Byte format	1 start, 8 data, 1 stop, no parity
Bit value "1"	low line level at connector
Bit value "0"	high line level at connector

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

Heating & Cooling Appliance Controls

Title: Functional description S4965A3025

Doc.: S4965A3025E20

Electrical rating	Value
Fusing	Ext. fuse 2A slow sand filled
Relay output (LPG)	230 VAC, 0,8 A max, $\cos \varphi = 0,6$
Gas valve output	230 Vrac, 50 mA
High limit switch input	24 VDC (22 k Ω)
Communication input	logic "0" 0,8 VDC, logic "1" 2 – 24 VDC (10 k Ω)
Communication output	open collector 24 VDC and 10 mA max
Length of wiring for external component	1,0 m max

Ignition	Value
Spark voltage	20 kV
Spark frequency	10 Hz
Spark pulse energy	15 μ As
Spark to	ground

Timings	Value
Pre purge/waiting time	0 s
Pre ignition time	0,4 s
Safety time	10 s
Number of ignition trials	3
Flame failure response time	1 s
Stabilization time	0 s
Post purge time	0 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 μ A
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

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

5.4 - Timing diagram

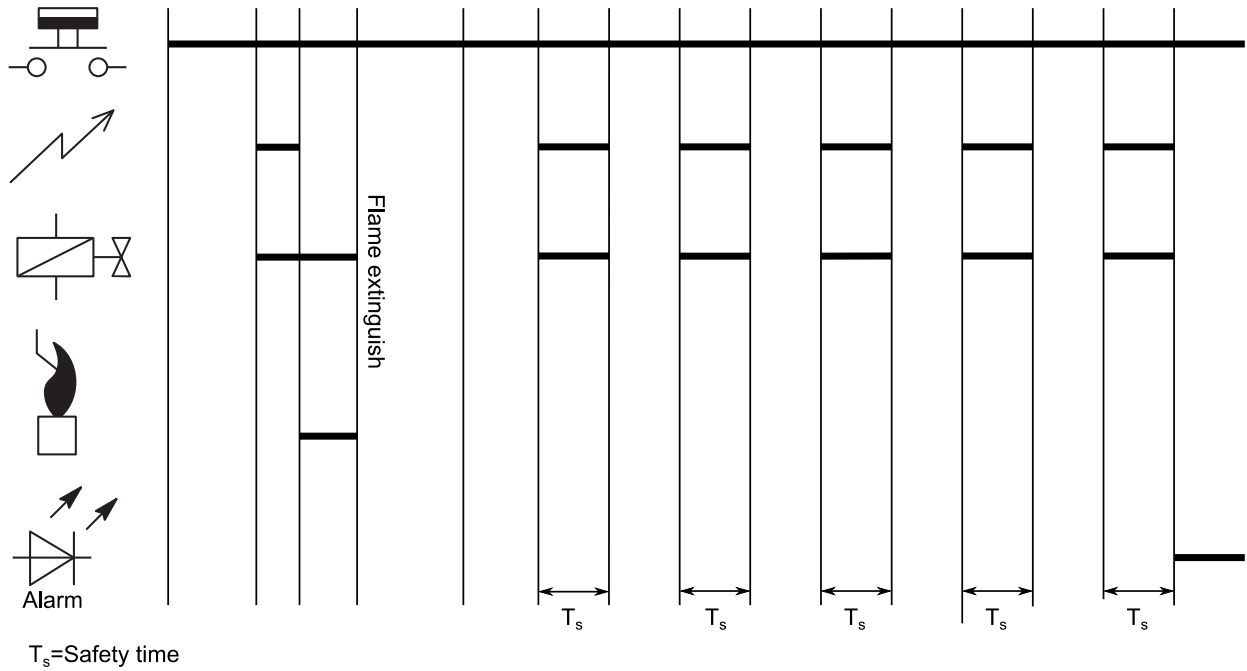


Fig. 3 - Timing diagram.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

5.5 - Recommended peripheral devices

Recommended valve: atmospheric VK41xxxxxx

Recommended display: N/A

5.6 - Sensors and actuators

5.6.1 - Safety Cut-off Switch

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 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 integral reset button or by the external communication.

5.6.2 - Alarm/Error Led

When an error condition is reached, the Alarm/Error LED indication output will be used to remote the fault indication externally (to ELS).

5.6.3 - Error Output to Esys 2

When the lockout error condition is reached (except error 40) the Error output indication will be low. It is used to indication lockout state to the second Esys.

5.6.4 - 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 VK4115G1005B. 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.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

6. Modes of operation

The controller has a number of basic modes of operation:

- STAND-BY, when there is no heat demand or error present;
- HEAT DEMAND;
- ERROR/FAULT conditions like over temperature conditions, sensor faults etc.

The priority of operating modes is fixed as following:

1. Error / Fault mode;
3. Heat Demand;
5. Stand-by mode (Idle).

6.1 - Stand-by

In STAND-BY mode igniter is off and gas valve is off.

6.2 - Heat Demand

When the high or low voltage Heat Demand input is closed, the boiler switch on if no error are present. The DHW demand is ended when the high or low voltage HD input will be open.

6.3 - Protection and error conditions

Several checks are included to protect the boiler and its environment. Double High Limit sensor 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 (igniter lockout) will cause a lockout condition which can only be cleared by the reset key on the controller itself, or via a closed contact on the reset input. In case of lockout and blocking conditions, Fan will not operate. Complete list of errors is given as following:

Error codes can be divided in 2 groups:

1. Lockout condition codes;
2. Blocking condition codes.

Error Code	Description
LOCKOUT	
1	Flame lockout after five ignition trials
2	False flame lockout
3	High Limit error
8	Flame circuit error
9	Gas valve driver circuit error
13	Remote reset lockout
21	ADC error
25	CRC error
40	Lockout on the second Esys
BLOCKING	
22	Low Main voltage
26	Internal reset knob blockage

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

Lockout condition codes

Lockout condition codes are all codes from 1 till 30. The meaning of the error numbers is as following:

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. All resets are limited to 5 resets per 15 min.

FAULT 2 = False flame indication. If flame signal is measured with no heat demand currently present, error 2 is created. This error condition also requires manual reset action.

FAULT 3 = High Limit error. If one of the two High Limit sensors detects a temperature of more than 85°C, High Limit 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 8 will be set.

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

FAULT 13 = All remote resets (communication) are limited to 5 resets per 15 min. If the limit is exceeded, error will be generated and to reset it. Power Off/On and reset is necessary.

FAULT 21 = ADC error.

FAULT 25 = Matching error between Hup and Lup CRC codes (different software versions).

FAULT 40 = When Error input from Esys 2 signal is low. This error condition is stopping the boiler and to get to the normal operation again, manual/remote reset is required. All resets are limited to 5 resets per 15 min.

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. Blocking errors are distinguished with codes from 30. The meaning of the code is as follow:

FAULT 22 = 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.

FAULT 26 = If the Reset knob is switched on for more than 2s, error 26 is set till the reset knob will be released.

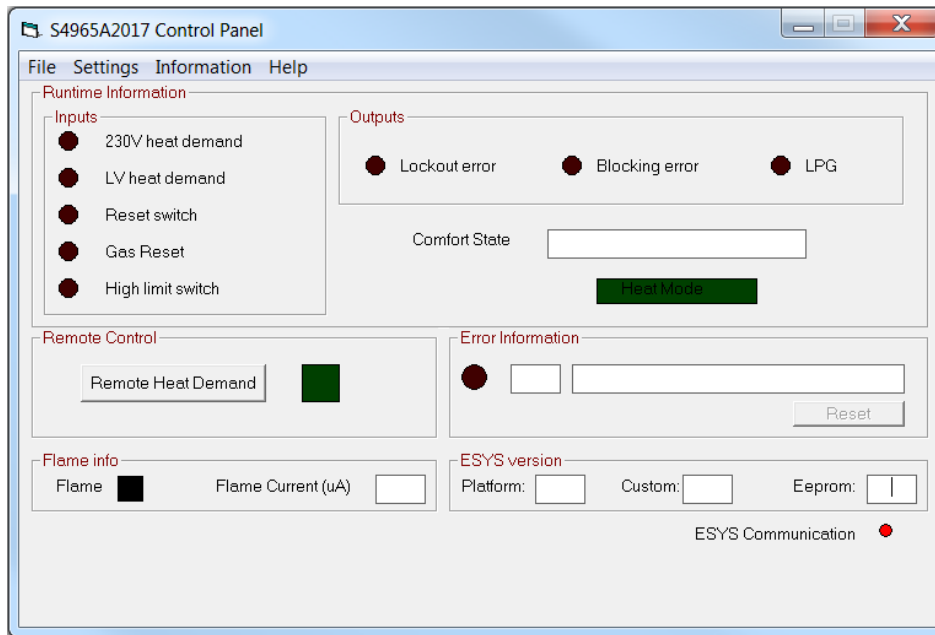
6.4 - Ignition sequence

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.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

7. Control Panel for ESYS

A Control Panel for ESYS has been developed for monitoring. In the following picture the default screen is shown:



Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

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 by using the MicroCom communication protocol.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

9. Other documentation

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

Title	Reference
Product Handbook ESYS	EN2R9071
Product Handbook Modulating Valves	EN2R9025
External Communication	ERE2038
Terms used in Honeywell product handbooks	EN2R9039

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

10. Installation

10.1 - General remarks

- After installation, ensure total protection equal to at least IP40 level as specified in EN60730-1.
- 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.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

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.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A

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.

Description	Sign.	E.C.N.	Date	Rev.
First issue	M.Matiasko		01-Sep-2015	A