Honeywell

krom schroder

Tightness controls TC

TECHNICAL INFORMATION

- Adjustable test period which can be adapted to different systems
- Adjustable test instant allows quick system start
- Maximum safety thanks to self-monitoring electronics



Safety manual for products complying with EN 61508-2

EN
Edition 03.23
03250636

ПРОМЭЛЕКТРОНИКА / sales@prom-elec.com

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1 Application



TC 1, TC 2



TC 3

The tightness control TC checks the fail-safe function of both valves before each start-up or after each shut-down of a system with two safety valves.

The aim is to identify an inadmissible leak on one of the gas valves and to prevent burner start. The other gas valve continues working properly and takes over the safe shut-off of the gas supply.

It is used in industrial thermoprocessing equipment, on boilers and on forced draught burners.

Standards ISO 13577-2, EN 746-2 and EN 676 stipulate tightness controls for capacities over 1200 kW (NFPA 86: from 117 kW or 400,000 Btu/h in conjunction with a visual indicator).

Pre-purge of the combustion chamber can be dispensed with under certain conditions in accordance with EN 746-2 if a tightness control is used. In this case, the system must be vented into a safe area.

TC 1V, TC 1C

Tightness control TC 1V can be directly flange-mounted to all valVario controls. There is only one version for all sizes.

TC 1C can be used for combination controls CG 1 to 3. An adapter plate is supplied for installation.

TC 2

Tightness control TC 2 can be used with gas solenoid valves of any nominal size, which are quick opening or slow opening with start rate. It is possible to conduct a tightness test on pneumatically operated or slow opening valves without start rate by using additional auxiliary valves.

Slow opening motorized valves VK up to DN 65 which are directly flanged together can also be checked by the TC 2 within a temperature range of 0 to 60°C (32 to 140°F).

An adapter plate is provided for installation of the TC 2.

TC 3

Tightness control TC 3 is a universal device for quick and slow opening gas solenoid valves of any nominal size as

well as for motorized valves. The tightness test is carried out with the valves installed in the TC 3.

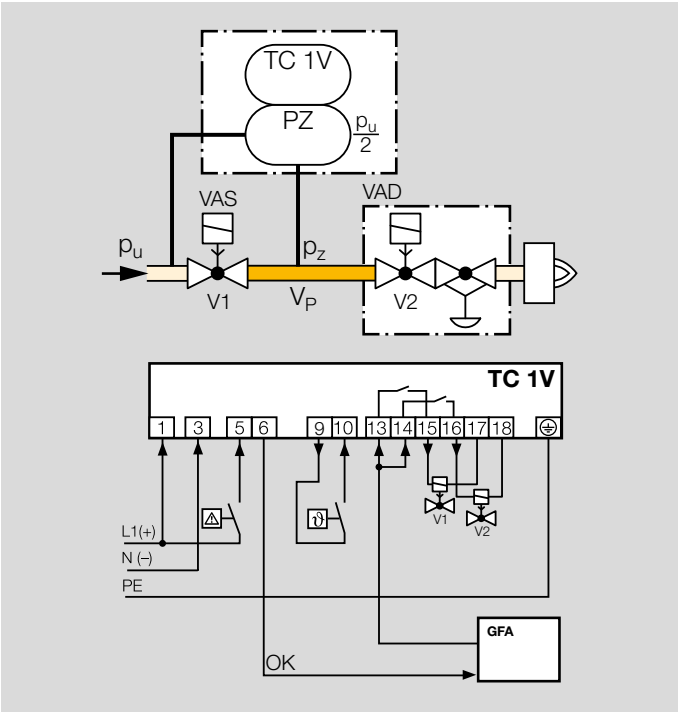


TC 1V on a valVario double solenoid valve

1.1 Application examples

Legend:
PZ = internal pressure sensor of the TC for the comparison of inlet pressure p_u and interspace pressure p_z
p_d = outlet pressure
V_P = test volume

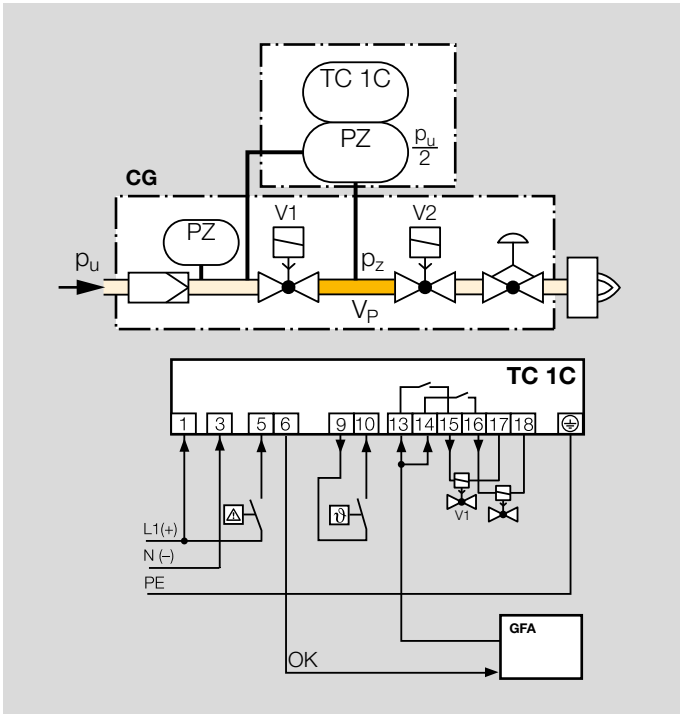
1.1.1 TC 1V with valVario controls



Mains voltage = control voltage
V1: quick or slow opening valve with start rate.
V2: pressure regulator with solenoid valve.

Tightness control TC 1V checks gas solenoid valves V1 and V2 and the pipe between the valves for tightness. If both valves are tight, the TC forwards the OK enable signal to the automatic burner control unit GFA. This opens valves V1 and V2 simultaneously. The burner starts.

1.1.2 TC 1C with combination control CG..D or CG..V

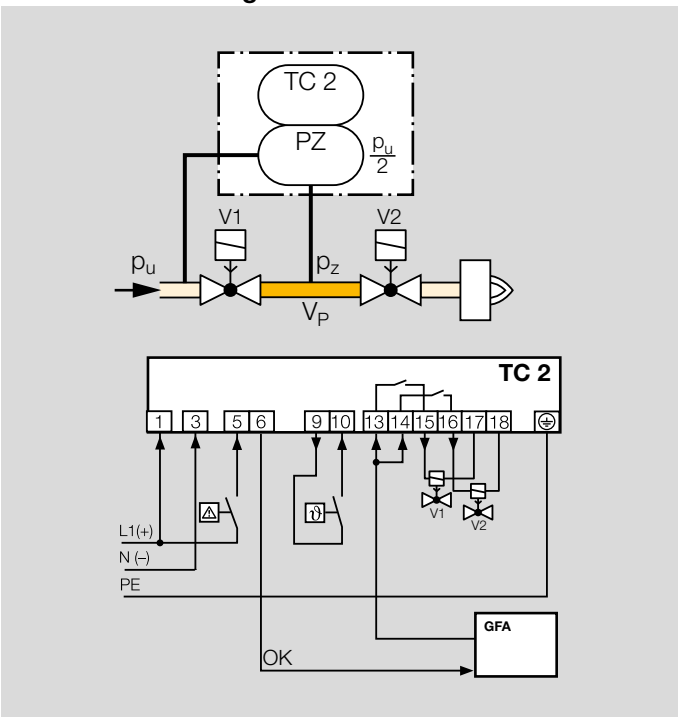


Mains voltage = control voltage
V1 and V2: quick opening valves.

TC 1C is directly flange-mounted to combination control CG..D or CG..V and checks gas solenoid valves V1 and V2 in the combination control for tightness.

Once the tightness test has been carried out successfully, the tightness control forwards the OK enable signal to the automatic burner control unit GFA. This opens valves V1 and V2 in the combination control CG simultaneously. The burner starts.

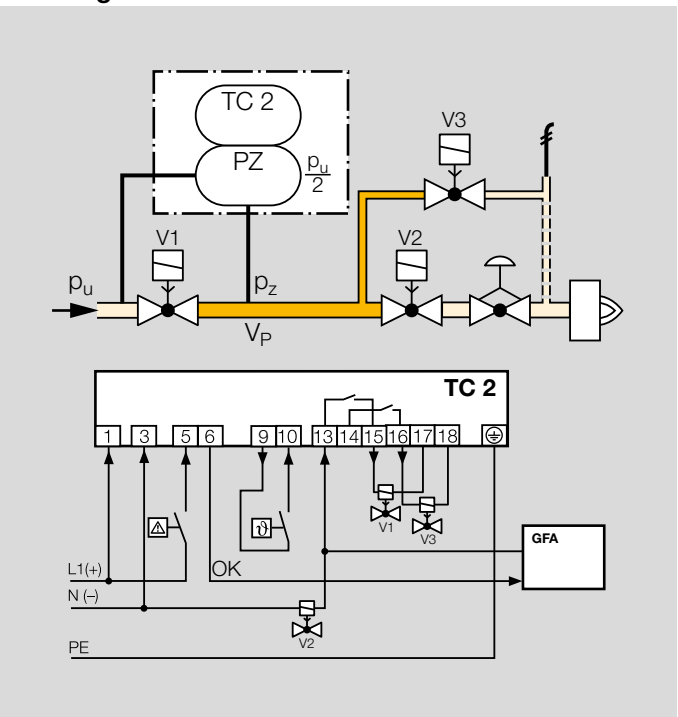
1.1.3 TC 2 with two gas solenoid valves



Mains voltage = control voltage
V1 and V2: quick or slow opening valves with start rate.

TC 2 checks gas solenoid valves V1 and V2 and the pipe between the valves for tightness. If both valves are tight, the TC forwards the OK enable signal to the automatic burner control unit GFA. This opens valves V1 and V2 simultaneously. The burner starts.

1.1.4 TC 2 with two gas solenoid valves, a gas pressure regulator and an auxiliary valve for discharge



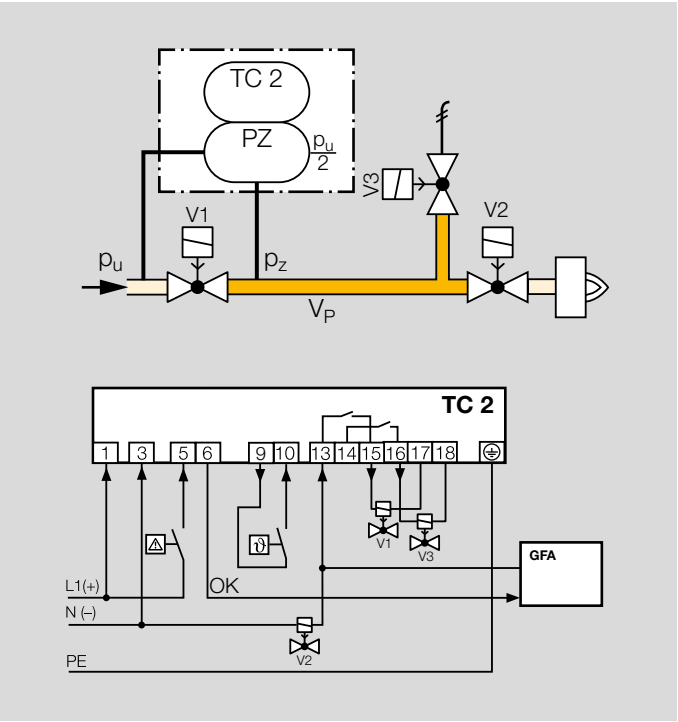
Mains voltage = control voltage
V1 and V2: quick or slow opening valves with start rate.
V3: quick or slow opening valve with start rate,
nominal size is dependent on test volume V_P and inlet pressure p_u, but is at least DN 15.
See project planning information, page 24 (5.8 Auxiliary valves).

TC 2 checks gas solenoid valves V1, V2, the auxiliary valve V3 and the pipe between the valves for tightness.

It must be ensured that the interspace p_z is vented during the 3-second opening time. This is not guaranteed by the gas pressure regulator downstream of V2. A relief line is thus used to discharge the test volume V_P safely into the combustion chamber or into a safe area. Auxiliary valve V3 can also be used as a pilot gas valve. Since valve V2 remains closed during the test, it can also be a slow opening motorized valve VK.

Once the tightness test has been carried out successfully, the tightness control forwards the OK enable signal to the automatic burner control unit GFA. The GFA opens the gas solenoid valves V1 and V2 simultaneously. The burner starts.

1.1.5 TC 2 with two gas solenoid valves and one auxiliary valve for discharge



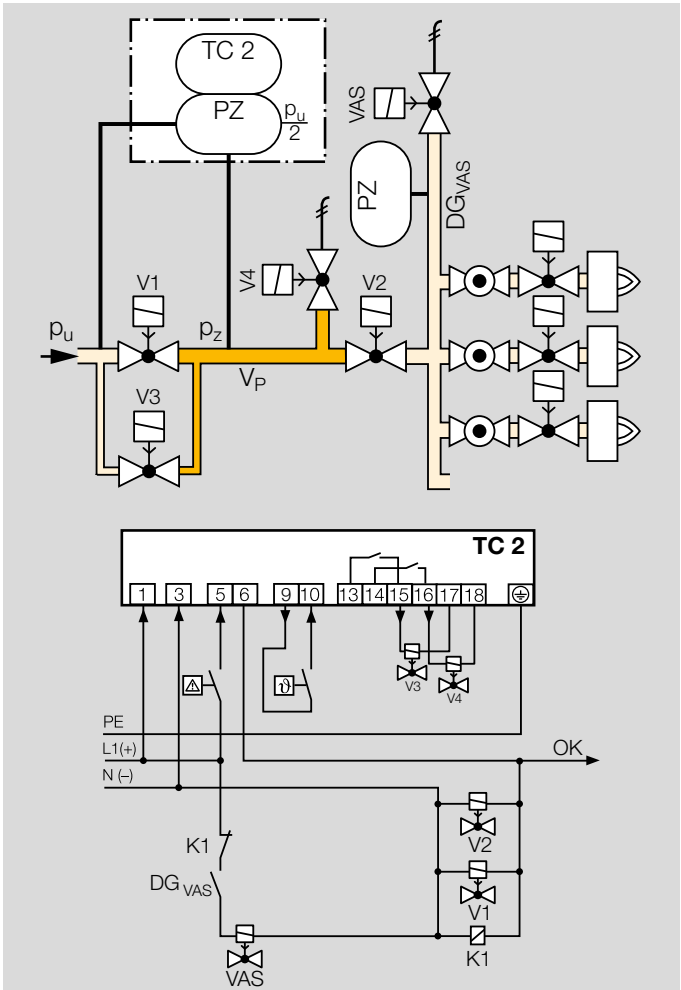
Mains voltage = control voltage
V1: quick or slow opening valve with start rate.
V2: any. V3: quick opening,
nominal size is dependent on test volume V_P and inlet pressure p_u, but is at least DN 15.
See project planning information, page 24 (5.8 Auxiliary valves).

TC 2 checks gas solenoid valves V1, V2, the auxiliary valve V3 and the pipe between the valves for tightness.

If all the gas solenoid valves are tight, the tightness control forwards the OK enable signal to the automatic burner control unit GFA. The GFA opens the gas solenoid valves V1 and V2 simultaneously. The burner starts.

A relief line is used to discharge the test volume V_P into a safe area. Thanks to the installed auxiliary valve V3, valve V2 can also be a slow opening motorized valve VK.

1.1.6 TC 2 in a multiple burner system



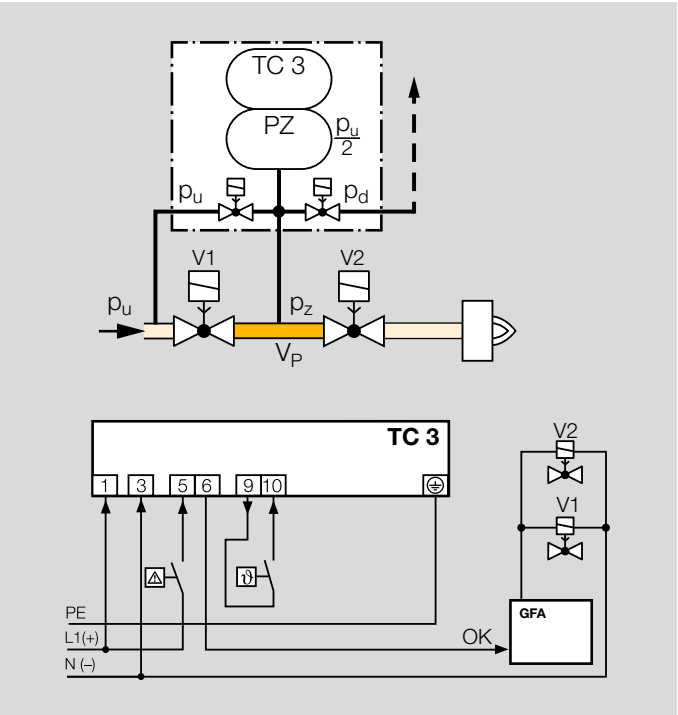
Mains voltage = control voltage
V3 and V4: quick or slow opening valves with start rate, nominal size is dependent on test volume V_P and inlet pressure p_u, but is at least DN 15.
See page 23 (5 Project planning information).

When using slow opening main valves (V1 and V2), auxiliary valves (V3 and V4) must be used for the supply and discharge of the test volume V_P.

TC 2 checks the central shut-off valve V1, the gas solenoid valve V2, the auxiliary valves V3 and V4 and the pipe between these valves for tightness. Valve V2 can only be checked for tightness when the pressure downstream of V2 approximately corresponds to the atmospheric pressure and the volume downstream of valve V2 is 5 x V_P. The gas solenoid valve VAS and the pressure switch DG_{VAS} are used to relieve the pressure. The pressure switch must be adjusted in such a way so that enough pressure is relieved and no air can get into the pipework.

Once the tightness test has been carried out successfully, the TC 2 opens the main valves V1 and V2 with the OK enable signal and enables the downstream burner control units.

1.1.7 TC 3 with two gas solenoid valves



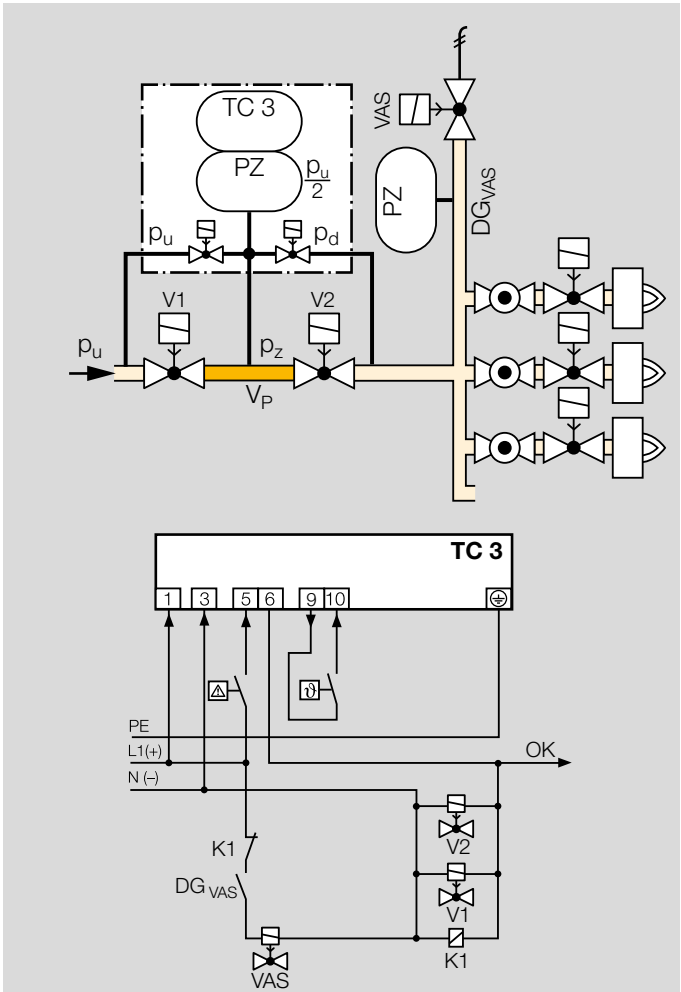
TC 3 checks the slow opening valves V1 and V2 and the pipe between these valves for tightness.

The test volume V_P is supplied and discharged via the TC 3 auxiliary valves and routed to a safe area using a relief line.

Valve V2 can only be checked for tightness when the pressure downstream of V2 approximately corresponds to the atmospheric pressure and the volume downstream of valve V2 is 5 x V_P.

Once the tightness test has been carried out successfully, the TC 3 forwards the OK enable signal to the downstream automatic burner control unit. The burner control unit then opens gas valves V1 and V2.

1.1.8 TC 3 in a multiple burner system with several valves installed in series



TC 3 checks the slow opening main valves V1 and V2 and the pipe between these valves for tightness.

The test volume V_P is supplied and discharged via the TC 3 auxiliary valves.

Valve V2 can only be checked for tightness when the pressure downstream of V2 approximately corresponds to the atmospheric pressure and the volume downstream of valve V2 is 5 x V_P. The gas solenoid valve VAS and the pressure switch DG_{VAS} are used to relieve the pressure. The pressure switch must be adjusted in such a way so that enough pressure is relieved and no air can get into the pipework.

Once the tightness test has been carried out successfully, the TC 3 opens the main valves V1 and V2 with the OK enable signal and enables the downstream burner control units.

2 Certification

Certificates – see www.docuthek.com

Certified to SIL and PL





For systems up to SIL 3 pursuant to EN 61508 and PL e pursuant to ISO 13849. See page 34 (11 Safety-specific characteristic values for SIL and PL).

EU certified



- 2014/35/EU (LVD), Low Voltage Directive
- 2014/30/EU (EMC), Electromagnetic Compatibility Directive
- 2011/65/EU, RoHS II
- 2015/863/EU, RoHS III
- (EU) 2016/426 (GAR), Gas Appliances Regulation
- EN 1643:2014
- EN 60730-2-5:2015
- EN 61508:2010, Parts 1–7 for Safety Integrity Level SIL 3

AGA approved



Australian Gas Association, Approval No.: 8618.
www.aga.asn.au

2.1 Eurasian Customs Union



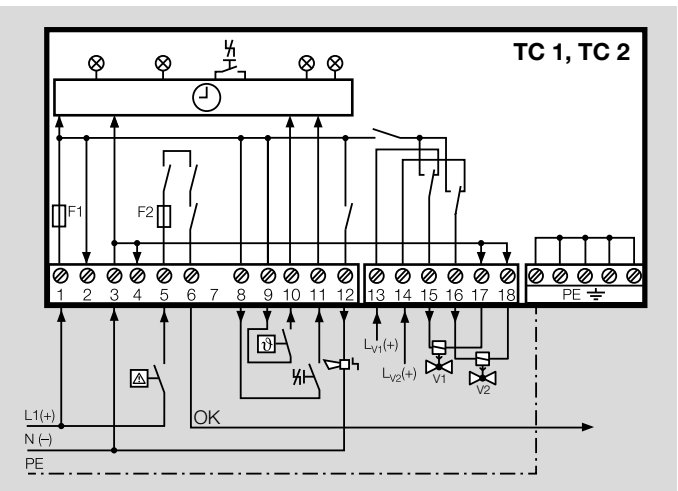
The products TC meet the technical specifications of the Eurasian Customs Union.

3 Function

3.1 Connection diagram for TC 1, TC 2

V1 = inlet valve,
V2 = outlet valve.

Mains voltage and control voltage:
24 V DC/120 V AC/230 V AC



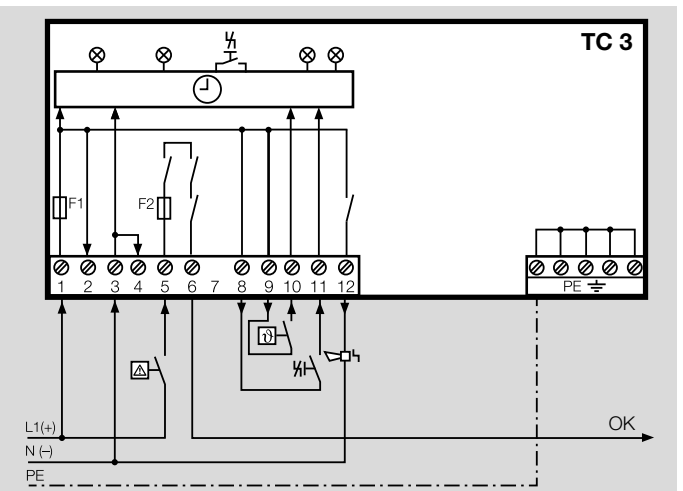
TC 1.. W/W, TC 1.. Q/Q, TC 1.. K/K,
TC 2.. W/W, TC 2.. Q/Q or TC 2.. K/K

Remote reset by applying control voltage to terminal 11 or via a floating contact between terminals 8 and 11.

3.2 Connection diagram for TC 3

The tightness test is carried out with the auxiliary valves installed on the TC 3 (pre-wired). The terminals for the valve inputs remain vacant.

Mains voltage and control voltage:
24 V DC/120 V AC/230 V AC



TC 3.. W/W, TC 3.. Q/Q or TC 3.. K/K

Remote reset by applying control voltage to terminal 11 or via a floating contact between terminals 8 and 11.

3.3 Test procedure

Depending on the pressure between the valves p_z, the tightness control TC carries out a check using test procedure **A** or **B**:
If pressure $p_z > p_u/2$, program A starts,
if pressure $p_z < p_u/2$, program B starts.

Test procedure A

Valve V1 opens for the opening time t_L = 3 s and closes again. During the measurement time t_M, the tightness control checks the pressure p_z between the valves.

If pressure p_z is less than half the inlet pressure $p_u/2$, valve V2 is leaking.

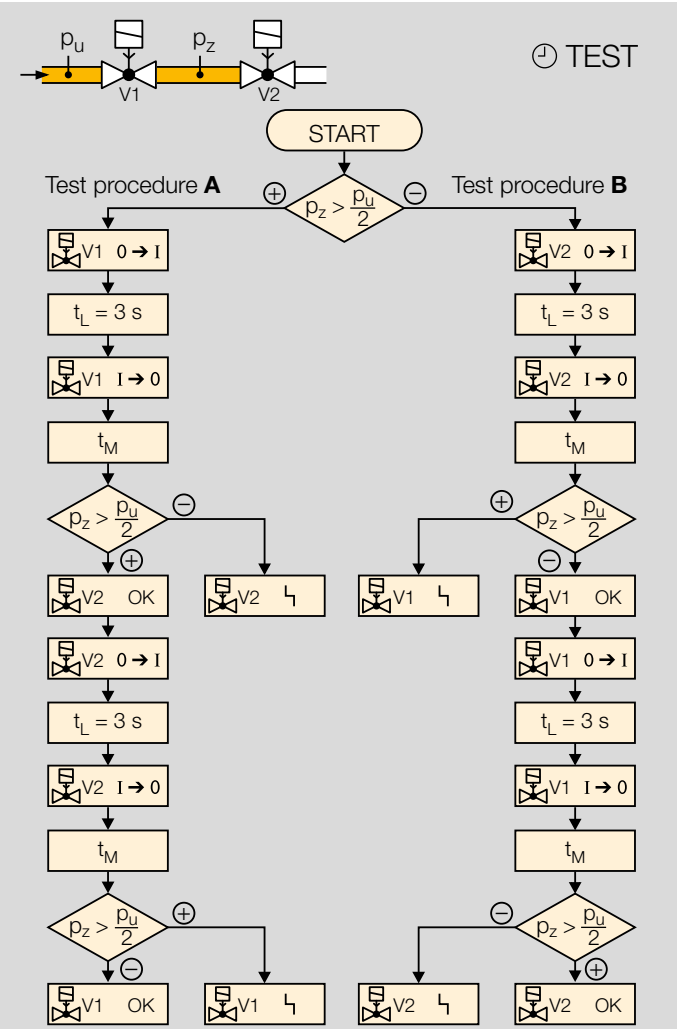
If pressure p_z is greater than half the inlet pressure $p_u/2$, valve V2 is tight. Valve V2 is opened for the set opening time t_L. V2 closes again.

During the measurement time t_M, the tightness control checks the pressure p_z between the valves.

If pressure p_z is greater than half the inlet pressure $p_u/2$, valve V1 is leaking.

If pressure p_z is less than half the inlet pressure $p_u/2$, valve V1 is tight.

The tightness test can only be performed if the pressure downstream of V2 is around atmospheric pressure.



Test procedure B

Valve V2 opens for the opening time t_L = 3 s and closes again. During the measurement time t_M, the tightness control checks the pressure p_z between the valves.

If pressure $p_z > p_u/2$, valve V1 is leaking.

If pressure $p_z < p_u/2$, valve V1 is tight. Valve V1 is opened for the set opening time t_L. V1 closes again.

During the measurement time t_M, the tightness control checks the pressure p_z between the valves.

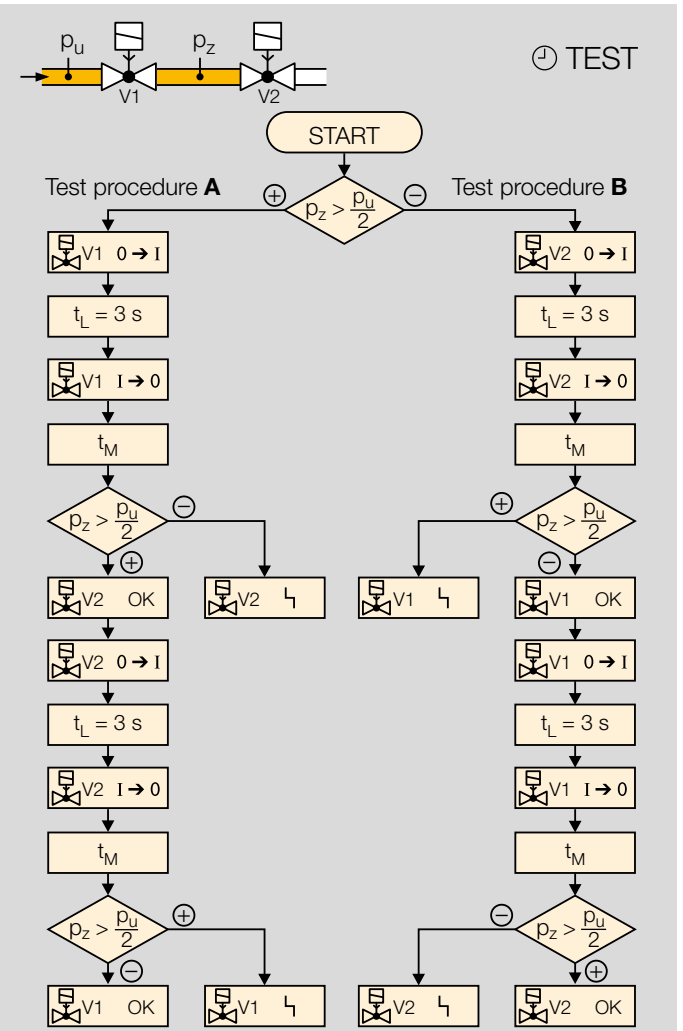
If pressure $p_z < p_u/2$, valve V2 is leaking.

If pressure $p_z > p_u/2$, valve V2 is tight.

The tightness test can only be performed if the pressure downstream of V2 is around atmospheric pressure and the volume downstream of V2 is at least 5 x higher than the volume between the valves.

If the power fails briefly during the test or during operation, the TC will restart in accordance with the test procedure described above.

If there is a fault message, the fault is displayed again after a power failure.

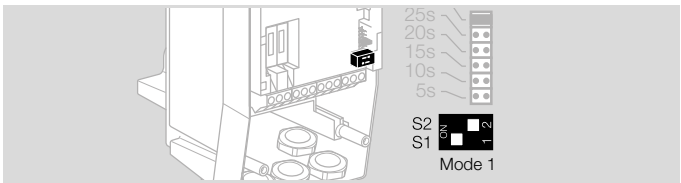


3.4 Setting the test instant

Two DIP switches are used to determine whether the tightness of the gas solenoid valves is to be checked before burner run, after burner run, or before and after burner run.

3.4.1 Mode 1: testing before burner run

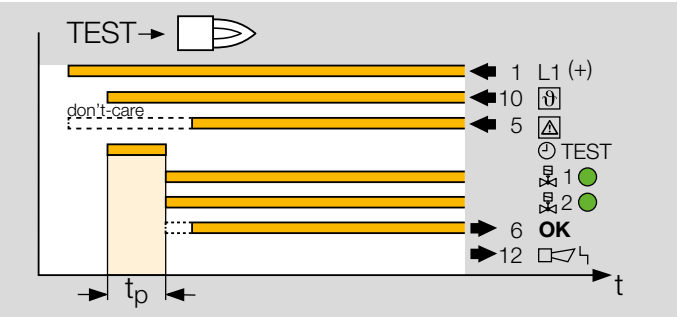
Mode 1 = factory setting.



Mains voltage L1 is switched on. In the case of untested valves, the LEDs 1 and 2 are permanently yellow.

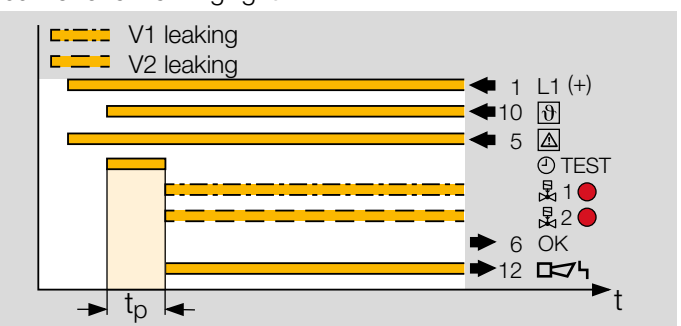
The tightness test starts with incoming thermostat/start-up signal . If the valves are tight, the LEDs 1 and 2 are permanently green. Once the safety interlock input signal is active, the OK enable signal is forwarded to the automatic burner control unit.

The tightness test is valid for up to 24 hours. If the safety interlock input signal is not connected during this time, the test is started again with the application of the safety interlock input signal. Once the test has been completed successfully, the OK enable signal is issued.

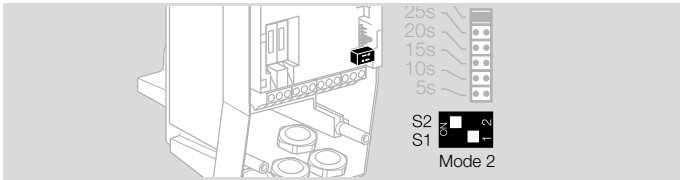


Leaks

If the tightness control TC detects a leak on one of the two valves, the red LED lights up for a fault on 1 or on 2 . A fault is signalled externally , e.g. by switching on a buzzer or a warning light.



3.4.2 Mode 2: testing after burner run

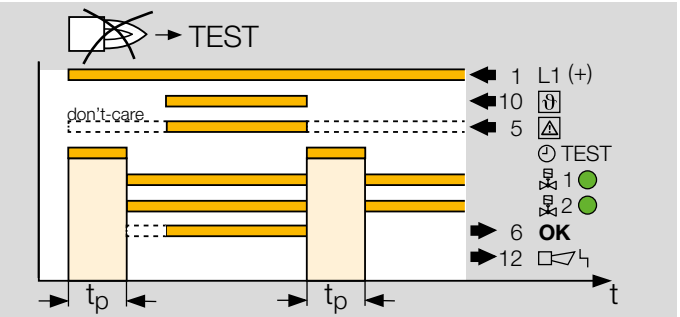


The tightness test after burner run begins as soon as the burner is switched off.

To ensure that the valves are checked for tightness once before starting up the system, the tightness test runs when the mains voltage (L1) is applied or after a reset. If the valves are tight, the LEDs 1 and 2 are permanently green. The OK enable signal is not forwarded to the automatic burner control unit until the thermostat/start-up signal and the safety interlock input signal have been applied.

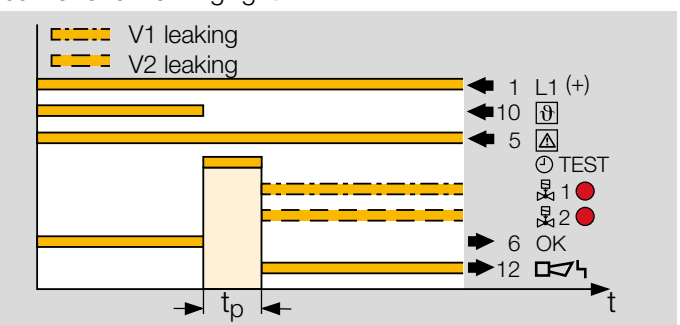
The tightness test after burner run starts when the thermostat/start-up signal drops. The OK enable signal is not forwarded to the automatic burner control unit again until the thermostat/start-up signal and the safety interlock input signal have been re-applied.

The tightness test is valid for 24 hours. If the thermostat/start-up signal and the safety interlock input signal are connected during this time, a new tightness test must not be carried out before burner run and the OK enable signal is set. However, if the 24 hours have elapsed, a new tightness test is carried out before burner run.

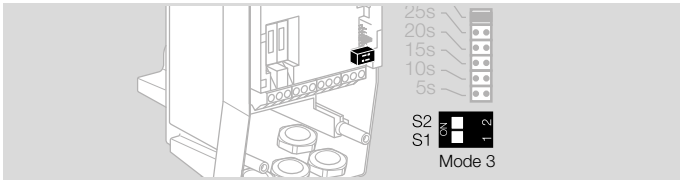


Leaks

If the tightness control TC detects a leak on one of the two valves, the red LED lights up for a fault on 1 or on 2 . A fault is signalled externally, e.g. by switching on a buzzer or a warning light.



3.4.3 Mode 3: testing before and after burner run

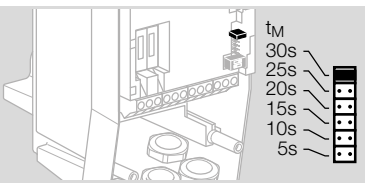


The first test is carried out before burner run (as with Mode 1): the tightness test starts with incoming thermostat/start-up signal . If the valves are tight, the LEDs 1 and 2 are permanently green. Once the safety interlock input signal is active, the OK enable signal is forwarded to the automatic burner control unit, see page 17 (3.4.1 Mode 1: testing before burner run).

The second test is carried out after burner run (as with Mode 2): The tightness test after burner run starts when the thermostat/start-up signal drops, see page 18 (3.4.2 Mode 2: testing after burner run).

3.5 Setting the measurement time t_M

The sensitivity of the tightness control TC can be adjusted by adapting the measurement time t_M for each individual system. The longer the measurement time t_M, the greater the sensitivity of the tightness control. The longer the measurement time, the smaller the leakage rate at which a safety shut-down/fault lock-out is triggered.



The measurement time can be set with a jumper to between 5 s and max. 30 s.

30 s = factory setting

No jumper: no function. LED ⏻ is permanently red.

3.6 Determining the measurement time

If a leakage rate is specified, find the measurement time t_M from the following:
$Q_{max.}$ = max. flow rate [m^3/h]
$Q_L = Q_{max.}$ [m^3/h] x 0.1% = leakage rate [l/h]
p_u = inlet pressure [mbar]
V_P = test volume [l]

$$t_M\,[s] = \frac{2{,}5 \times p_u\,[mbar] \times V_P\,[l]}{Q_L\,[l/h]}$$

For all CG versions, measurement time t_M must be set to 5 s on TC 1C.

3.6.1 Calculation of the measurement time

A web app for calculating the measurement time t_M is available at www.adlatus.org.

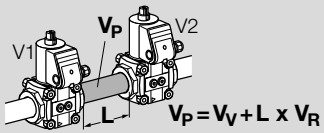
3.7 Calculating the entire test period

The entire test period t_P is made up of the measurement times t_M of both valves and the fixed opening time t_L of both valves together.

$$t_P\,[s] = 2 \times t_L + 2 \times t_M$$

3.8 Determining the test volume

Test volume V_P is calculated from the valve volume V_V, added to the volume of the pipe V_R for each additional metre in length L.



Valves	Valve volume V_V [l]	Nominal size DN	Pipe volume V_R [l/m]
VG 10	0.01	10	0.1
VG 15	0.05	15	0.2
VG 20	0.10	20	0.3
VG 25	0.11	25	0.5
VG 40/VK 40	0.64	40	1.3
VG 50/VK 50	1.61	50	2
VG 65/VK 65	2.86	65	3.3
VG 80/VK 80	4	80	5
VG 100/VK 100	8.3	100	7.9
VK 125	13.6	125	12.3
VK 150	20	150	17.7
VK 200	42	200	31.4
VK 250	66	250	49
VAS 125	0.08		
VAS 240	0.27		
VAS 350	0.53		
VAS 665	1.39		
VAS 780	1.98		
VAS 8100	3.32		
VAS 9125	5.39		
VCS 125	0.05		
VCS 240	0.18		
VCS 350	0.35		
VCS 665	1.15		
VCS 780	1.41		
VCS 8100	2.85		
VCS 9125	4.34		

3.9 Determining the leakage rate

If no leakage rate Q_L is specified, we recommend the max. possible test period/measurement time is set.

It is possible to check a specific leakage rate Q_L using the TC. Within the European Union, the maximum leakage rate Q_L is 0.1% of the maximum flow rate $Q_{(n)\ max.}$ [m^3/h].

$$Q_L\ [l/h] = \frac{Q_{(n)\ max.}\ [m^3/h] \times 1000}{1000}$$

If a low leakage rate Q_L is to be detected, a long test period/measurement time must be set.

4 Selection

4.1 ProFi

A web app selecting the correct product is available at www.adlatus.org.

4.2 Selection table

Description	Code	TC 1V	TC 1C	TC 2	TC 3	Condition
Attachment type						
For attachment to valVario	**V**	•				
For attachment to CG	**C**		•			
For quick opening individual valves	**2**			•		
For quick or slow opening individual valves	**3**				•	
Pipe connection						
Rp internal thread	**R**			•	•	
NPT internal thread	**N**			•	•	For 120 and 24 V
Inlet pressure						
p_u max. 500 mbar	**05**	•	•	•	•	
Mains voltage						
230 V AC, 50/60 Hz	**W**	•	•	•	•	
120 V AC, 50/60 Hz	**Q**	•	•	•	•	
24 V DC	**K**	•	•	•	•	
Control voltage						
230 V AC, 50/60 Hz	**/W**	•	•	•	•	Mains voltage = control voltage: TC..W/W
120 V AC, 50/60 Hz	**/Q**	•	•	•	•	Mains voltage = control voltage: TC..Q/Q
24 V DC	**K**	•	•	•	•	Mains voltage = control voltage: TC..K/K

Order example

TC 1V05W/W

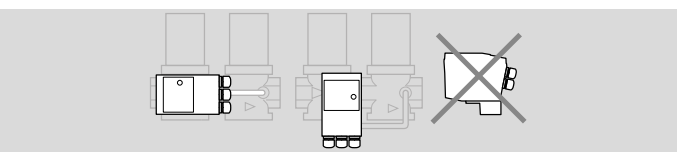
5 Project planning information

5.1 Start rate

The tightness control TC requires a minimum start rate in order to carry out tightness tests on slow opening valves:
up to 5 l (1.3 gal) test volume V_P =
5% of maximum flow rate $Q_{max.}$,
up to 12 l (3.12 gal) test volume V_P =
10% of maximum flow rate $Q_{max.}$.

5.2 Installation

Installation in the vertical or horizontal position, housing cover/indicators must not point upwards or downwards. The electrical connection should preferably be pointing downwards or towards the outlet.



Condensation must not be allowed to get into the housing.

The unit may only be stored/installed in enclosed rooms/buildings.

The housing must not be in contact with masonry. Minimum clearance 20 mm (0.8").

5.3 TC 1V for solenoid valves for gas VAS, VCx

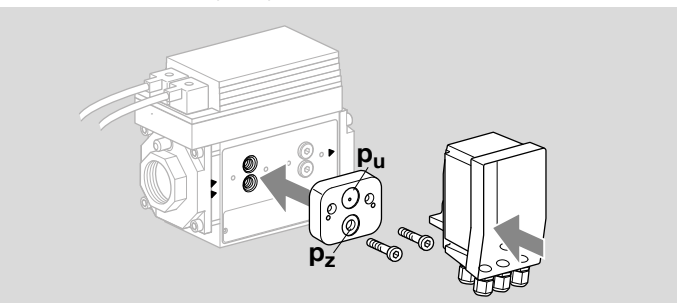
The valve actuator cannot be rotated on gas solenoid valves with a proof of closure switch VCx..S or VCx..G.

When using a valve/pressure regulator combination VCG/VCV/VCH, the pressure regulator must be activated with air during the entire test period t_P. This ensures that the space between the valves can be filled and vented.

A TC and a bypass/pilot gas valve cannot be fitted together on the same attachment side of the VAS or VCx.

5.4 TC 1C for combination controls CG

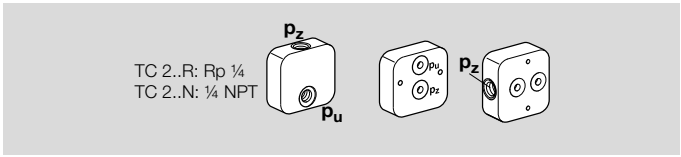
An adapter plate is supplied for mounting the TC 1C to a combination control CG. The connections for p_u and p_z are marked on the adapter plate.



5.5 Mounting TC 2

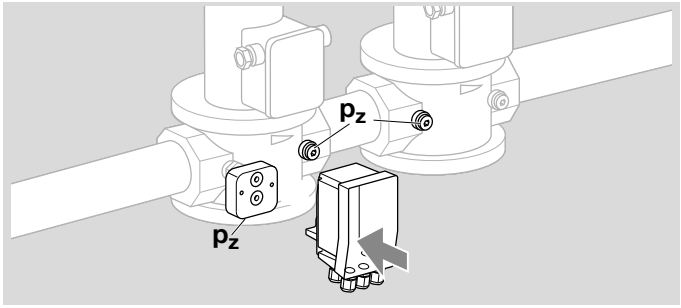
The TC is connected to the inlet pressure connection p_u and the interspace pressure connection p_z of the inlet valve.

An adapter plate is supplied for mounting the TC 2 to a gas solenoid valve. The connections for p_u and p_z are marked on the adapter plate.



We recommend using Ermeto screw couplings to attach the adapter plate to the gas solenoid valve.

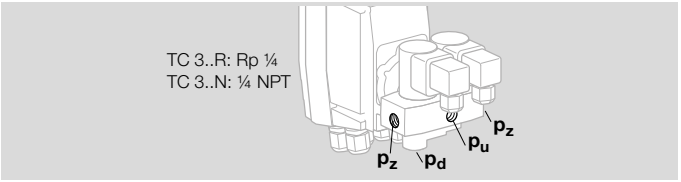
Connect the interspace pressure connection p_z on the adapter plate to the space between the valves using a 12 x 1.5 or 8 x 1 pipe.



5.6 Mounting TC 3

The TC is connected to the inlet pressure connection p_u, the interspace pressure connection p_z and the outlet pressure connection p_d of the inlet valve.

Ensure that connections p_u, p_z and p_d on the TC are not reversed.



Use a 12 x 1.5 or 8 x 1 pipe for the pipe connections.

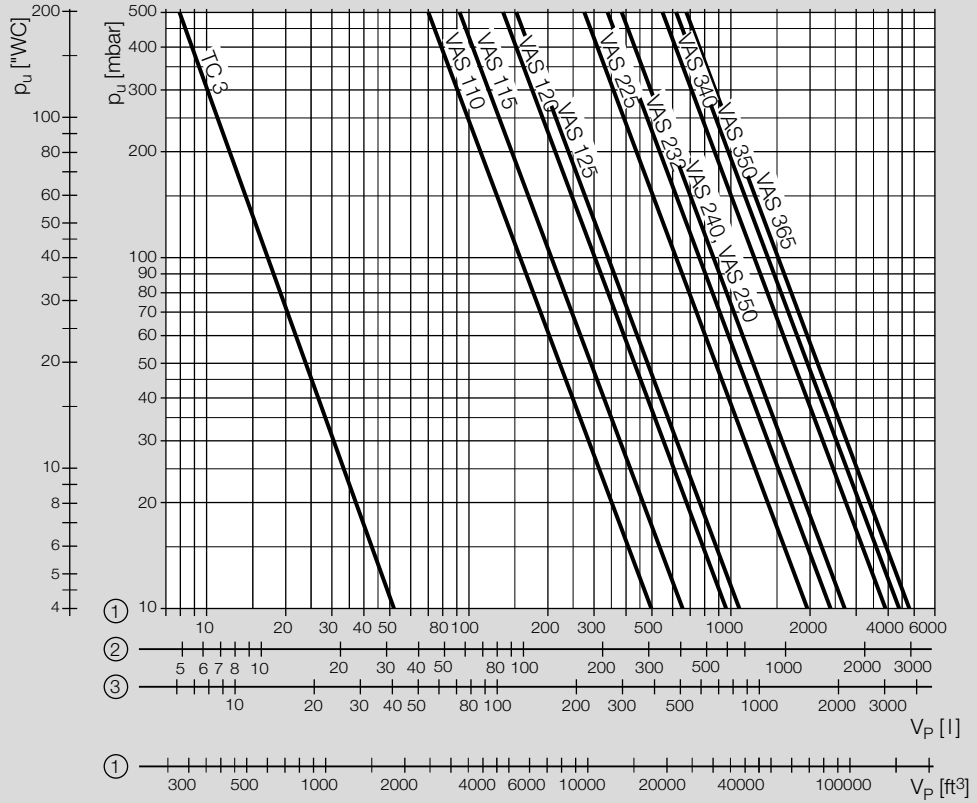
5.7 Determining the relief line size

The nominal diameter of the relief line should be large enough to discharge the test volume V_P. The cross-section of the relief line should be 5 times the sum of the cross-sections of all pipes whose volume is intended to be discharged via the relief line.

5.8 Auxiliary valves

On slow opening valves without start rate or pneumatically operated valves, the test volume can be supplied or discharged via auxiliary valves if discharge into the furnace chamber is impossible for process reasons.

Selection



1 = natural gas (ρ = 0.80 kg/m³)
2 = propane (ρ = 2.01 kg/m³)
3 = air (ρ = 1.29 kg/m³)

Example:
V_P = 32.45 l (8.44 gal),
p_u = 50 mbar (19.5 "WC).

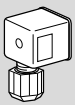
Selecting auxiliary valve V1:
selected –> VAS 110.
The valve is sufficiently large to vent the pipe between the valves.

5.9 Electrical connection of TC 1, TC 2

For the electrical connection of the TC to valves with a plug, a socket can be supplied as an accessory, see page 27 (6 Accessories).

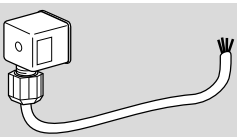
6 Accessories

6.1 Socket



Standard socket, 3 pins + PE, black/B:
Order No. 74916715

6.2 Valve connection cable



Standard socket, 3 pins + PE, black,
4-core electrical cable, cable length 0.45 m,
Order No. 74960689

7 Technical data

7.1 Ambient conditions

Icing, condensation and dew in and on the unit are not permitted.

Avoid direct sunlight or radiation from red-hot surfaces on the unit. Note the maximum medium and ambient temperatures!

Avoid corrosive influences, e.g. salty ambient air or SO_2.

The unit may only be stored/installed in enclosed rooms/ buildings.

The unit is suitable for a maximum installation height of 2000 m AMSL.

Ambient temperature: -20 to +60°C (-4 to +140°F), no condensation permitted.
Long-term use in the upper ambient temperature range accelerates the ageing of the elastomer materials and reduces the service life (please contact manufacturer).

Storage temperature = transport temperature: -20 to +40°C (-4 to +104°F).

Enclosure: IP 65.

This unit is not suitable for cleaning with a high-pressure cleaner and/or cleaning products.

7.2 Mechanical data

Gas types: natural gas, LPG (gaseous), biogas (max. 0.1 %-by-vol. H_2S) or clean air. The gas must be clean and dry in all temperature conditions and must not contain condensate.

Medium temperature = ambient temperature.

Inlet pressure p_u: 10 to 500 mbar (3.9 to 195 "WC).

Measurement time t_M: 5 to 30 s, adjustable. Set at the factory to 30 s.

Valve opening time: 3 s.

Housing made of impact-resistant plastic.

Connectors: aluminium.

Weight:
TC 1V: 215 g (0.47 lbs),
TC 2 with adapter: 260 g (0.57 lbs),
TC 3: 420 g (0.92 lbs).

7.3 Electrical data

Mains voltage and control voltage:
120 V AC, -15/+10%, 50/60 Hz,
230 V AC, -15/+10%, 50/60 Hz,
24 V DC, ±20%.

Power consumption (all LEDs green):
5.5 W at 120 V AC and 230 V AC,
2 W at 24 V DC,
TC 3: plus 8 VA for an auxiliary valve.

Fine-wire fuse:
5 A, slow-acting, H, 250 V, pursuant to IEC 60127-2/5,
F1: protection of valve outputs (terminals 15 and 16), fault signal (terminal 12) and supply of the control inputs (terminals 2, 7 and 8).
F2: protection of safety interlock/controller enable signal (terminal 6).

The input current at terminal 1 must not exceed 5 A.

Max. load current (terminal 6) for safety interlock/controller enable and valve outputs (terminals 15 and 16):

at 230/120 V AC mains voltage, max. 3 A resistive load;
at 24 V DC mains voltage, max. 5 A resistive load.

Fault signal (terminal 12):
Fault output at 120 V AC/230 V AC/24 V DC mains and control voltage:
max. 5 A.

TC switching cycles:
250,000 pursuant to EN 13611.

Reset: using a button on the device or by remote reset.

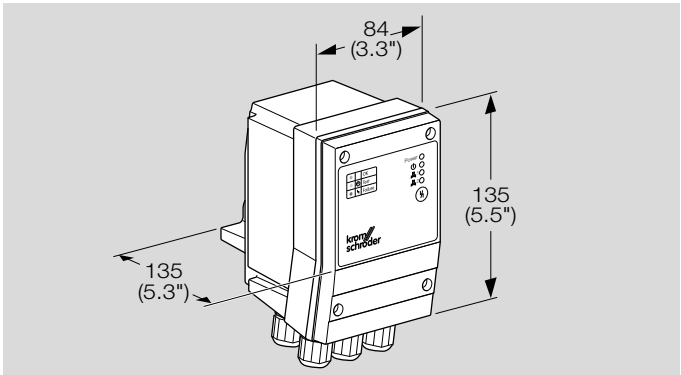
Length of connection cable:
at 230 V AC/120 V AC: any, at 24 V DC (supply connected to PE): max. 10 m permitted,
at 24 V DC (supply not connected to PE): any.

5 cable glands:
M16 x 1.5.

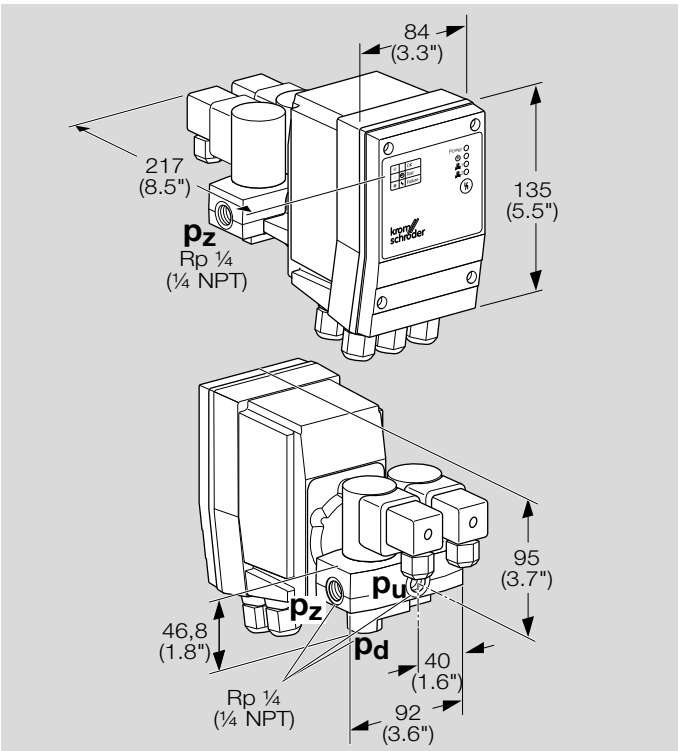
Electrical connection:
Cable cross-section: min. 0.75 mm^2 (AWG 19),
max. 2.5 mm^2 (AWG 14).

8 Dimensions

Connections: inlet pressure = p_u,
interspace pressure = p_z and
outlet pressure = p_d:



TC 1, TC 2

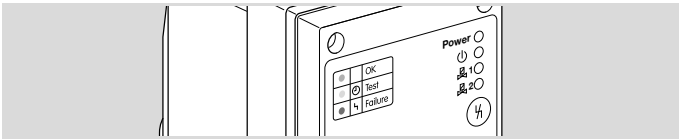


TC 3

9 Converting units

See www.adlatus.org

10 Indicators and operating controls



LED	Meaning
Power	Power supply
⏻	Operating signal
1	Valve 1
2	Valve 2
↯	Reset button

The LEDs can display messages using three colours (green, yellow, red) and permanent ○ or flashing light ☼:

LED			Message/Operating status
Power	○	Green	Power supply OK
⏻	○	Yellow	TC is ready for operation; safety interlock* input signal interrupted
⏻	○	Green	TC is ready for operation; active safety interlock* input signal
1	○	Green	V1 is tight
1	○	Yellow	V1 is untested
1	☼	Yellow	Tightness test is running on V1
1	○	Red	V1 is leaking
2	○	Green	V2 is tight
2	○	Yellow	V2 is untested
2	☼	Yellow	Tightness test is running on V2
2	○	Red	V2 is leaking
All		Yellow	Initialization

** Safety interlock = linking of all the relevant safety-related control and switching equipment for the use of the application. The burner start enable signal is issued via the safety interlock output (terminal 6).*

» For other messages, see TC 1–3 operating instructions, Assistance in the event of malfunction.

11 Safety-specific characteristic values for SIL and PL

Mains and control voltage: 120 V AC/230 V AC	
Diagnostic coverage DC	91.4%
Mean probability of dangerous failure PFH_D	17.3 x 10^{-9} 1/h

Mains and control voltage: 24 V DC	
Diagnostic coverage DC	91.5%
Mean probability of dangerous failure PFH_D	17.5 x 10^{-9} 1/h

General	
Mean probability of dangerous failure PFH_D	Auxiliary valves with valve block on TC 3: 0.2 x 10^{-9} 1/h
Type of subsystem	Type B to EN 61508-2
Mode of operation	High demand mode pursuant to EN 61508-4 Continuous operation (to EN 1643)
Mean time to dangerous failure $MTTF_d$	$1/PFH_D$
Safe failure fraction SFF	97.5%

For a glossary of terms, see page 39 (14 Glossary).

11.1 Relationship between the Performance Level (PL) and the Safety Integrity Level (SIL)

PL	SIL
a	–
b	1
c	1
d	2
e	3

11.2 Designed lifetime

Max. service life under operating conditions in accordance with EN 13611 for TC 1, TC 2, TC 3:
designed lifetime after date of production, plus max. ½ year in storage prior to first use, or once the given number of operating cycles has been reached, depending on which is achieved first:

Switching cycles	Time (years)
250,000	10

11.3 Certificate download

Certificates – see www.docuthek.com

12 Safety information in accordance with EN 61508-2

12.1 General

Scope of application

Machinery Directive (2006/42/EC) with the applicable harmonized standards as set out in “Industrial thermoprocessing equipment – Part 2: Safety requirements for combustion and fuel handling systems” (EN 746-2).

For further information, see page 4 (1 Application) and on the certificates, see www.docuthek.com.

Aim

The TC 1, TC 2, TC 3 is a control unit pursuant to EN 60730-2-5, Section 6.3.103.

Type of action:

The automatic action of the TC 1, TC 2, TC 3 corresponds to Type 2 pursuant to EN 60730-1, Section 1/5.

Mode of operation

The TC 1, TC 2, TC 3 is capable of continuous operation and thus fulfils the characteristic of automatic action type 2.AD pursuant to EN 60730-2-5, Section 6.4.104.

Switching off the safety-relevant output signals: the safety-relevant output signals are switched off via relays. This is a micro-disconnection pursuant to EN 60730-1, Sections 6.4.3.2 and 6.9.2.

Fault lock-out

Non-volatile fault lock-out, action type 2.V pursuant to EN 60730-2-5, Section 6.4.101.

Other classifications:

Load

The outputs of the TC are primarily designed for resistive loads with a power factor ≥ 0.95.

Automatic cycles

The tightness control is designed for more than 250,000 automatic cycles.

Fault detection time

On demand

Software class

C (operates in a similar double-channel architecture with comparison)

Electrical data:

Safety class

Safety class

Overvoltage category

Overvoltage category III (hard wiring/industrial application)

Pollution degree

Pollution degree 2 (≥ IP 65).

12.2 Interfaces

Electrical wiring

Attachment type X to EN 60730-1.

230 V AC, 120 V AC

Connection:

The TC 1, TC 2, TC 3 must be correctly phased in accordance with the connection diagrams.

24 V DC

Extra-low voltage (ELV):

If the TC 1, TC 2, TC 3 is supplied with ELV, at which Minus/-/GND are connected to PE, all connected cables must not be longer than 10 m.

If the TC 1, TC 2, TC 3 is supplied with ELV, at which Minus/-/GND are not connected to PE, all connected cables may be longer than 10 m.

Safety extra-low voltage (SELV):

If the TC 1, TC 2, TC 3 is supplied with SELV, all connected components must also fulfil the requirements of SELV.

Protective extra-low voltage (PELV):

If the TC 1, TC 2, TC 3 is supplied with PELV, all connected cables must not be longer than 10 m.

Connection terminals:

Supply and control signal terminals

Mains voltage = control voltage 24 V DC,
120 V AC or 230 V AC: power is supplied to the TC via connection terminals 1 (L1 (+)) and 3 (N (-)). Further terminal assignment, see connection diagrams.

Terminals for automatic burner control unit and valves

See connection diagrams.

PE wire connection

5 PE terminals for forwarding. Connection to the system PE must be carried out/wired by the user.

Inputs:

Safety interlocks (limits)

Input voltage = mains voltage

Thermostat/start-up signal

Input voltage = control voltage

Reset/remote reset

Input voltage = control voltage

Outputs:

Safety interlocks (limits)/OK enable signal

at 230/120 V AC mains voltage, max. 3 A resistive load; at 24 V DC mains voltage, max. 5 A resistive load.

Valve outputs V1 and V2

at 230/120 V AC mains voltage, max. 3 A resistive load; at 24 V DC mains voltage, max. 5 A resistive load.

Fault signal

at 24 V DC, 120 V AC or 230 V AC mains voltage and control voltage:
max. 5 A resistive load.

12.3 SIL and PL

Safety function

The basic safety function of the TC 1, TC 2, TC 3 is to check that automatic shut-off valves have closed effectively by detecting leakage.

Classification

Class C regulating and control functions

Demand mode

High demand mode pursuant to IEC 61508-4

Hardware Fault Tolerance HFT

HFT: N = 0

SIL Safety Integrity Level/PL Performance Level

See page 34 (11 Safety-specific characteristic values for SIL and PL)

13 Maintenance cycles

TC requires little servicing.

We recommend that a function check is carried out once per year, or at least twice a year if biogas is used.

14 Glossary

14.1 Tightness control

The term “tightness control” is the product name of product group TC from Elster GmbH. Tightness control TC is a valve proving system (VPS).

14.2 Valve proving system VPS

System to check that automatic shut-off valves have closed effectively by detecting leakage. This system is frequently comprised of a program unit, a measuring device, valves and other functional equipment. Valve proving systems for gas burners and gas appliances pursuant to DIN EN 1643 determine whether an automatic shut-off valve has closed on the basis of the detected leakage rate.

see EN 1643

14.3 Safety interlocks (limits)

Linking of all the relevant safety-related control and switching equipment for the use of the application. The burner start enable signal is issued via the safety interlock output (terminal 6).

14.4 Diagnostic coverage DC

Measure of the effectiveness of diagnostics, which may be determined as the ratio between the failure rate of detected dangerous failures and the failure rate of total dangerous failures

NOTE: Diagnostic coverage can exist for the whole or parts of a safety-related system. For example, diagnostic coverage could exist for sensors and/or logic system and/or final elements. Unit: %

see EN ISO 13849-1

14.5 Mode of operation

High demand mode or continuous mode

Operating mode, where the frequency of demands for operation made on a safety-related system is greater than one per year or greater than twice the proof-test frequency

see EN 61508-4

14.6 Hardware fault tolerance HFT

A hardware fault tolerance of N means that N + 1 is the minimum number of faults that could cause a loss of the safety function

see IEC 61508-2

14.7 Probability of dangerous failure PFH_D

Value describing the likelihood of dangerous failure per hour of a component for high demand mode or continuous mode. Unit: 1/h

see EN 13611/A2

14.8 Mean time to dangerous failure $MTTF_d$

Expectation of the mean time to dangerous failure

see EN ISO 13849-1:2008

For more information

The Honeywell Thermal Solutions family of products includes Honeywell Combustion Safety, Eclipse, Exothermics, Hauck, Kromschröder and Maxon. To learn more about our products, visit ThermalSolutions.honeywell.com or contact your Honeywell Sales Engineer.

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TC · Edition 03.23 · EN