

## VK4105G AND S4565.M SERIES COMBINED VALVE AND IGNITION MODULATING SYSTEM

### INSTRUCTION SHEET



### APPLICATION

The VK4105G and S4565.M, Combined Valve and Ignition modulating system (CVI-m) have specially been developed for application in gas fired appliances with direct burner ignition that require electric modulating control of the gas input like instantaneous hot water combi boilers and air heating appliances.

For this system, the VK4105G series gas control has been designed to have the S4565.M series ignition control attached directly onto the valve.

The combined system then provides programmed safe light up, flame supervision, regulation and modulation of gas flow to the main burner of the appliance.

### DESCRIPTION

The CVI-m system comprises a modulating gas control with on/off regulating and modulating function and an ignition control with integrated power supply for the electric modulating operator.

The gas control holds a first electric on/off direct operator for opening the safety valve of class B according to EN 161 and a second electric on/off servo operator of class J according to EN 161 for opening the main valve.

The second electric operator also includes the modulation function.

The minimum gas flow can be set by means of an adjustable throttle.

The pressure regulator controls the maximum setting and is in accordance with class B requirement of EN 88.

The S4565.M ignition control provides automatic ignition for direct gas burner applications.

The power supply for the modulating current is generated by the ignition control.

The S4565.M system function in accordance with EN 298.  
 S4565AM, BM ..... code A/M/C/L/X/N  
 S4565CM ..... code F/M/C/L/X/N  
 S4565DM ..... code F/T/C/L/X/N  
 S4565PM, QM ..... code A/M/C/N/X/N  
 S4565RM, TM ..... code F/M/C/N/X/N

### SPECIFICATIONS VK4105G

#### Main gas connection

Inlet and outlet  $\varnothing$  17.9 mm to be made with straight or elbow flanges.

Inlet  $\varnothing$  17.9 mm and side outlet  $\varnothing$  14 mm be made with straight or elbow flanges.

Inlet G  $\frac{1}{2}$ " external thread and outlet  $\varnothing$  18.6 mm

Inlet G  $\frac{3}{4}$ " external thread and outlet  $\varnothing$  18.6 mm

$\frac{3}{8}$ " and  $\frac{1}{2}$ " straight or elbow flanges are according to the torsion and bending stress of EN 126 group 2

Connections with G  $\frac{1}{2}$ " or G  $\frac{3}{4}$ " external thread fitted with nuts according to ISO 228-1 in combination with applicable sealing(s) withstand the torsion and bending stress of EN 126 group 1

#### Pressure feedback connection

M5 connection on pressure regulator on maximum setting.

#### Ambient temperature

-15 ... 60 °C

#### Dimensions

See fig. 1.

#### Maximum capacity

2.5 m<sup>3</sup>/h air at  $\Delta p = 3$  mbar

#### Minimum capacity

The minimum rate is adjustable with a throttling screw from 0.2 m<sup>3</sup>/h air up to 0.92 m<sup>3</sup>/h air at  $\Delta p = 17$  mbar

#### Outlet pressure range

1.5 ... 32 mbar

#### Minimum rate range

1.5 ... 7 mbar max

#### Maximum inlet pressure

60 mbar

#### Modulation characteristics

In fig. 2. and 3. the modulating performance of the CVI-m system is reflected at 20 mbar and 37 mbar.

#### Closing time

< 1 second

#### Mounting holes

Two mounting holes at the bottom for thread forming screws.

### Mounting position

90° tilted in any direction from the upright, deviation ±5° max.

### Valve classification

1<sup>st</sup> valve: class B, 50 mbar backpressure  
2<sup>nd</sup> valve class J, 0 mbar backpressure

### Electrical data

Valve power consumption at nominal voltage: 7 VA

Valve current at nominal voltage: 30 mA

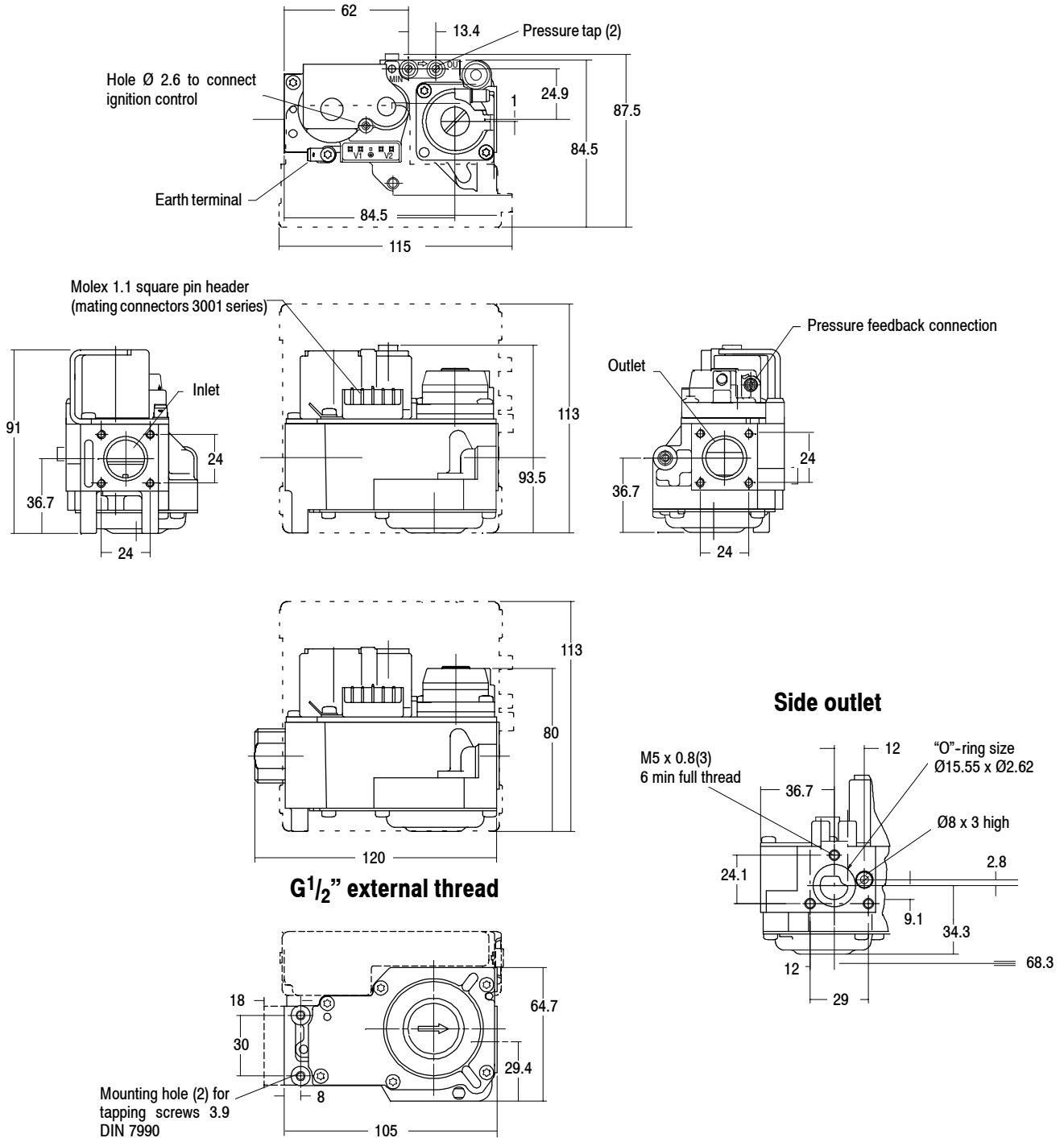
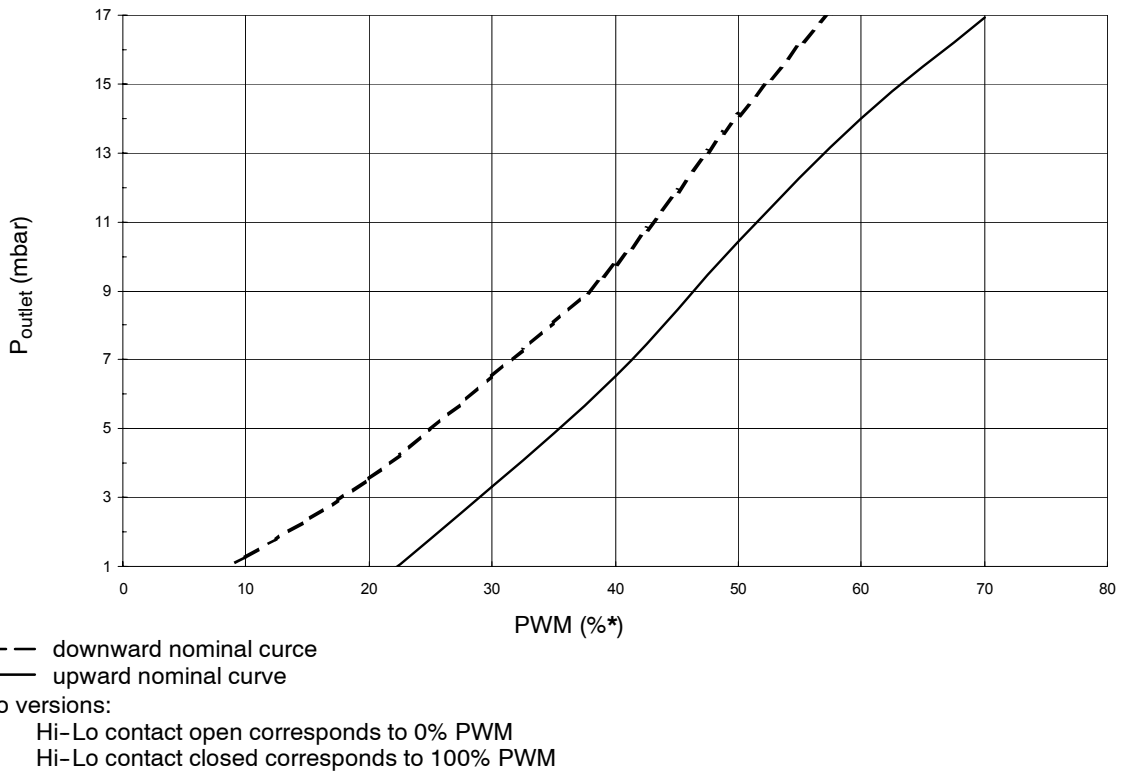
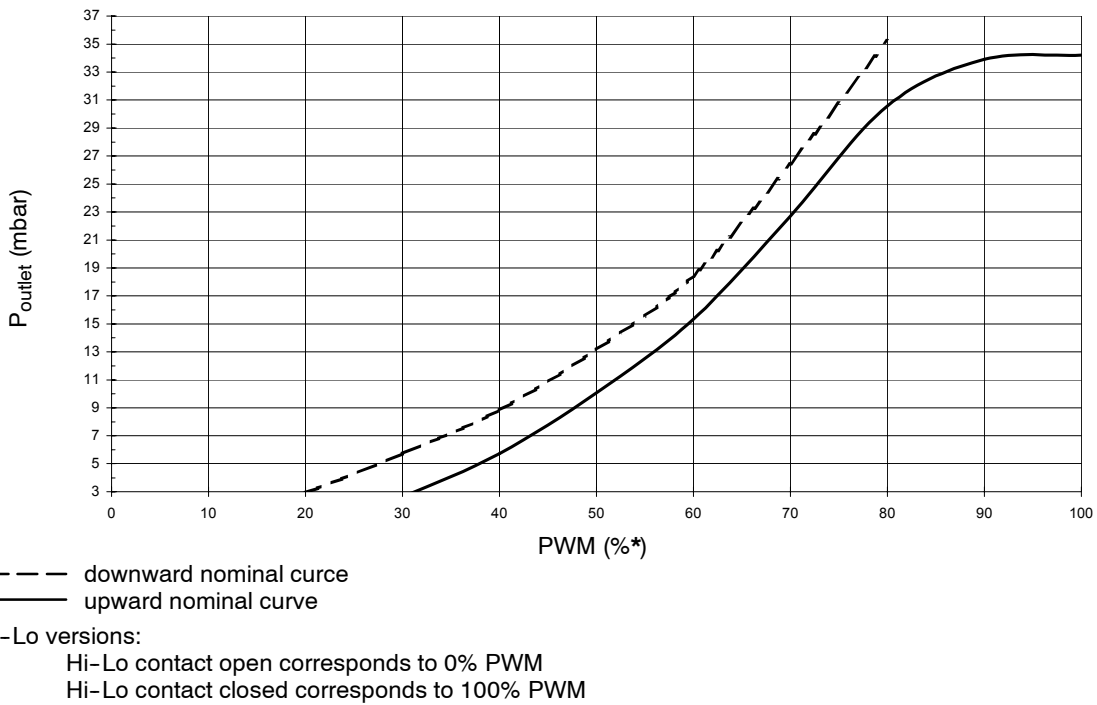


Fig. 1. Dimensional drawing



**Fig. 2. Nominal graph modulating performance at 20 mbar inlet pressure, Ø 4.3 mm outlet restriction**



**Fig. 3. Nominal graph modulating performance at 37 mbar inlet pressure, Ø 2.8 mm outlet restriction**

# SPECIFICATIONS S4565AM, BM, CM, DM, PM, QM, RM, TM

## Model

Suffix AM: atmospheric, direct burner ignition, modulation or Hi-Lo input

Suffix BM: as AM but with fixed or adjustable start pressure during ignition.

Suffix CM: as AM but fan assisted

Suffix DM: as BM but fan assisted

Suffix PM: as AM except volatile lock-out

Suffix QM: as BM except volatile lock-out

Suffix RM: as CM except volatile lock-out

Suffix TM: as DM except volatile lock-out

For suffix BM, DM, QM, and TM either ignition pressure or electrical minimum pressure (non fail safe) is adjustable with potmeter by thumbwheel in the housing

## Supply voltage

230 Vac, 50 Hz

## Power consumption

4 VA

## Humidity

90% RH max. at 40 °C

## Ambient temperature

-15 ... 60 °C

## Electrical rating

Alarm: Suffix AM, BM, CM, DM neon lamp output max 5mA  
Suffix PM, QM, RM, TM neon lamp output max 1mA

Fan: 230 Vac, 50 Hz, 1 A,  $\cos \varphi$  0.6

Air flow switch: 230 Vac, 0.1 A

Limit thermostat: 230 Vac, 0.1 A

Control thermostat: 230 Vac, 1.5 A,  $\cos \varphi$  0.6

PWM input: 12V  $\pm$  4V, 1 k $\Omega$ ,

PWM frequency: 0.2 ... 0.5 kHz, synchronized to even harmonics of 50 Hz mains; curve specified

PWM frequency: 0.1 and 0.6 ... 1 kHz, synchronized to even harmonics of 50 Hz mains; curve **not** specified

PWM on/off ratio: 0 ... 100 %

Hi-Lo thermostat: 230 Vac, 0.1 A

Thumbwheel potmeter can optionally be used as either ignition pressure adjustment or electrical minimum pressure adjustment.

### Ignition pressure adjustment

Adjustment range mechanical minimum to at least 14 mbar.

### Electrical minimum pressure adjustment

Adjustment range mechanical minimum to at least 10 mbar.

## Electrical connection

High voltage spark: 2.8 mm spade terminal

Flame sensing: 4.8 mm spade terminal

PCB connectors: Molex 3003 series suitable for Molex 3001 female cable connector

## Housing (degree of protection)

### IP 20 (standard)

As accessory a strain relief (order number 45.900.440-001) is available.

### IP 40

Use: cover set 45.900.431-004 or

cover set 45.900.431-005

(flame retardant according to UL94-VO)

cable grommet 45.900.442-008

### IP 44 (only applicable for specific O.S. numbers)

Use: cover set 45.900.431-004 or

cover set 45.900.431-005

(flame retardant according to UL94-VO)

cable grommet 45.900.442-008

sleeve 45.900.442-003

gasket 45.900.442-011

## Timing

Self check time ( $T_C$ ): 1.5 s

Waiting time ( $T_W$ ): 0 ... 10 s

Safety time ( $T_S$ ): 3 ... 25 s

Extended spark ignition time: 0 ...  $T_S$

(dependent on elaps of safety time)

## Flame sensing

Min flame current:

for optional phase independent versions: 0.5  $\mu$ A

for phase dependent versions: 0.9  $\mu$ A

Response time on: > 0.2 s

Response time off: < 1.2 s

## Ignition

Spark voltage: 12 kV at 40 pF load

Spark energy: 3... 15  $\mu$ As

Repetition rate: 5 ... 50 Hz (depending on O.S. number)

Max. spark gap: 3.5 mm

## Length flame sensing cable

1 m max.

## Length ignition cable

0.5 m max.

## Length of wiring for external components

1 m max.

## Remark

PWM input has safe separation with respect to mains voltage (dependent on O.S. number)

Side connections

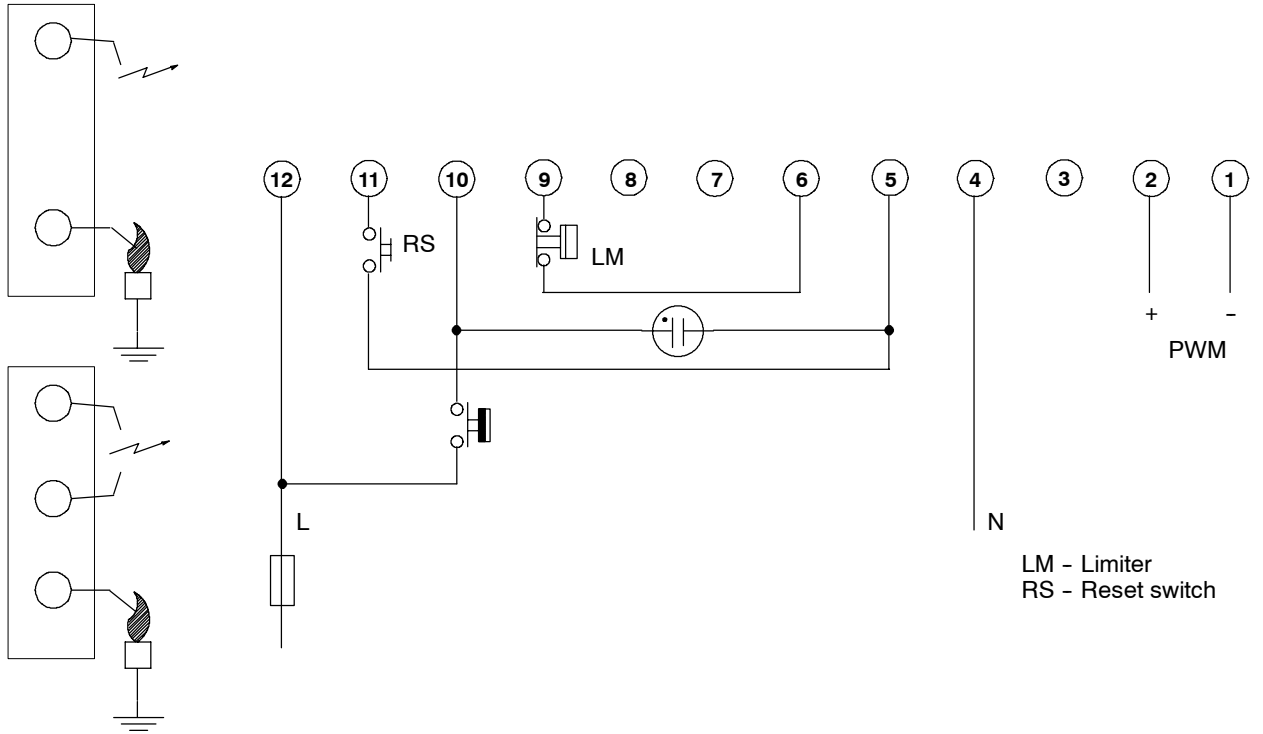


Fig. 4. Connection diagram S4565AM, BM, PM, QM <sup>1)</sup>

<sup>1)</sup> For more configurations: see Product Handbook EN2R-9028

Side connections

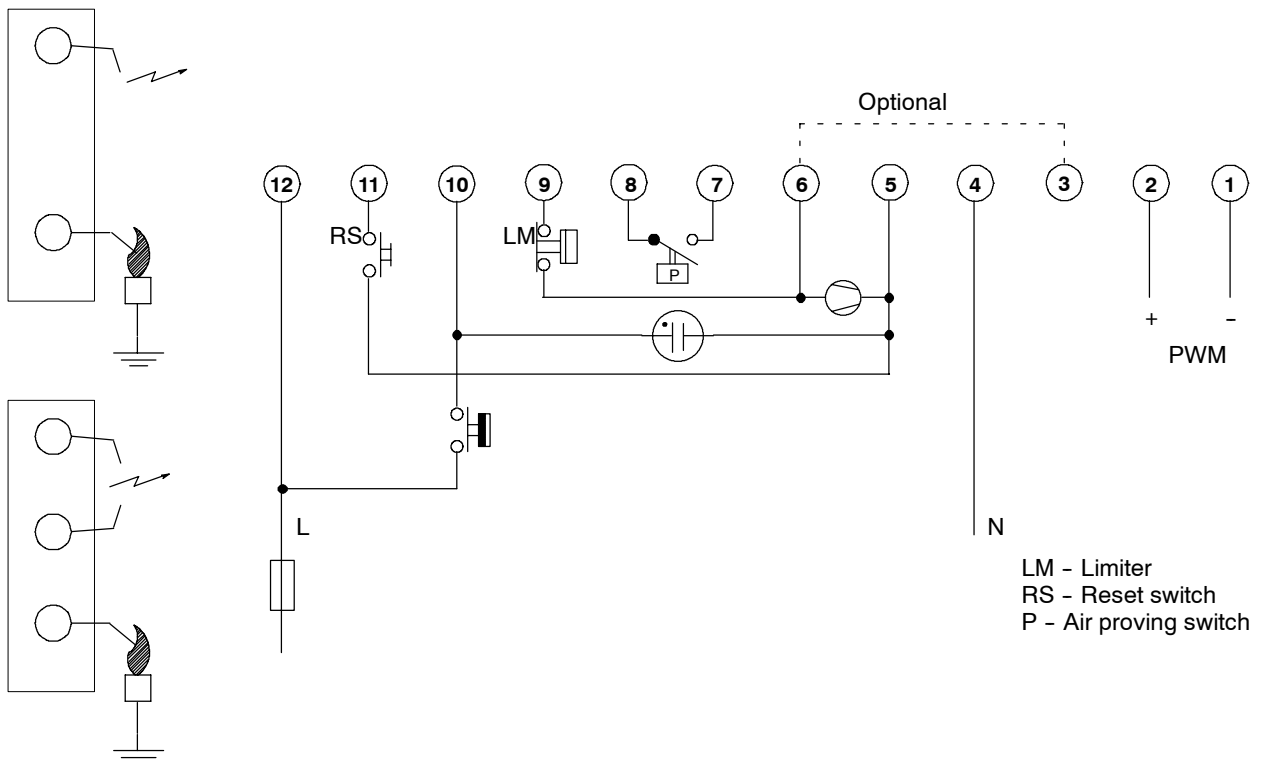


Fig. 5. Connection diagram S4565CM, DM, RM, TM <sup>1)</sup>

<sup>1)</sup> For more configurations: see Product Handbook EN2R-9028

Side connections

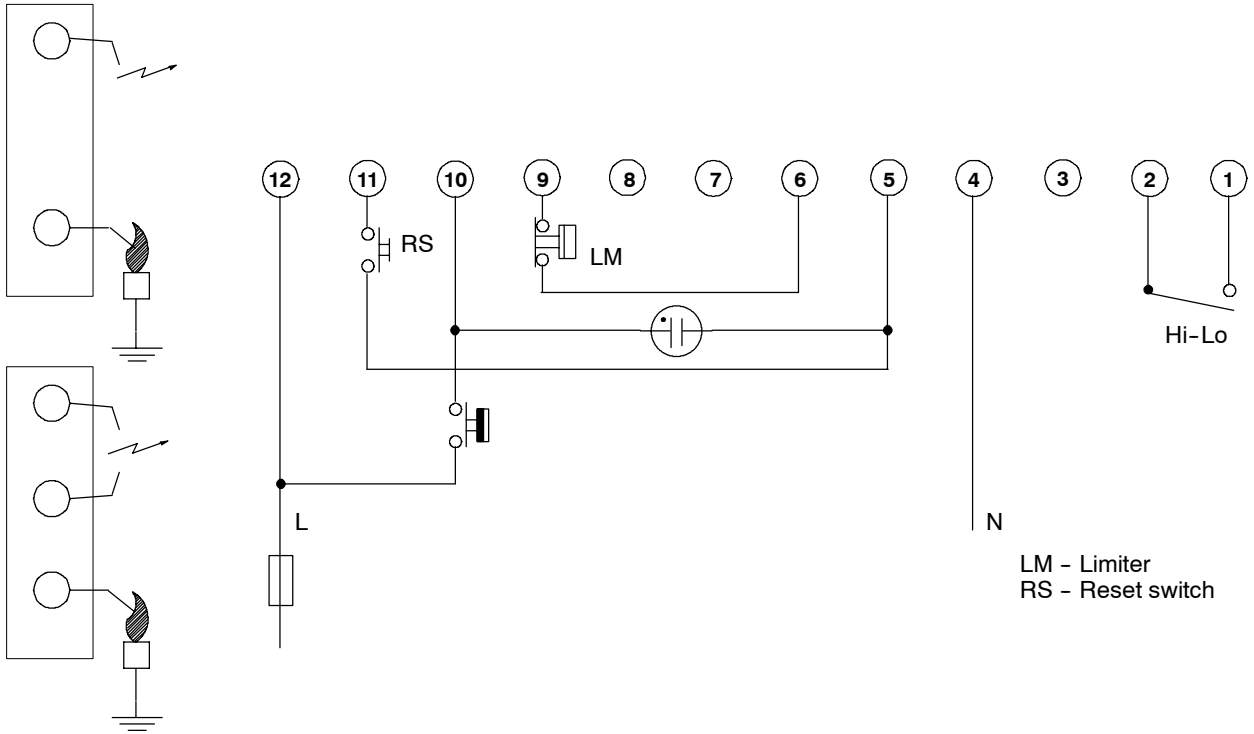


Fig. 6. Connection diagram S4565AM, PM with Hi-Lo <sup>1)</sup>

<sup>1)</sup> For more configurations: see Product Handbook EN2R-9028

Side connections

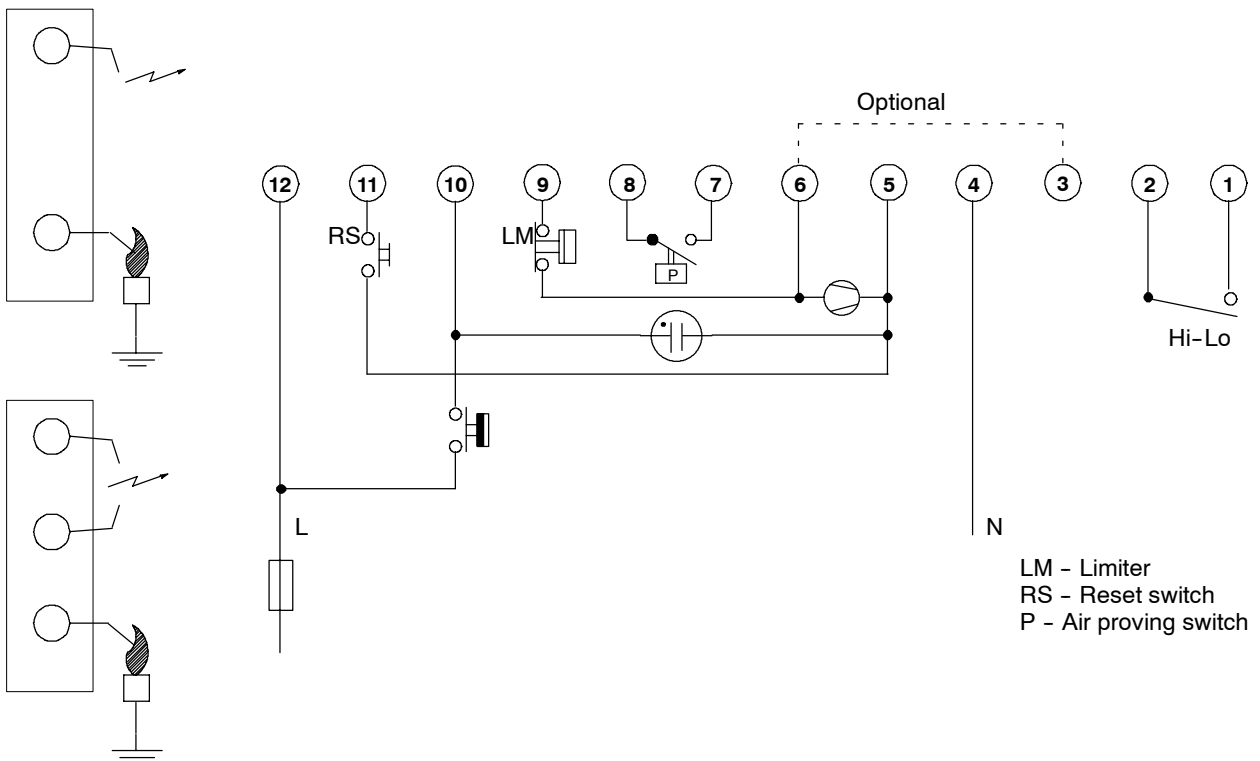


Fig. 7. Connection diagram S4565CM, RM with Hi-Lo <sup>1)</sup>

<sup>1)</sup> For more configurations: see Product Handbook EN2R-9028

Side connections

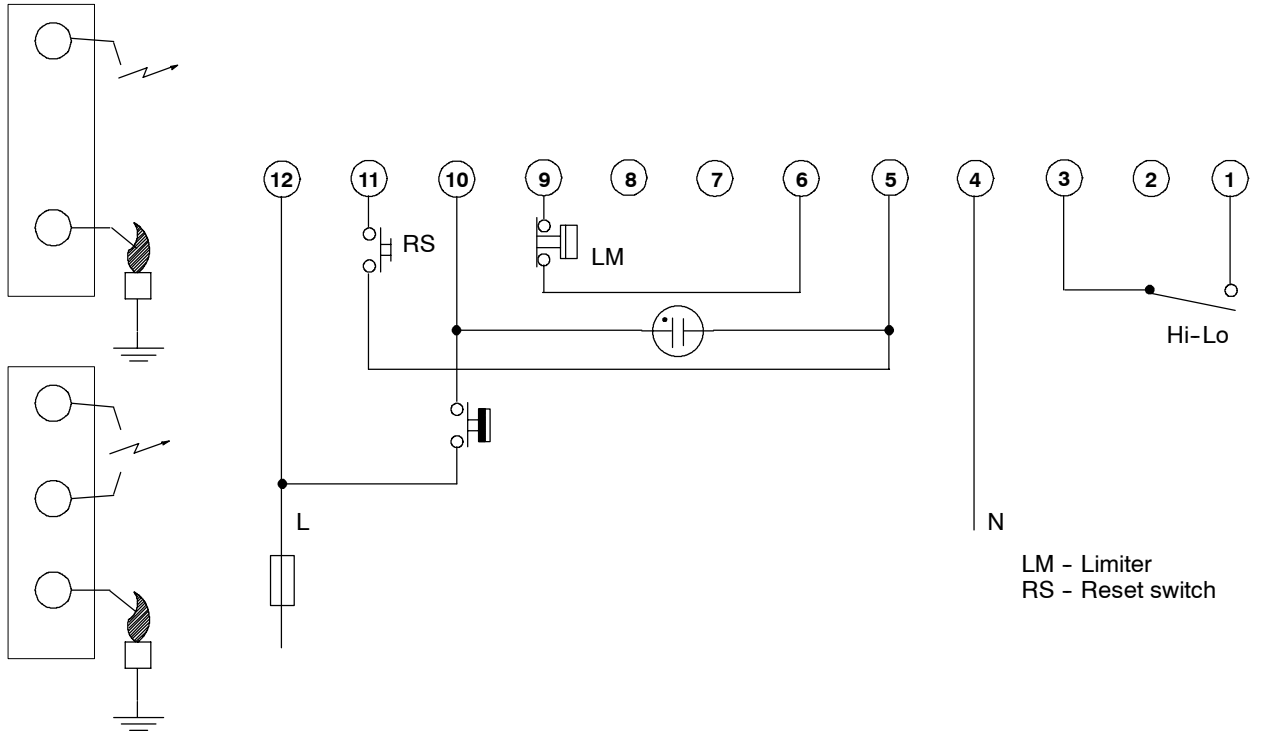


Fig. 8. Connection diagram S4565BM, QM with Hi-Lo <sup>1)</sup>

<sup>1)</sup> For more configurations: see Product Handbook EN2R-9028

Side connections

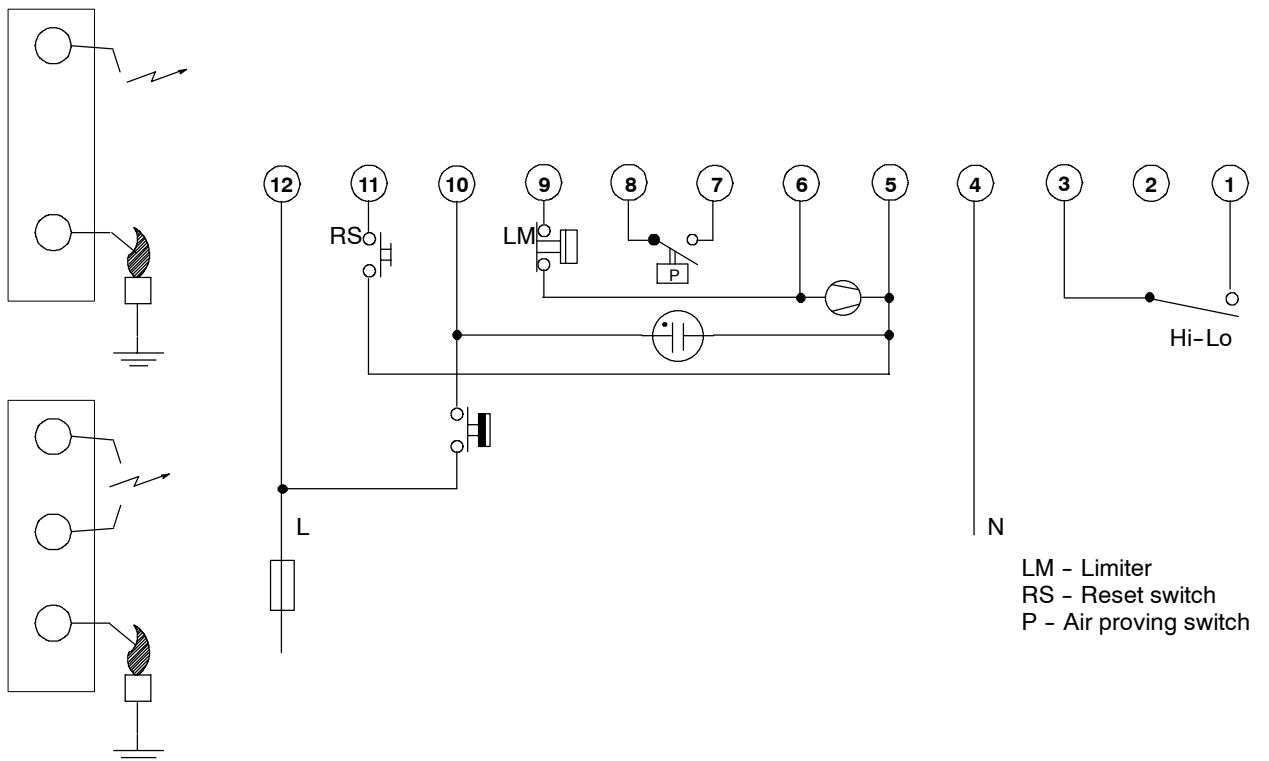


Fig. 9. Connection diagram S4565DM, TM with Hi-Lo <sup>1)</sup>

<sup>1)</sup> For more configurations: see Product Handbook EN2R-9028

# SYSTEM OPERATION

## General

The S4565AM, BM, CM, DM, PM, QM, RM, TM ignition control can provide both closed-loop sparking and sparking to ground.

If the S4565AM, BM, CM, DM, PM, QM, RM, TM will be used in sparking to ground applications, the upper spark gap has to be grounded.

The output pressure of the gas valve can be controlled with the PWM input signal

## Suffix AM and PM (see fig. 10.)

When there is a call for heat a self check period ( $T_c$ ) plus waiting period ( $T_w$ ) elapses before built-in igniter and gas valve are switched on.

The ignition spark ignites gas and resulting flame is detected by the flame rod.

Ignition is switched off after a predetermined extended ignition time and flame establishment.

If flame is not established within the safety time ( $T_s$ ), the ignition control locks out.

If the flame is lost during normal run, the ignition control repeats start sequence.

## Suffix BM and QM (see fig. 10.)

As AM and PM except a fixed or with potmeter adjustable start pressure occurs during the no flame detection period

## Suffix CM and RM (see fig. 11.)

When there is a call for heat the fan starts running through the no air position of the air proving switch after a self check period ( $T_c$ ) plus waiting period ( $T_w$ ). When sufficient air flow is proven by the air proving switch, the built-in igniter and gas valve are switched on.

The ignition spark ignites gas and resulting flame is detected by the flame rod.

Ignition is switched off after a predetermined extended ignition time and flame establishment.

If flame is not established within the safety time ( $T_s$ ), the ignition control locks out.

If the flame is lost during normal run, the ignition control repeats start sequence.

If air flow is lost during operation, a restart occurs.

## Suffix DM and TM (see fig. 11.)

As CM and RM except a fixed or with potmeter adjustable start pressure occurs during the no flame detection period

## Lock-out reset

The S4565 can be reset by either depressing the internal/external reset button (suffix AM, BM, CM and DM) or by interrupting the permanent life (suffix PM, QM, RM, and TM).

NOTE 1.: If during normal use the reset button is pressed, the gas valves drop out and the S4565 starts a new sequence after releasing the reset button.

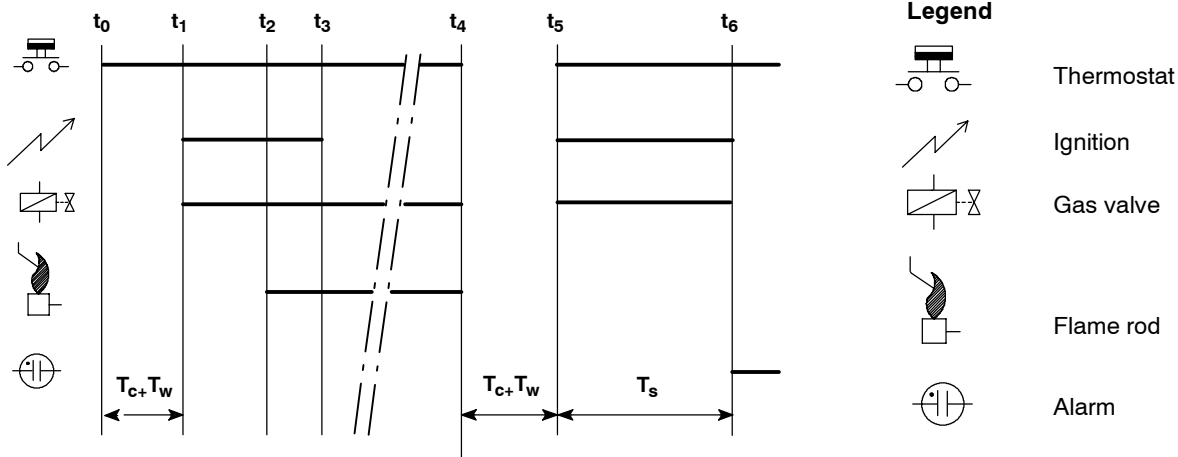


Fig. 10. Functional diagram S4565AM, BM, PM, QM

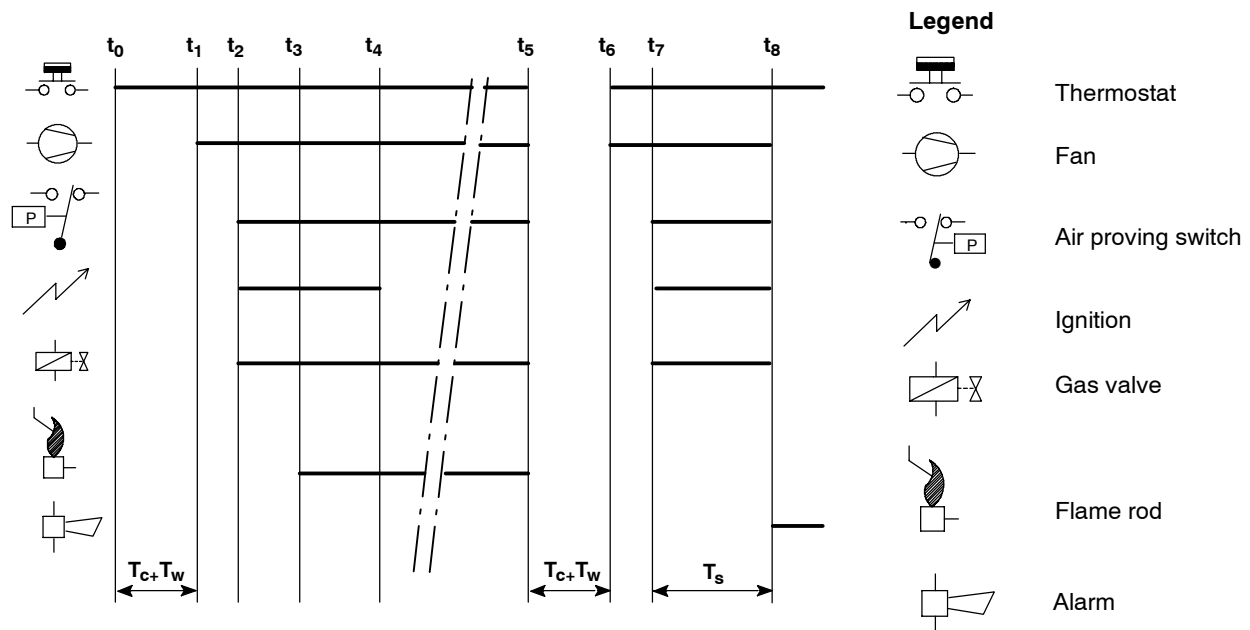


Fig. 11. Functional diagram S4565CM, DM, RM, TM

## GENERAL CONSIDERATIONS

To ensure reliable long term operation, mount ignition control at a position in the appliance with a low ambient temperature and a low radiation.

High temperatures will affect product life.

To suppress Radio Frequency Interference (RFI) the ignition control including spark igniter cabling should be mounted in sufficient shielded environment.

NOTE 2.: When first starting, the control can be in the lock-out condition; reset the ignition control. If a first reset is not succesful, wait at least 15 seconds before attempting another one. After a reset an extended waiting time will occur.

NOTE 3.: Electrical rating of connected controls and air proving switch should be appropriate for the load that is switched by the ignition control.

NOTE 4.: Power interruptions will cause program restart.

NOTE 5.: The flame connection pin of all types is protected against electrical shock.

NOTE 6.: If the ignition control incorporates an EMC filter, disconnect the ignition control from mains before performing a dielectric strength test.

NOTE 7.: If an automatic return high limit thermostat is used, the high limit switch in the application needs a longer return time than the trial for ignition time of the control. This in order to provide non volatile lock out.

NOTE 8.: The adjustable start pressure during ignition and modulation function of the S4565.M burner control units are non fail safe circuits. As a result the gas-technical safety of the appliance provided with a S4565.M burner

control unit should not rely on the proper functioning of the adjustable start pressure during ignition and modulation function of this burner control unit.

## INSTALLATION GAS CONTROL

### IMPORTANT

*Take care that installer is a trained experienced service man.*

*Turn off gas supply before starting installation.*

*Disconnect power supply to prevent electrical shock and/or equipment damage.*

*Do not remove seals covering valve inlet and outlet until ready to connect piping.*

*Take care that dirt cannot enter the gas control during handling.*

*Ensure gas flows in the same direction as the arrow on the bottom of the gas control.*

### Main gas connection

#### Flange connection

- Insert "O"-ring in the groove of each flange, if necessary grease "O"-ring slightly to keep it in place.
- Mount gas control between flanges using the four screws for each flange.

#### External thread connection G 1/2"

- ① With nut and flat sealing ring for pipe 14 mm (see fig 12.)

Nut: order number: ..... 45.900.447-005

Flat sealing ring size:  $\varnothing 18 \times \varnothing 10 \times 1.5$  mm:

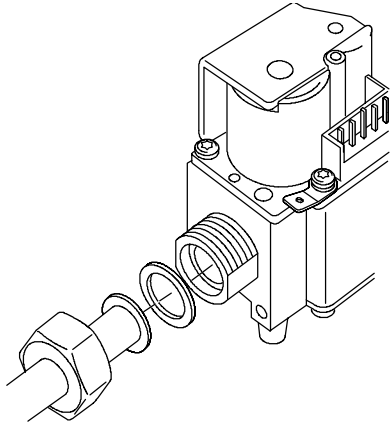
order number ..... 45.900.447-007

Fastening torque: maximum 40 Nm

minimum 25 Nm

Pipe end construction: see fig.: 13.

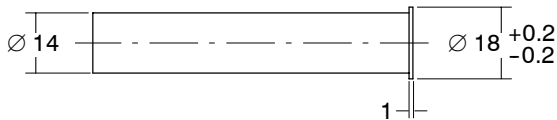
- ② **With nut and flat sealing ring for pipe 15 mm (see fig 12.)**  
 Nut: order number: ..... 45.900.447-004  
 Flat sealing ring size:  $\varnothing 18 \times \varnothing 10 \times 1.5$  mm  
     order number ..... 45.900.447-007  
 Fastening torque: maximum 40 Nm  
                           minimum 25 Nm  
 Pipe end construction: see fig.: 14.



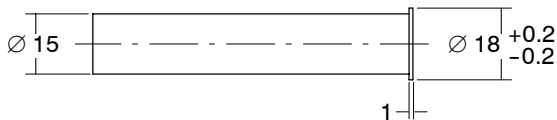
**Fig. 12. External thread G<sup>1/2</sup>” connection with nut and flat sealing ring**

**⚠ WARNING**

Fastening torque flat sealing ring only applicable for type Klingersil C4324



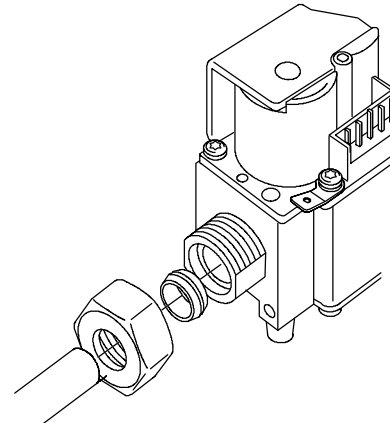
**Fig. 13. Pipe (dia 14 mm) for flat sealing ring connection**



**Fig. 14. Pipe (dia 15 mm) for flat sealing ring connection**

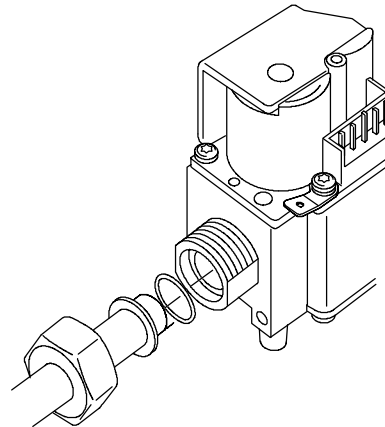
**External thread connection G<sup>3/4</sup>”**

- ① **With nut and olive for pipe 15 mm (see fig. 15.)**  
 Fastening torque: maximum 50 Nm  
                           minimum 30 Nm  
 Nut: order number: ..... 45.900.447-003  
 Olive shall be suitable for  $\varnothing 15$  mm pipe.  
 Olives for this application are not supplied by Honeywell.  
 Pipe end construction: square off end of tubing and remove burrs.



**Fig. 15. External thread connection with nut and olive**

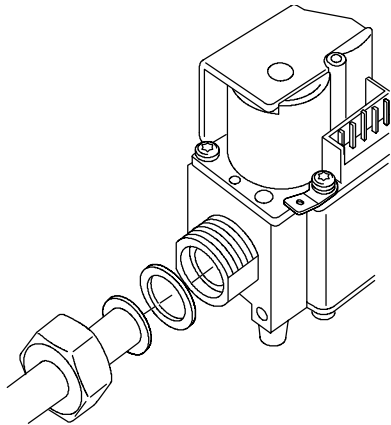
- ② **With nut and “O”-ring for pipe 15 mm (see fig 16.)**  
 Fastening torque: maximum 50 Nm  
                           minimum 10 Nm  
 Nut: order number: ..... 45.900.447-003  
 “O”-ring size:  $\varnothing 14.3 \times \varnothing 2.4$  mm  
     order number: ..... 45.900.447-001  
 Pipe end construction: see fig.: 18.



NOTE: Before fastening the nut be sure that the “O”-ring is proper placed on the pipe.

**Fig. 16. External thread connection with nut and “O”-ring**

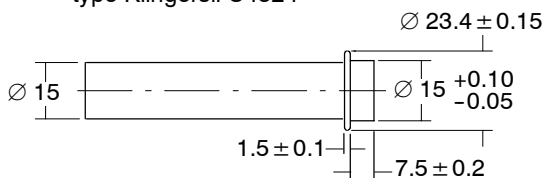
- ③ **With nut and flat sealing ring for pipe 15 mm (see fig 17.)**  
 Fastening torque: maximum 50 Nm  
                           minimum 30 Nm  
 Nut: ordernumber: ..... 45.900.447-003  
 Flat sealing ring size:  $\varnothing 24 \times \varnothing 16 \times 1.5$  mm  
     order number: ..... 45.900.447-006  
 Pipe end construction: see fig.: 19.
- ④ **With nut and flat sealing ring for pipe 18 mm (see fig 17.)**  
 Fastening torque: maximum 50 Nm  
                           minimum 30 Nm  
 Nut: order number: ..... 45.900.447-002  
 Flat sealing ring size:  $\varnothing 24 \times \varnothing 16 \times 1.5$  mm  
     order number: ..... 45.900.447-006  
 Pipe end construction: see fig.: 20.



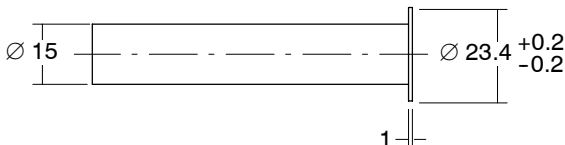
**Fig. 17. External thread connection with nut and flat sealing ring**

## WARNING

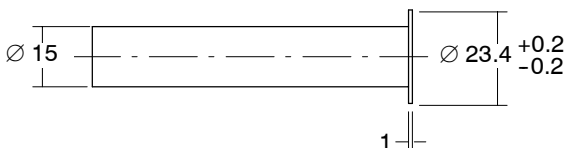
Fastening torque flat sealing ring only applicable for type Klingersil C4324



**Fig. 18. Pipe end for "O"-ring connection for G 3/4" external thread**



**Fig. 19. Pipe (dia 15 mm) for flat sealing ring connection for G 3/4" external thread**



**Fig. 20. Pipe (dia 18 mm) for flat sealing ring connection for G 3/4" external thread**

### Pressure feedback connection

## WARNING

To avoid decreasing of performance of pressure regulator by pinching off the pressure feedback tubing, it is recommended to use a metal tubing.

### Perform gas leak test

## WARNING

**FIRE OR EXPLOSION HAZARD CAN CAUSE PROPERTY DAMAGE, SEVERE INJURY OR DEATH**

Check for gas leaks with a rich soap and water solution any time work is done on a gas control.

### Gas leak test

- Paint all pipe connections upstream of the gas control with a rich soap and water solution. Bubbles indicate a gas leak.
- If a gas leak is detected, tighten the pipe connection.
- Stand clear while lighting the main burner to prevent injury caused from hidden gas leaks, which could cause flashback in the appliance vestibule. Light the main burner.
- With the main burner in operation, paint all pipe joints (including adapters) and gas control inlet and outlet with a rich soap and water solution an approved leak detection fluid.
- If another gas leak is detected, tighten adapter screws, joints and pipe connections.
- Replace the part if gas leak can not be stopped.

### Electrical connections

#### IMPORTANT

*Disconnect power supply to prevent electrical shock and/or equipment damage.*

*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 ignition control can be in lock out; depress reset button to free control.*

## CAUTION

Do not connect the ignition control to power supply when is not connected to the gas control

If ignition frequency > 25 Hz the ignition cable and its connections shall be protected against electrical shock.

### Wiring

- Use leadwire which can withstand 105 °C ambient.
- Use leadwire which is proven against moisture.
- Wiring between ignition control and spark sensing probe should have good quality insulation, suitable for the temperatures encountered.

### Fusing

In order to prevent unsafe conditions at too high current, the ignition control has two integral non replaceable fuses. This fuse will be blown long before the maximum 16 A external fuse switches off.

### Spark gap

Max. allowable spark gap 3.5 mm

### Supply voltage polarity for phase dependant versions

## WARNING

If ignition control seems to operate normally but does not detect flame, check for right polarity of power supply (line, neutral).

If there is no sufficient flame current due to phase-phase mains it is recommendable to use a phase independant version.

## 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.

### Outlet pressure adjustment on/off versions (see fig. 1.)

- Disconnect pressure feedback connection (if applicable)
- Start-up appliance in order to have gas input to burner and make sure appliance is running at maximum heat demand.
- Check gas input to the appliance using a clocking gas meter or alternatively a pressure gauge connected to the outlet pressure tap.
- Remove cap screw to expose pressure regulator adjustment screw.
- Slowly turn adjustment screw with a suitable small screw driver until the burner pressure required is recorded on the pressure gauge. Turn adjustment screw clockwise to increase or counter-clockwise to decrease gas pressure to the burner.
- For non-regulating mode (LP gas) turn adjustment screw clockwise until it stops.
- Replace pressure regulator cap screw.
- Connect pressure feedback connection (if applicable).

### Setting of minimum rate

- Disconnect PWM input signal.
- Make sure appliance is running
- Check gas input to the appliance using a clocking gas meter or alternatively a pressure gauge connected to the outlet pressure tap.
- Turn adjustment screw clockwise to decrease the minimum gas flow or counter-clockwise to increase the gas flow to the desired value.
- Connect PWM input signal.

### Adjustment of ignition pressure during ignition.

- Disconnect flame detection or connect it to earth.
- Start up boiler, during the safety time the ignition pressure can be set by the thumb wheel.
- Reset the appliance if necessary and check/readjust until the desired ignition pressure is set.
- Allow 15 seconds recovery time between two start attempts.
- Check if ignition pressure is correct.
- Connect the flame detection.

NOTE: For the best accuracy keep following sequence:

- ① Make minimum rate setting.
- ② Set the adjustable ignition pressure during ignition.

### Checking flame current

- For phase **dependant** versions the minimum value should be 0.9  $\mu$ A.
- For phase **independant** versions the minimum value should be 0.5  $\mu$ A.
- To check flame current connect a DC micro-Ampèremeter between flame sensing wire and flame sensing rod.
- If flame current is insufficient check that flame sensing rod is fully enveloped by the flame.

### Final checkout of the installation

Set appliance in operation after any adjustment and observe several complete cycles to ensure that all burner components function correctly.