Control device for system leakage test

DSLC px Vx

8.21

DUNGS®
Combustion Controls

Technical description

Together with one or two gas pressure switches, the DSLC control device built according to EN 1643 for system leakage tests checks the burner gas shut-off valves for leakage.
A synchronous gear motor with control cams controls the DSLC program sequence via microswitches.

Application

The DSLC is suitable for automatic leakage tests between two solenoid valves in gas-consuming devices.
The testing system can be used alone for leakage tests or combined with all types of automatic burner control systems.
It can be used in gas burner control systems for heating and industrial purposes, gas combustion motors etc., with or without pipes for venting into the open air.

Approvals

EU type test approval as per EU Gas Appliance Directive:

DSLC px Vx CE-0085 AQ 0808

EU type test approval as per EU Pressure Equipment Directive:

DSLC px Vx CE0036

Approvals in other important gas-consuming countries.

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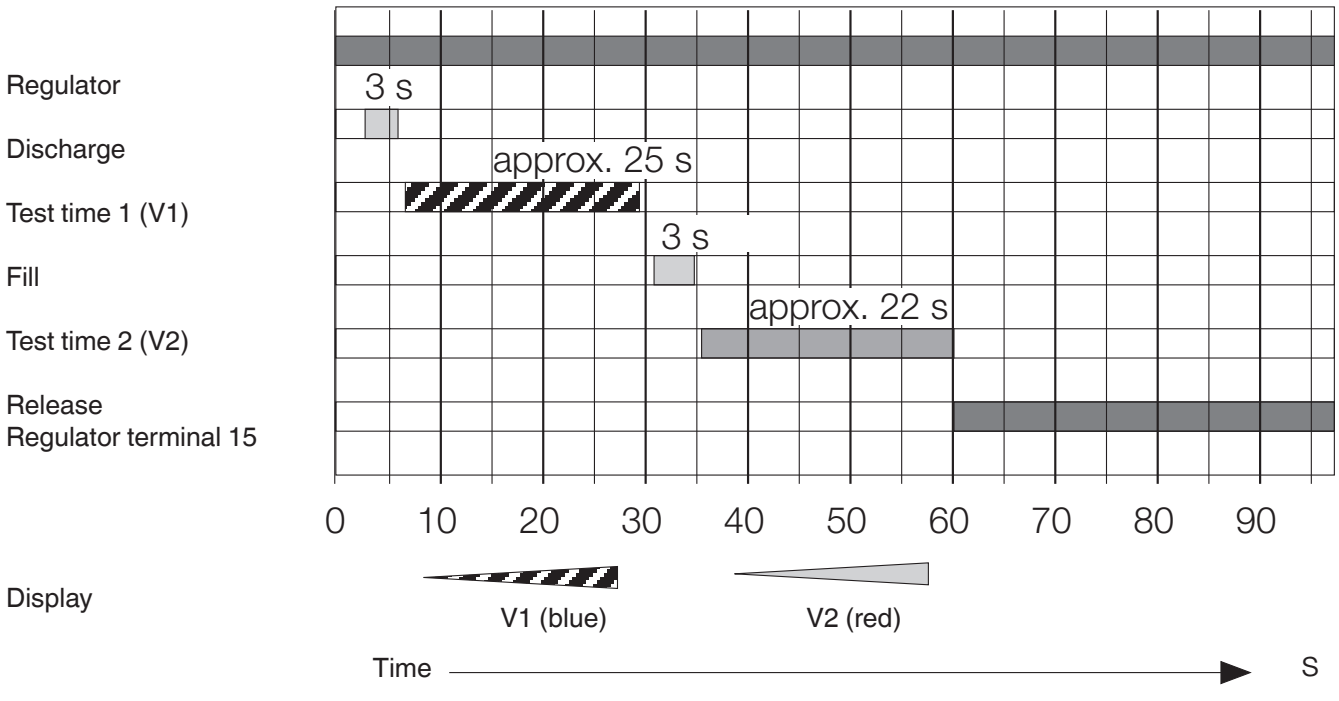
DSLC px Vx	Control device built according to EN 1643:2001-02 for system leakage tests for all pressures (px) and unlimited testing volume (Vx)

Technical data	
Nominal voltage	= (DC) 24 V (± 20 %)
Test volume	min. 1,5 l
Power requirement	approx. 5 VA
Back-up fuse (to be provided by the customer)	10 A flink oder 6,3 A träge
Kontaktbelastung	Operating output (terminal 15) max. 4 A Fault output (terminal 5) max. 1 A Pressure switch (terminals 1, 2, 11) min. 1 A Fault unlocking (terminals 4, 7) min. 1 A Valves (terminals 9, 10, 14) max. 2 A ⚠ **The permissible breaking capacities must be observed! The current input of all solenoid valves, motors etc. which are switched via the controller circuit must not exceed 4 A.**
Degree of protection	IP 42
Ambient temperature	0 °C to +60 °C
Test cycle	approx. 60 s
Valve opening times Test time V1 (valve on gas side) Test time V2 (valve on burner side)	max. 3 s min. 22 s min. 20 s
Switch-on duration of the control	100 % ED
Installation position	any

Program flowchart DSLC px Vx



Functional description and program sequence shown with 1 pressure switch

The section from valve seat V1 to valve seat V2 is called “test section”.
The DSLC performs a test before every burner start-up, i.e. when heat is requested by the controller or after the unit is switched off due to loss of mains voltage, gas shortage etc. The test consists of two phases:

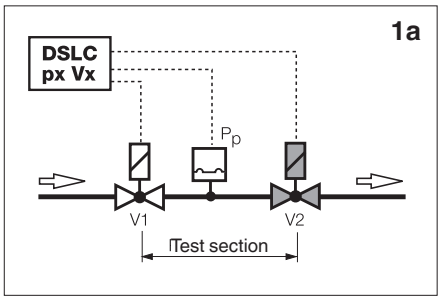
1. Test of the valve (V1) on the gas inlet side
2. Test of the valve (V2) on the burner side

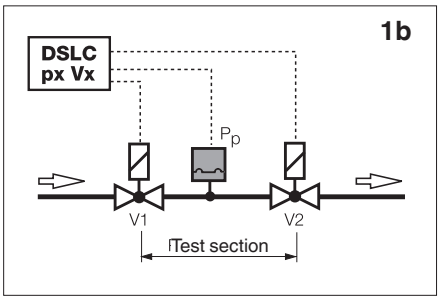
When heat is required, the controller circuit is closed, and the DSLC receives voltage and starts the test cycle (approx. 60 s).

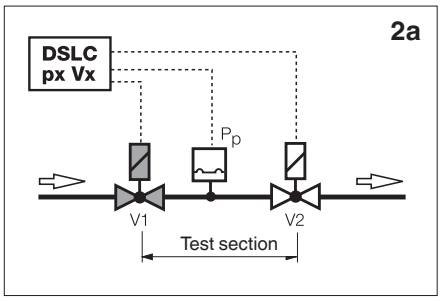
At the beginning of the first test phase (figure 1a), valve V2 is opened for max. 3 s.
The pressure in the test section must drop to atmospheric pressure, i.e., the pressure switch P_p must switch back after the pressure is relieved. If it is not possible to evacuate the test section, the pressure is relieved again after 60 s*.

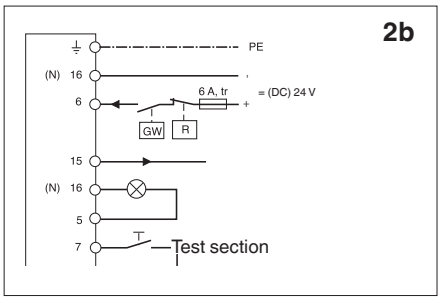
During the subsequent test time (figure 1b) the pressure built up in the test section must not exceed the switch point of the pressure switch P_p.
However, if this happens due to leakage in solenoid valve V1, the DSLC takes the fault position and prevents the burner from being started.
The red fault display lights up. There is voltage at terminal 5 of the device for teleindication of the fault.
The DSLC opens valve V1 for max. 3 s before the second test phase (figure 2a).

Thus, the test section is under gas pressure, and the second test phase begins.
During the subsequent test time (figure 2b) the pressure in the test section must not drop below the switch point of the pressure switch P_p.
However, if the pressure falls due to leakage in valve V2, the pressure switch P_p reports this and the DSLC is locked in the fault position.
All parts lying in the test section, such as pressure switches, pipes, screw joints etc., are simultaneously tested for leakage.
Only after the second test phase, too, shows that all parts are “properly sealed”, the DSLC through-connects the controller circuit (voltage at terminal 15) and enables the program sequence for starting up the burner.



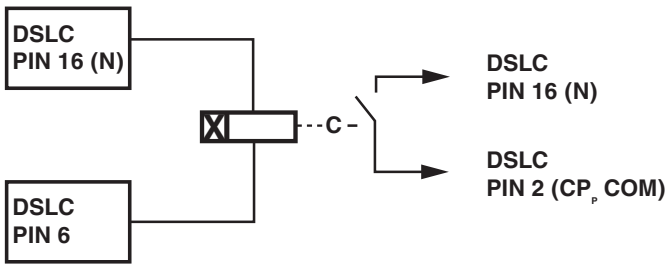






*The number of the emptying cycles is not limited. The maximum number of cycles can be defined by using an additional time relay.

Circuit configuration:

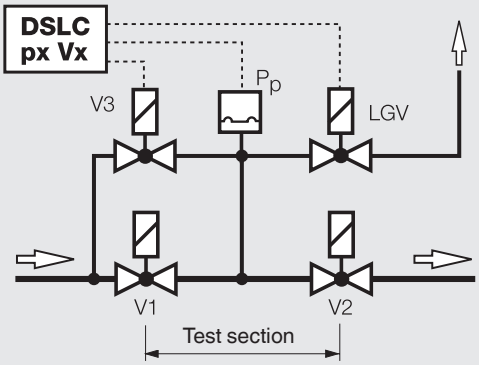


Set approx. 65 s per emptying cycle.
Example: 3 emptying cycles correspond to approx. 190-195 s

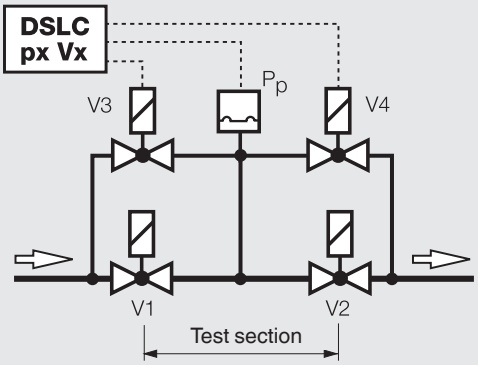
Venting in the firing chamber
According to EN1643 venting may be carried out in the firing chamber if the volume released [m^3] per test cycle does not exceed 0.05 % of the nominal volume flow [m^3/h].
Example:
For a nominal volume flow of 100 m^3/h, the permissible volume is 0.05 m^3 = 50 dm^3

Schematic diagrams

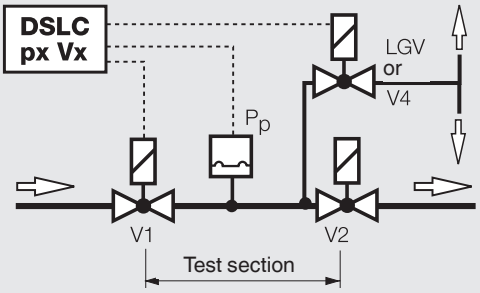
1. Valve test with auxiliary valves V3, LGV



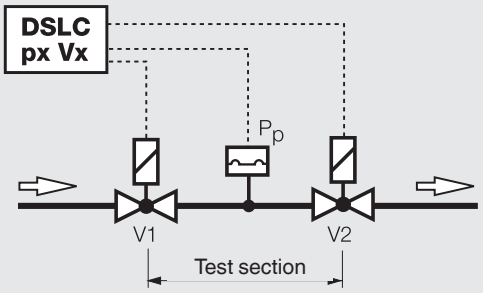
2. Valve test with auxiliary valves V3, V4



3. Direct valve test V1 with auxiliary valve V4 or LGV



4. Direct valve test V1, V2



Legend to schematic diagrams

V1	Safety solenoid valve
V2	Burner solenoid valve
V3	Filling gas solenoid valve
V4	Discharge solenoid valve
LGV	Leakage gas solenoid valve
P_p	Test pressure switch

⚠ The function principle must be selected according to local regulations!

⚠ The valves used must meet the requirements of EN 161!

Nominal diameter
For main actuators > DN 65, auxiliary valves should be used.

Avoiding leakage
The most common reason for leaky actuators is dirt accumulation.
Therefore, the gas filter preceding the gas control section must be sufficiently large. Special attention must be paid to loss of pressure in the filter, i.e. the filter must be checked and cleaned at regular intervals.

Test pressure switch
One or two pressure switches can be used for monitoring the pressure in the test section:

⚠ The pressure switches used must meet the requirements of EN 1854!

A change-over contact is required if **a common pressure switch (P_p)** is used for test phases 1 and 2.
The switch point of the pressure switch must be set to half of the gas flow pressure.

Leak gas rate limit value
The DSLC must prevent ignition and the opening of the actuators at a limit value < 0.1 % of the burner consumption (with regard to the burner capacity), or < 50 dm³/h (the higher value must be taken into account). We recommend that a max. limit value of 200 dm³/h should not be exceeded.

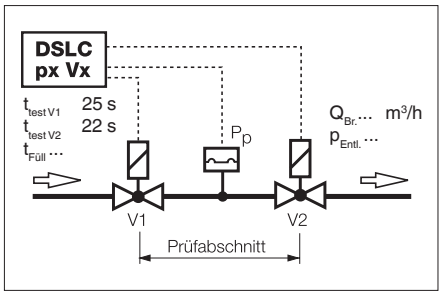
⚠ The leak gas rate must be calculated using the following equations.

If the admissible leak gas rate is exceeded, two control pressure switches must be used.

Test volume of valves and pipelines

Nominal diameters Rp	DN	dm³ Valve	dm³/m Pipeline
1/2		0,20	0,07
3/4		0,30	0,12
1		0,20	0,50
1 1/2		1,40	0,10
2		0,90	2,00
	40	0,70	1,40
	50	1,20	2,00
	65	2,00	3,40
	80	3,80	5,00
	100	6,50	8,00
	125	12,50	12,40
	150	17,50	17,80
	200	46,00	31,40

Test volume DSLC:
min. 1,5 dm³



$\dot{V}_{V1}$= leak rate V1

$$\dot{V}_{V1} = \frac{(p_1 - p_{disch}) \cdot V_P \cdot 3600\ s/h}{p_{atm} \cdot t_{test\,V1}}\ dm^3/h$$

$\dot{V}_{V2}$= leak rate V2

$$\dot{V}_{V2} = \frac{(p_{fill} - p_2) \cdot V_P \cdot 3600\ s/h}{p_{atm} \cdot t_{test\,V2}}\ dm^3/h$$

Calculation examples (calculation steps I and II) for a DN 100 test section:

I) Calculation of the volume of the test section

V1 + V2, DN 100	V = 6.50 dm³
Line DN 100, length 1.5 m	V = 12.00 dm³
V3 + V4, Rp ½	V = 0.07 dm³
Line V3 / V4 1/2", length 2 m	V = 0.40 dm³
	V_p = 18,97 dm³

II) Calculation of leak rates

	System with 1 pressure switch
Burner capacity	30 m³/h
p_1	11 mbar
p_2	9 mbar
p_{disch}	1 mbar
p_{fill}	18 mbar
p_{atm}	1013 mbar
t_{testV1}	25 s
t_{testV2}	22 s22 s
limit value as per standard	50 dm³/h
Recommended limit value	

Result of the calculation:

Leak rate V1	$\dot{V}_{V1}$ = 26,97 dm³/h
Leak rate V2	$\dot{V}_{V2}$ = 27,58 dm³/h

Legend of the calculations:

p_1 = switch point of pressure switch P1 or Pp rising [mbar]
p_2 = switch point of pressure switch P2 or Pp falling [mbar]
p_{disch} = gas pressure after discharge [mbar]
p_{fill} = gas pressure after filling [mbar]
p_{atm} = atmospheric pressure [mbar]
t_{testV1} = test time V1 [s]
t_{testV2} = test time V2 [s]
V_p = test section volume [dm³]

Test pressure switch
One or two pressure switches can be used for monitoring the pressure in the test section:

⚠ The pressure switches used must meet the requirements of EN 1854!

If set properly, **two pressure switches** detect even small amounts of leaked gas. The amounts of leaked gas can be individually set to the required value for:
test phase 1 (safety solenoid valve) with pressure switch **P1** and
test phase 2 (burner solenoid valve) with pressure switch **P2**.

Pressure switch basic setting
Pressure switch p1:
Inlet pressure range · 0,9
Pressure switch p2:
Inlet pressure range · 0,1

Leak gas rate limit value
The DSLC must prevent ignition and the opening of the actuators at a limit value < 0.1 % of the burner consumption (with regard to the burner capacity), or < 50 dm³/h (the higher value must be taken into account). We recommend that a max. limit value of 200 dm³/h should not be exceeded.

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Nominal diameters Rp	DN	dm³ Valve	dm³/m Pipeline
1/2		0,20	0,07
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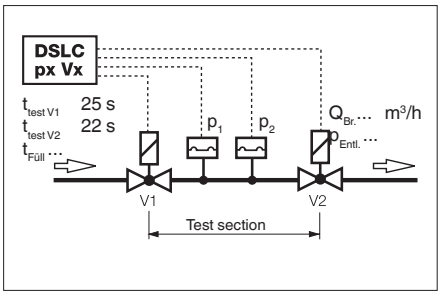


$\dot{V}_{V1}$= leak rate V1

$$\dot{V}_{V1} = \frac{(p_1 - p_{Entl.}) \cdot V_P \cdot 3600\ s/h}{p_{atm} \cdot t_{test\ V1}}\ dm^3/h$$

$\dot{V}_{V2}$= leak rate V2

$$\dot{V}_{V2} = \frac{(p_{Füll} - p_2) \cdot V_P \cdot 3600\ s/h}{p_{atm} \cdot t_{test\ V2}}\ dm^3/h$$

Calculation examples (calculation steps I and II) for a DN 100 test section:

I) Calculation of the volume of the test section

V1 + V2, DN 100	V = 6.50 dm³
Line DN 100, length 1.5 m	V = 12.00 dm³
V3 + V4, Rp ½	V = 0.07 dm³
Line V3 / V4 1/2", length 2 m	V = 0.40 dm³

V_p = 18,97 dm³

II) Calculation of leak rates

	System with 2 pressure switches
Burner capacity	400 m³/h
p_1	60 mbar
p_2	220 mbar
p_{disch}	18 mbar
p_{fill}	500 mbar
p_{atm}	1013 mbar
t_{testV1}	25 s
t_{testV2}	22 s
limit value as per standard	400 dm³/h
Recommended limit value	200 dm³/h

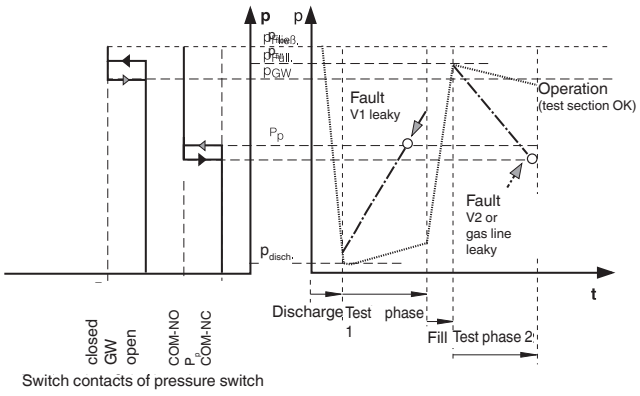
Result of the calculation:

Leak rate V1	$\dot{V}_{V1}$ = 113,26 dm³/h
Leak rate V2	V_{V2} = 183,86 dm³/h

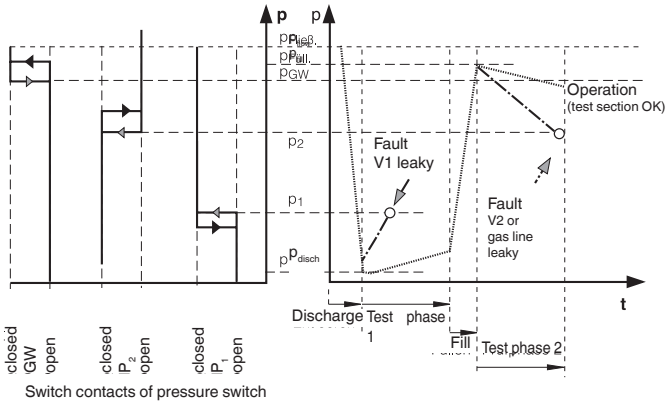
Legend of the calculations:

p_1 = switch point of pressure switch P1 or Pp rising [mbar]
p_2 = switch point of pressure switch P2 or Pp falling [mbar]
p_{disch} = gas pressure after discharge [mbar]
p_{fill} = gas pressure after filling [mbar]
p_{atm} = atmospheric pressure [mbar]
t_{testV1} = test time V1 [s]
t_{testV2} = test time V2 [s]
V_p = test section volume [dm³]

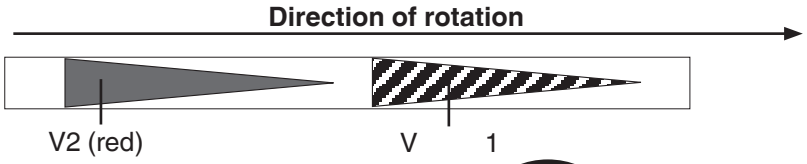
Switch points of the test pressure switch (1 pressure switch)



Switch points of the test pressure switch (2 pressure switches)



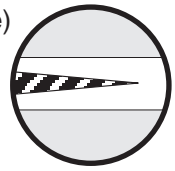
DSLC display of valves



DSLC fault positions

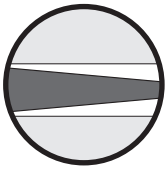
Example 1:

V1 (blue) large leak



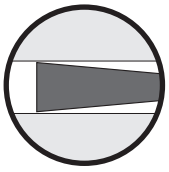
Example 2:

V2 (red) medium leak



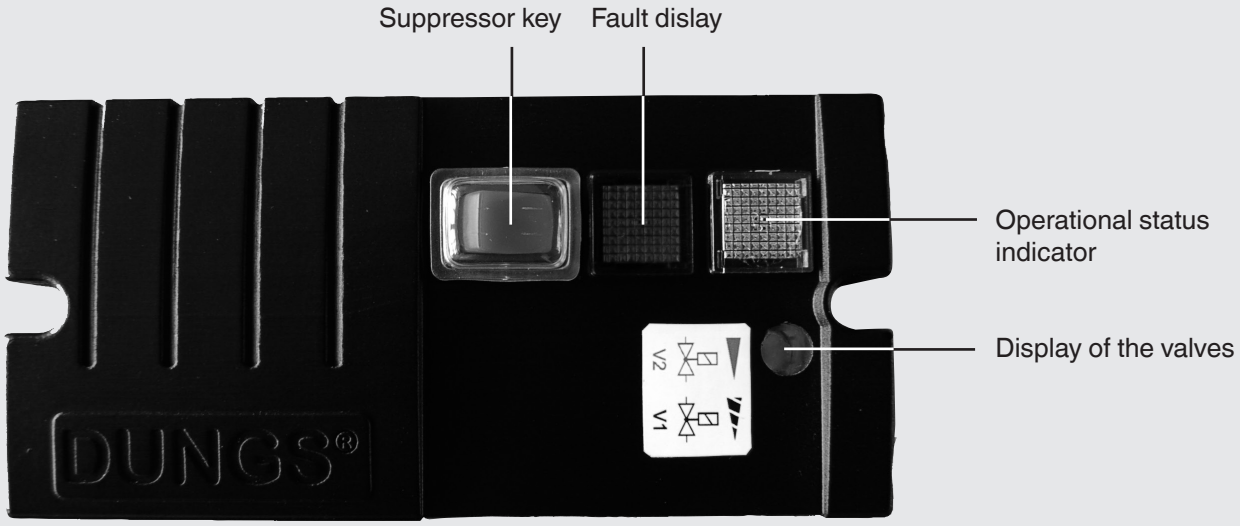
Example 3:

V2 (red) small leak

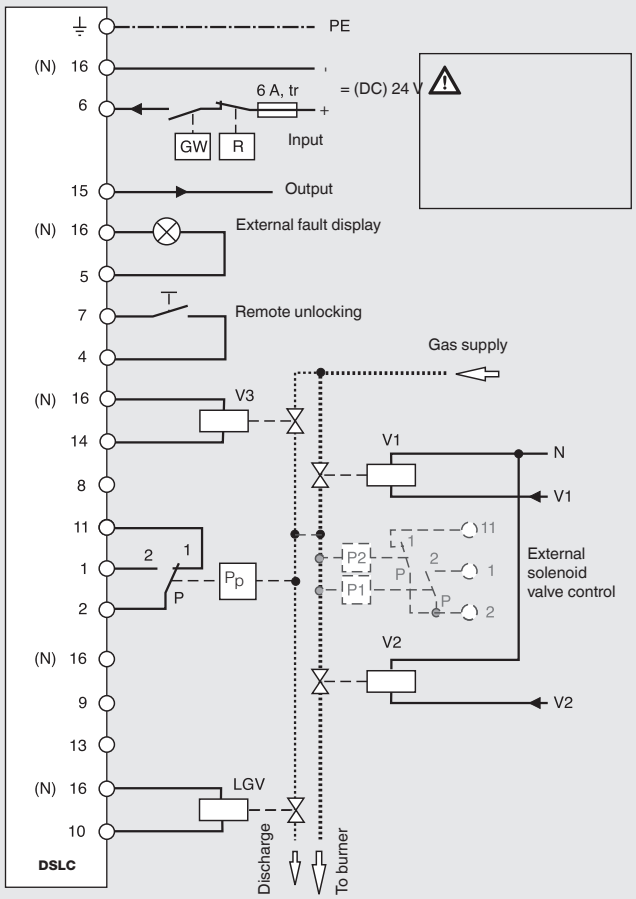


The qualitative differentiation between small, medium and large is used for fault analysis only. However, the valves must always be regarded as leaky!

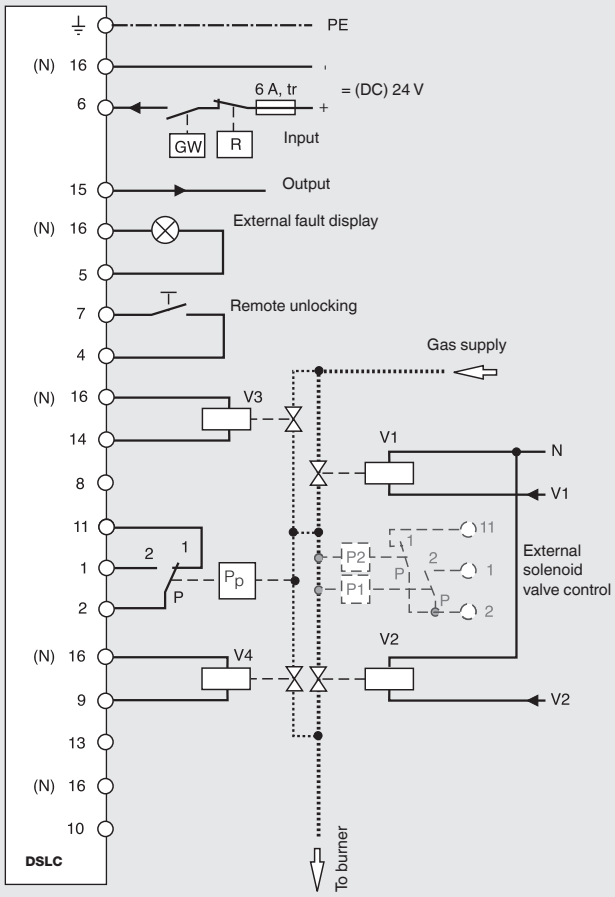
Structure of the leakage control device DSLC px Vx



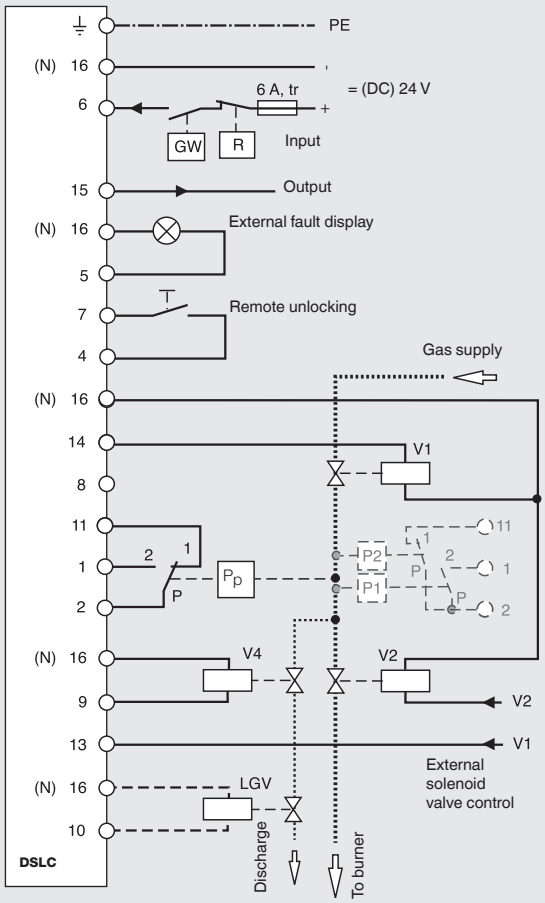
DSLC connection diagram for valve test with auxiliary valves V3, LGV (for schematic diagram 1)



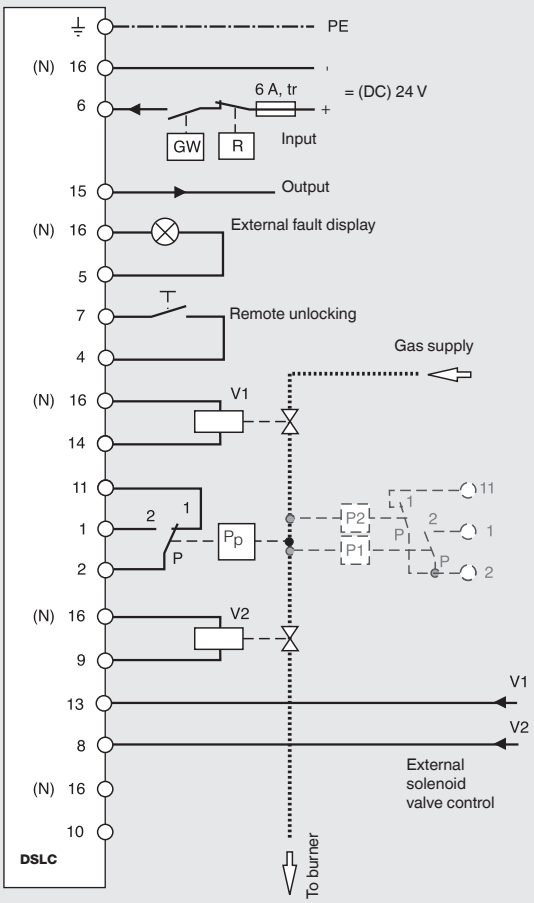
DSLC connection diagram for valve test with auxiliary valves V3, V4 (for schematic diagram 2)



DSLC connection diagram for direct valve test V1 with auxiliary valve V4 or LGV (for schematic diagram 3)



DSLC connection diagram for direct valve test V1, V2 (for schematic diagram 4)

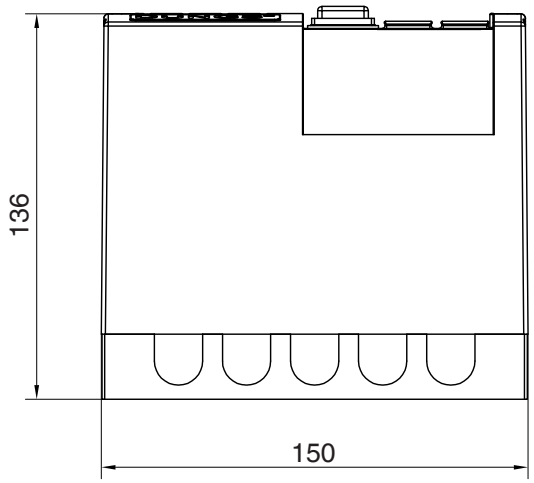


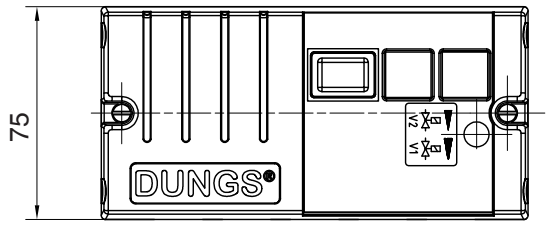
V1 Safety solenoid valve
V2 Burner solenoid valve
V3 Test gas solenoid valve
V4 Discharge solenoid valve
LGV Leakage gas solenoid valve
P_p Test pressure switch
GW gas pressure switch (gas shortage).
R Regulator

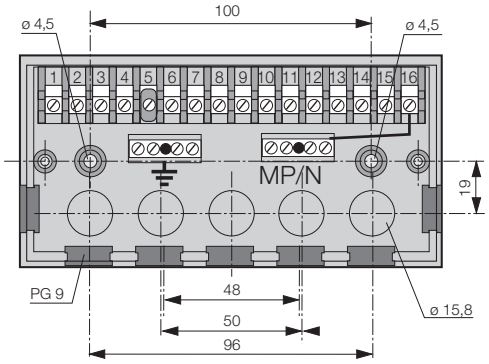
Control device for system leakage test
DSLC px Vx

DUNGS®
Combustion Controls

Dimensions







Type overview/ordering data

	Order no.
DSLC px Vx - (DC) 24 V	247 963
DSLC px Vx - (DC) 24 V für Hutschienenmontage	265 264

Accessories

Gas pressure switch see datasheets	depending on the operating pressure, LGW…A4 (5.08) GW…A6 (5.01) GW…A4 HP (5.04)
Auxiliary solenoid valves see datasheets	MV 502 (6.21) MVD, MVD/5, MVDLE/5 (6.20) LGV/5 (6.24) SV-D(LE) (6.01)

Pressure switches (according to EN 1854) and auxiliary solenoid valves (according to EN 161) must be ordered separately.

We reserve the right to make any changes in the interest of technical progress.

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