ESYS CONTROLLER

S4965C2011

FUNCTIONAL DESCRIPTION

Table of Contents

Description	Sign.	E.C.N.	Date	Rev.
First issue	MasCon	0099409	29-Mar-2013	A
Software upgrade into C0.02_P0.20_E0.02	MasCon	0105045	13-Sep-2013	B
Software upgrade into C0.03_P0.20_E0.03	MasCon	0109930	23-Apr-2014	C

1. Revisions

Software	Date	Description of amendments
C0.01_P0.20_E0.01	14/11/12	
C0.02_P0.20_E0.02	13/09/13	-Automatic fan system detection has been added. This functionality check if APS is used in the appliance - High voltage input has been integrated to monitor fan feedback input
C0.03_P0.20_E0.03 crc"747E"	16-Mar-2014	- The postpurge range has been extended to 0-255s (the old one was 0-30s). - Moreover the postpurge configuration has been changed to not interrupt the postpurge when a new heat demand is requested in the mean time (postpurge break was enabled in the previous FW).

Table 1 - Revisions

2. Reference standards and Approvals

2.1 Standards

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

- **EN298:2003**
  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 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 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.

3. Quality assurance statement

Products are manufactured under an ISO 9001 (1994) based and certified Quality System.

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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 Gastec against certificate number 9.302/2.

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.

4. Identification

To ensure product tracking and identification, each board shows:

- Bar code label with production data;
- CE XX / XXX labelling (CE0051xxyyyy – XXXXX) screen printed on the PCB
- Label showing firmware version, type and model burner control, programming batch, production date.

Honeywell part number	Customer part number	Notes
S4965C2011	–	–

Table 2 - Identification

5. Product description

5.1 Application

The S4965C2011 controller has been specially developed for application in gas fired fireplaces.
The S4965C2011 controller is designed to provide both and optimized safety sub-system for programmed safe light-up and flame supervision of the main burner of the appliance and a comfort control sub system for temperature.

5.2 Description

The S4965C2011 controller operates in conjunction with V4600/V8600 and VR46../VR86.. gas control.

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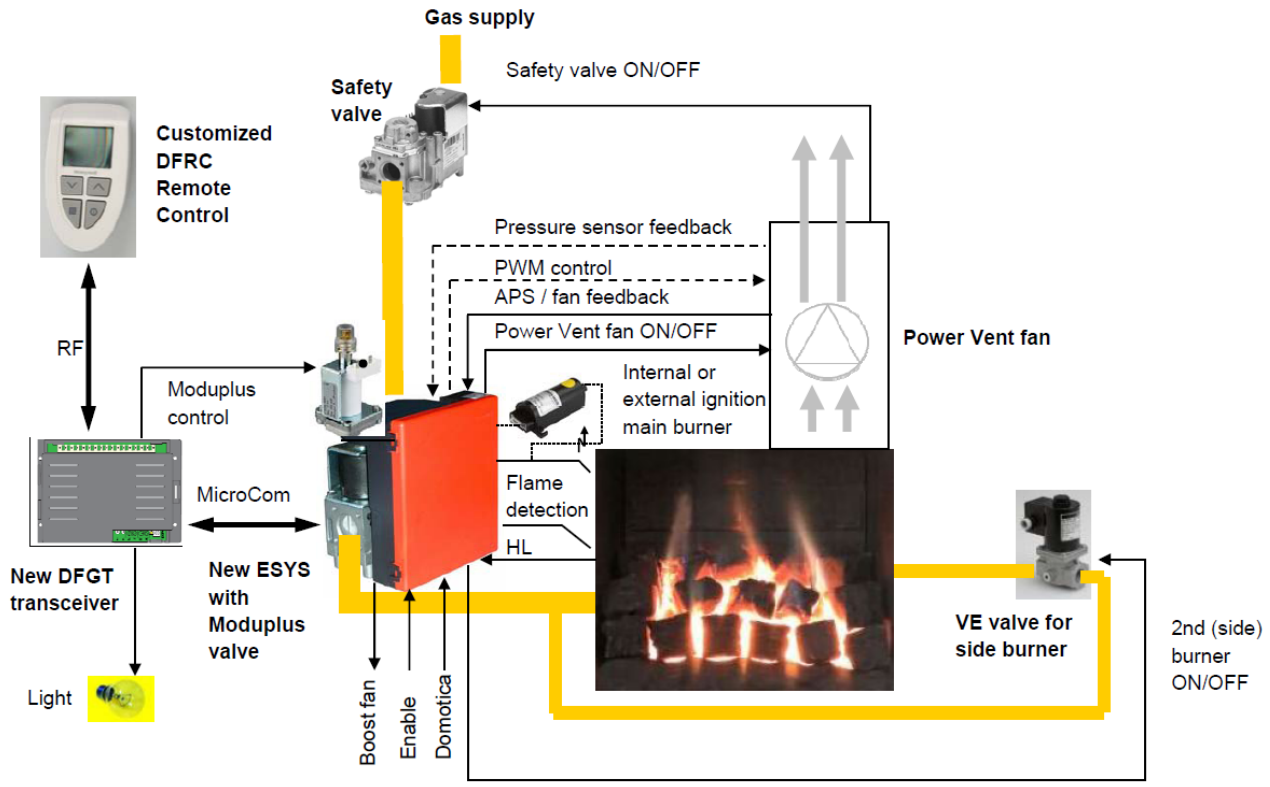

Figure 1 - The system overview

5.3 Features

The controller can operate on 230 Volts AC and a mains frequency of 50 Hz.
The modulation is driven by DFGT transceiver on moduplus gas valve. An example of such a modulator is V7335A.
The safety cut off switch (High Limit Protection) protects the controller from overheating the application.
The supported room unit is:

- DFRC-HW

The application is controlled via microcom interface (DFGT and Esys) and by RF opentherm interface (DFRC and DFGT).
Central Heating (CH) demand can be generated by microcom communication.

5.4 Layout

Component side view

Overall dimensions (indicative average dimensions)	155 x 125 mm
PCB thickness	1,6 mm
Fixing points	n° 4 holes Ø 3 mm
Tolerances	according to STP0015

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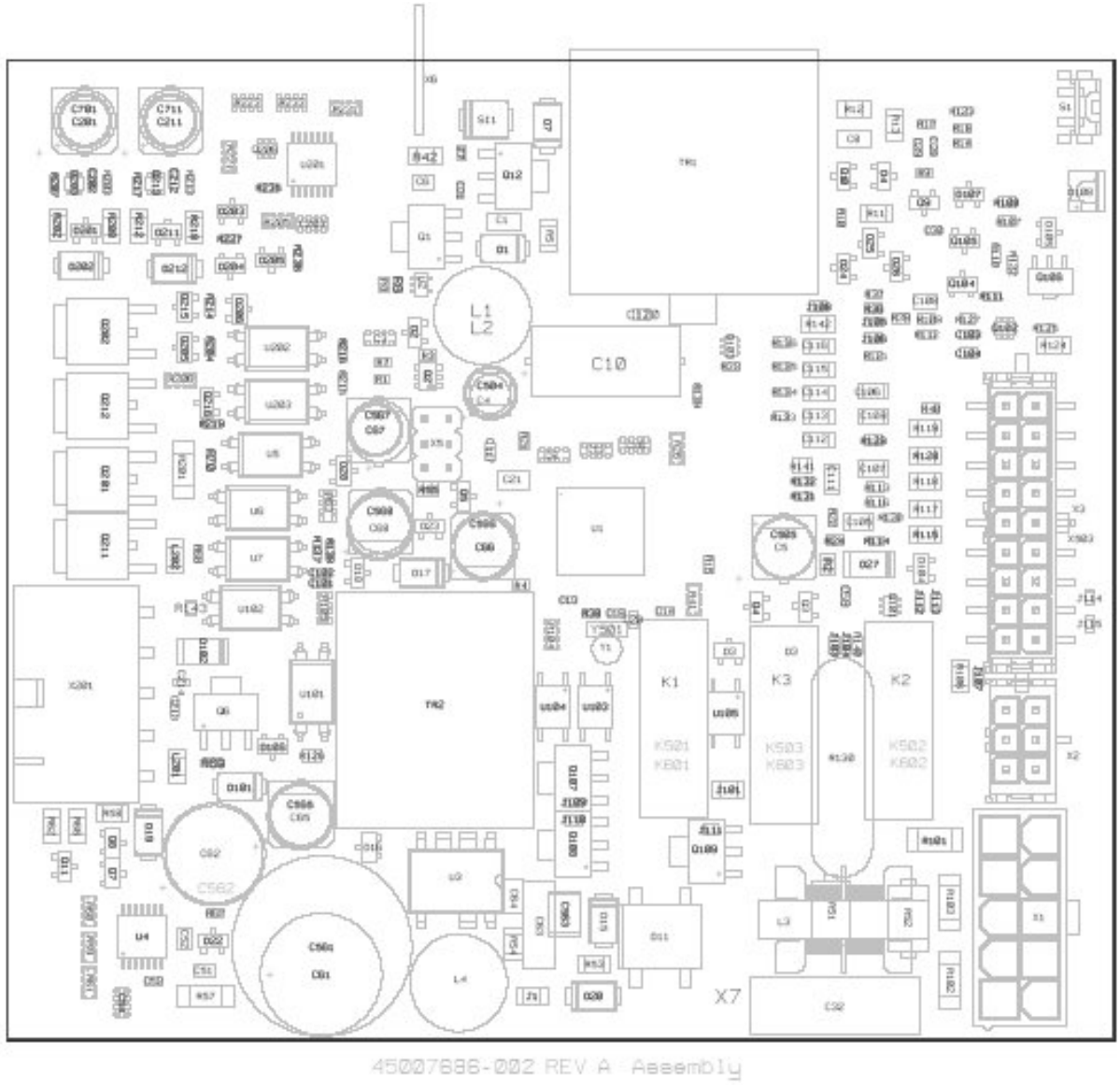

Figure 2 - Assembly component view

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5.5 Connector and connections

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

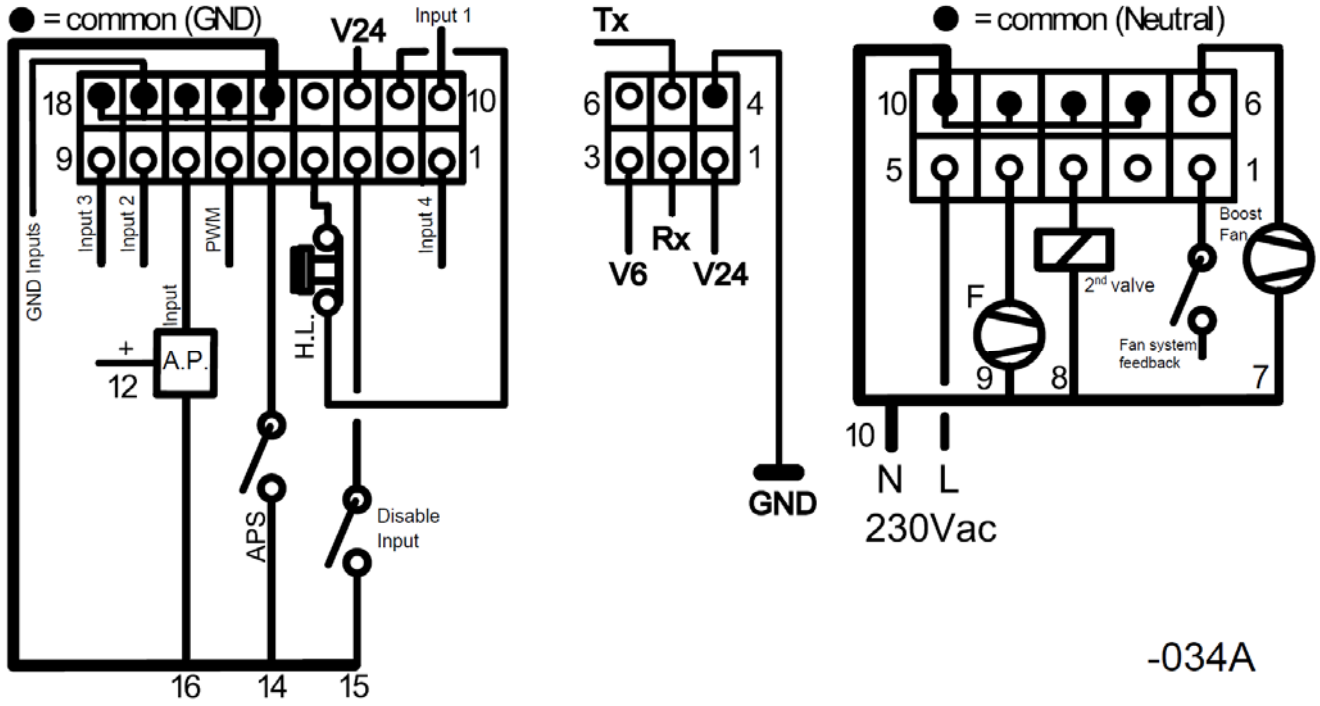

Figure 3 - Connectors and connections

Connector	Pin	Description	Connection
HIGH VOLTAGE (230V) CONNECTIONS			
X1	1	Molex Minifit	Fan system feedback
X1	2	Molex Minifit	-
X1	3	Molex Minifit	2nd (side) burner valve – L
X1	4	Molex Minifit	FAN power supply – L
X1	5	Molex Minifit	Main Power Line Phase – L
X1	6	Molex Minifit	Boost Fan – L
X1	7	Molex Minifit	Boost Fan – N
X1	8	Molex Minifit	2nd (side) burner valve – N
X1	9	Molex Minifit	FAN power supply – N
X1	10	Molex Minifit	Main Power Line Neutral – N
SAFETY EXTRA LOW VOLTAGE (SELV) CONNECTIONS			

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Connector	Pin	Description	Connection
X2	1	Molex Microfit	NC
X2	2	Molex Microfit	RX serial communication
X2	3	Molex Microfit	NC
X2	4	Molex Microfit	Ground connection
X2	5	Molex Microfit	TX serial communication
X2	6	Molex Microfit	NC
X3	1	Molex Microfit	2nd (side) burner On/Off
X3	2	Molex Microfit	NC
X3	3	Molex Microfit	Disable – input
X3	4	Molex Microfit	Safety line (High limit, air valve) – input
X3	5	Molex Microfit	APS – input
X3	6	Molex Microfit	PWM – output
X3	7	Molex Microfit	Pressure sensor – input
X3	8	Molex Microfit	Domotica 2 – input (-)
X3	9	Molex Microfit	Domotica 3 – input (+)
X3	10	Molex Microfit	Domotica 1 – input (on/off)
X3	11	Molex Microfit	Safety line (High limit, air valve) – 24V
X3	12	Molex Microfit	Pressure sensor – 24V
X3	13	Molex Microfit	NC
X3	14	Molex Microfit	APS – Gnd
X3	15	Molex Microfit	Disable – Gnd
X3	16	Molex Microfit	Pressure sensor – Gnd
X3	17	Molex Microfit	Domotica – Gnd
X3	18	Molex Microfit	PWM – Gnd
IGNITION CONNECTION			
TR1		2.8x0.5mm faston	High voltage Trasformer output
TR2		2.8x0.5mm faston	High voltage Trasformer return
FLAME INPUT CONNECTION			
X6		4.8x0.8mm faston	Flame rod input

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5.6 Specification (nominal data)

Supply voltage
- 230 V AC +10 %, -15 %
- 47 – 65 Hz

Power consumption
- 2,5 VA

Humidity
- 90 % RH max at 40 °C (no condensing)

Ambient temperature
- 0 – +60 °C

Electrical rating
- Main inputs: see supply voltage
- AC fan output: 230 V AC, 0,8 A max, cos φ = 0,6
- 2nd (side) burner valve output: 230 V AC, 0,4 A max, cos φ = 0,6
- Gas valve output: 230 V rac, 50 mA
- Communication input: logic “0” p 0,8 V DC - logic “1” 2 -24 V DC (10 kΩ)
- Communication output: open collector 24 V and 10 mA max

Flame sensing
- Factory parameter setting: minimum flame current 0,8 µA

Ignition
- Spark voltage: 15 kV
- Spark frequency: 22 Hz
- Spark pulse energy: 5 µAs
- Spark with Closed Loop

Timings
- Pre-purge time: 5 s (adjustable)
- Pre ignition time: 0,2 s
- Safety time: 15 s
- Number of ignition trials: 3
- Flame failure response time: 1 s (nominal value aligned with survey)
- Stabilization time: 0 s
- Post purge time: 0 s

Communication
- 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

Length flame sensing/spark cable
- 0,5 m max

Length of wiring for external components
- 1 m max

Product life
- 500.000 cycles for safety and main operator gas valve
- 250.000 cycles at rated loads
- 6.000 lock-out operations with rated loads

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5.7 Parameters

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 OEM and the end user should be aware of the fact that changing parameters can lead to a less performing controller. It is not possible to generate an unsafe situation, but the control can give less performance.

5.7.1 System Parameters list (and default values)

The following table shows the parameters which can be changed by the OEM with the help of a PC tool and a communication cable. All parameters from this table are located in Class 5.

Name	Description	Unit	Default Value	Low limit	High limit	ID
CH setpoint	Modulation Setpoint for Central Heating mode	°C	80	30	80	0x056D
Anticycling time	Anticycling time	Min	3	0	15	0x05AE
Ignition reset delay	Delay to reset no flame error	s	10	0	255	0x2815
Flame Loss delay	Delay to reset flame loss error	s*10	1	0	255	0x0537
Delay side burner on	Delay side burner on time	s	0	0	255	0x09CB
Custom prepurge	Custom prepurge time	s	5	0	255	0x0CA7

Table 4 - System parameters

5.7.2 Supported Opentherm IDs

Class	ID	R/W	Description
1	0	R	Status
	1	W	Control setpoint
	5	R	Fault flags/ faultcode
3	4	W	Lockout reset
4	17	R	Relative modulation level
	25	R	CH water temperature
	57	R/W	CH setpoint
8	14	W	Maximum relative modulation setting

Table 5 - Supported Opentherm IDs

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5.8 Sensors and Actuators

In order to proper operate the controller, different sensors and actuators must be connected to this controller.

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.

Combustion Fan
The combustion fan is a simple on-off single speed fan which is used in the combustion minimum. The electrical specification for the combustion fan is described in the table below.

Voltage	Current	Special
230 V AC	0.8 A	Cos φ >= 0,6

Table 6 Fan parameters

6. Modes of operation

The controller has a number of basic modes of operation:

- STAND-BY, when there is no heat demand;
- CH-MODE, when the Heat Demand input is closed or the internal frost protection is requesting heat;
- ERROR/FAULT conditions like over temperature conditions, sensor faults, etc.

The priority of the heat demands is as follows:

1. Error or Fault Mode;
2. Central Heating Mode;
3. Stand-by Mode.

6.1 Startup

After Power On, manual reset or each 12/24 hours, the control will perform its start up routines.
12/24 hour reset 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 a maximum of 24 hours to perform the reset.
The pump is switched on during this start up time preventing sticking of the pump.

6.2 Stand-by

In this mode the controller has no heat demands. It is waiting to be switched on by a CH demand or a Test Mode demand. If an error is present the controller will also remain in the stand-by mode and it will not accept a heat demand. Through the OT or a PC connection the actual status or error code of the controllers can be displayed.

6.3 Central Heating Mode

The CH heat demand can be created by DFGT device via microcom.
When a valid CH heat demand is received, the controller will start up in CH mode. The modulation is demanded to DFGT which will drive the moduplus gas valve according to the power requested set by DFRC. The side burner valve is driven by Esys according to DFGT microcom message.

Picture below shows the Central Heating mechanism.

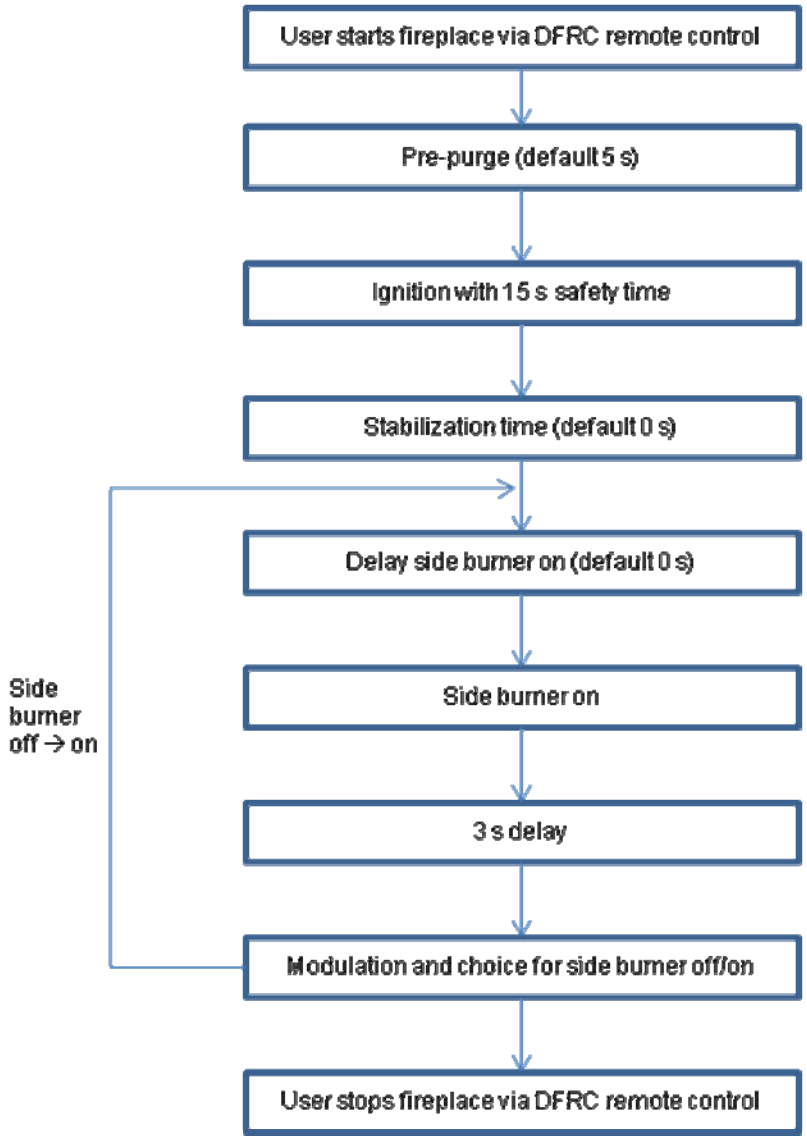

Figure 4 Central Heating mechanism

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6.4 Lockout Errors

The table below shows the lockout errors of the controller and an explanation of these errors. All the mentioned errors require a user action to clear the error.

Error Code	Description	Error is set when…
1	Ignition Lockout	The number of ignition trials has been elapsed and there was not flame establishment during the safety time.
27	Flame Lost	There was not flame establishment during the safety time
8	Flame Circuit Error	The self check of the flame circuit has failed.
9	Valve Drive Circuit Error	S: The self check of the valve drive circuit has failed.
12	EEPROM Lockout	Safety EEPROM content check failed
13	Remote reset lockout	The allowed limit of remote lockout resets per a unit of time is over passed. The volatile lockout which is cleared by turning off and on the board.
21	ADC Error	Internal controller error
99	Wrong wiring	If there is wrong connection

Table 7 Lockout errors

6.5 Self Resolving Errors

All the errors mentioned below will be resolved automatically if the cause of the error disappeared. User action is required to solve the error cause only (no user action is required to clear the error position of the controller itself).

Error Code	Description	S: Error is set when… C: Error is cleared when…
22	Low Mains Voltage	S: The mains voltage drops below 157V (+/- 10V). If pump overrun is active, pump will stop after pump overrun.
		C: The mains voltage rises above 157V (+/- 10V) again
25	Matching Error	S: Software in micro and EEPROM don't belong to each other
		C: Control needs to be replaced

Table 8 Self resolving error

7. 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 CVI3 communication protocol.

8. Other documentation

This chapter contains references for further documentation of the controller.

Title	Reference
External Communication	ERE2038

Table 9 Other documentation

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9. Installation

9.1 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.

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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**.

9.2 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.

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.)

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9.3 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 minimise 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.

9.4 Ionization current check

- The current value must be greater than the specified minimum.
- If the ionisation 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.

9.5 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.

9.6 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.

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