Control unit for system leakage tests
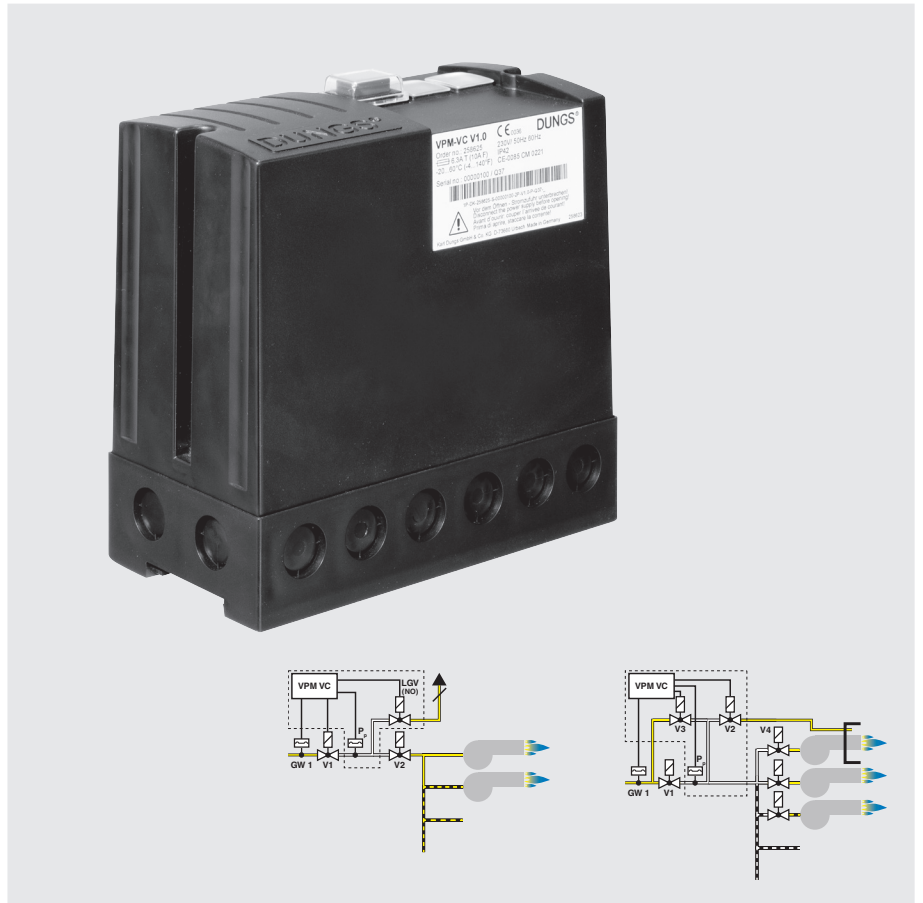
Type VPM-VC (Valve Check)

8.22

DUNGS®
Combustion Controls

neu novità
nouveau new

- **Test time max. 1h**

- **Depending on the application, 3 different program sequences can be selected:**

1. **Valve test before burner start**
2. **Valve test after burner switch-off**
3. **Valve test after burner switch-off with optimised valve operating cycles (patent pending)**

- **LED indicators signal leaky valves**

- **Multifunction output (MFA) for direct output of various device information**

- **Venting into the burner room or through the roof**

- **Suitable for applications up to SIL 2. Meets the requirements according to DIN EN 61508:2011, Part 1-3. Certified by TÜV Süd**

Description

The VPM-VC valve test module checks the tightness of burner gas shut-off valves in combination with one or two pressure switches. The test is performed in accordance with EN 1643.
The program sequence, filling and venting parameters as well as program times can be adjusted by the user according to the system requirements.

Application

The VPM-VC has been designed for automatic leak testing between two solenoid valves in gas-consuming devices, either prior to start-up or after switching off the system. The test system can be used as a single leakage tester or in combination with automatic burners. It is used in gas burner systems for heating, process heating, process industry and gas engines.

Approvals

EC type-examination certificate according to the EC Gas Appliances Directive (2009/142/EC):
VPM-VC   CE-0085 CM 0240

EC type-examination certificate according to the EC Pressure Equipment Directive:
VPM-VC   CE0036

The VPM meets the requirements of:
- Machinery Directive 2006/42/EC
- Low Voltage Directive 2006/95/EC
- EMV 2004/108/EC

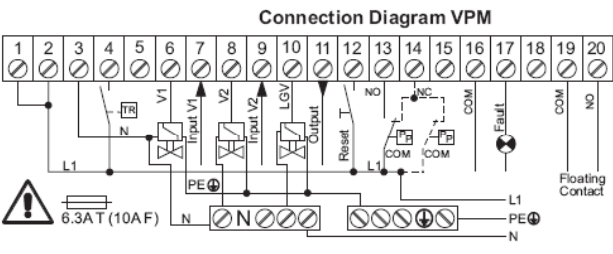Approvals in other important gas-consumingcountries.

FM and CSA approval on request.

VPM-VC	Control unit for system leakage tests according to En 1643. Checks tightness of the gas burner shut-off valves either before burner start or after shutdown. Equipment: one or two gas pressure switches. Additional pilot valves are required depending on the system
⚠	Pressure switches/valves/pilot valves are not part of the scope of delivery!

Technical data

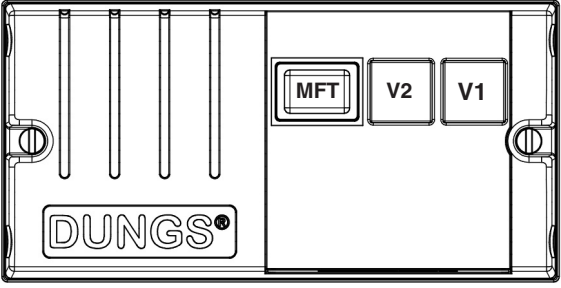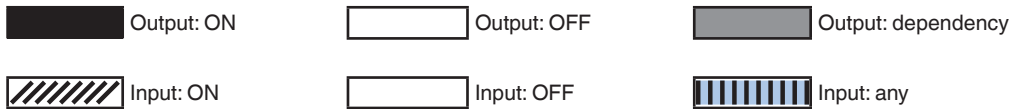|	
Rated voltage (depending on the model)	~ (AC) 230 V +10 % / -15 % 50-60 Hz ±5 % ~ (AC) 115 V +10 % / -15 % 50-60 Hz ±5 %
Power consumption	max. 10 W

Power consumption
Typical
	115 V: standby 2.6 W
	              operation 4.6 W
	230 V: standby 3.1 W
	              operation 5.4 W

Backup fuse L1	6.3 A T (10 A F), integrated, replaceable
Humidity	DIN 60730-1, no dewing admissible
Type of protection	IP 42
Ambient temperature	-20 °C to +60 °C
Storage temperature	-40 °C to +80 °C
Switch-on duration	100 %
Test volume	Unlimited
Medium	Any; gas type depending on pressure switch and valve
Inlet pressure	Any; depending on pressure switch and valve
Multifunction output (MFA)	Number of operating cycles V1 > 100000 (terminal 19 + 20, potential-free). Further settings possible via VisionBox + parameter change: 1. Freely selectable number of operating cycles up to 6.5 million (standard 100,000) 2. Signal output with freely selectable number of operating cycles of V2, LGV or release in place of V1 3. Signal output while the test is running or while voltage is applied 4. Signal after successful switch-off
Program sequence can be selected	Three different program sequences can be selected via DIP switches: 1. Valve test before burner start 2. Valve test after burner switch-off 3. Test sequence with optimised valve operating cycles after burner switch-off without additional switching cycles. In this case, only one valve will be tested at a time after successful switch-off, --> lower power consumption and increased valve life.
Test times can be set	DIP switches can be used to select predefined test times of V1 and V2, enabling optimal setting in case of different test volumes, inlet pressures and leakage rates. Alternatively, individual test times, even different times for V1 and V2, can be set via VisionBox.
Filling and venting attempts	Depending on the test volume, different combinations can be selected using DIP switches.
Signalling for V1 and V2	Red/green LEDs signal various information on the program and release states or error codes.
TWI interface	Plug-in connection for DUNGS VisionBox. The VisionBox can be used to access the VPM via a PC. The VisionBox is hardware and software for VPM parameter setting. Status information and error error memory data can be read out.
Mounting position	As desired

Application information	
EN 676: 2008-11	... requests tightness checks at burner capacities above 1,200 kW or already at capacities from 70 kW for burners without pre-purging.
EN 746-2: 2011-02	…requests the use of a VPM for some applications. Pre-venting of the burner chamber can be omitted when using a VPM. Venting of the furnace is done to the atmosphere.
EN 1643: 2001-02	…in combination with a VPM, venting may be done into the furnace for max. 3 s.

Wiring scheme	⊘	**Outputs**		**Electrical data**

Connection Diagram VPM

The sum of the currents of **all safety-related** consumers must not exceed 5 A! The sum of the currents of **all consumers** must not exceed 6.3 A (10 A). | **11** | | Release | 115/230 VAC / 5 A cos φ = 1 **Minimum load 0.5 W** |
	6		V1	115/230 VAC / 2 A cos φ = 1 **Minimum load 0.5 W**
	8		V2	115/230 VAC / 2 A cos φ = 1 **Minimum load 0.5 W**
	10		LGV	115/230 VAC / 2 A cos φ = 1 **Minimum load 0.5 W**
	16 17		External fault	115/230 VAC / 1 A cos φ = 1
	19 20		MFA	115/230 VAC / 1 A cos φ = 1
	⊘	**Inputs**		**Electrical data**
	4	**TR**	Test request	115/230 VAC
	13		Pp1	115/230 VAC normally open
	14		Pp2	115/230 VAC normally closed
	12		Remote unlocking	115/230 VAC
	7		V1_In	115/230 VAC
	9		V2_In	115/230 VAC

Signalling unit			Error information		
			V2	V1	Detailed error information via flash codes All LEDs are flashing: • when a key press is requested during a level change • when the VPM is ready for extended unlocking
MFT = multifunction switch: Unlocking switch for error status …max. 5x/15 min. Changeover switch to switch to the password-protected function level for service and OEM parameter setting via TWI interface by means of the VisionBox.	**V2** two LEDs green / red	**V1** two LEDs green / red	Off	Constantly red	V1 leaking
			Constantly red	Off	V2 leaking
			Red flashing 1x	Red flashing 1x	Venting error
			Red flashing 2x	Red flashing 2x	Filling error
	Switch-on (mains): all LEDs light up as a functional test for approx. 1.5 s. Depending on the states, the LED-V1 and LED-V2 indicators are flashing or lit constantly		Red flashing 3x	Red flashing 3x	Wrong position of DIP switch
			Red flashing 4x	Red flashing 4x	Unlock failed
			Red flashing 5x	Red flashing 5x	V1_in or V2 –in
			Constantly red	Constantly red	...all other errors
			Constantly green	Constantly green	Release signal

Program sequence

State	-	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
⊗ V1	-	{r}	gf	gf	gf	gf	gf	gf	g	g	g	g	-	g				g	-	-	-	rf	-	gf
⊗ V2	-	{r}	gf	-	-	-	-	-	gf	gf	gf	g	-	g	-	-	-	g	gf	gf	gf	-	rf	gf
*3					P21		P22	P20			P23		*9		P21		P22		P20		P23	P30	P30	P28
⏲		0..	0..	3 s	< 0.5 s	(3 s)	< 0.5 s		(3 s)	< 0.5 s		0..		0..	(3 s)	< 0.5 s		0..	(3 s)	< 0.5 s		(60 s)	(60 s)	(0 s)
TR P33	(any)				(any)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(any)	(ON)	(any)	(any)	(any)	(ON)	(any)	(any)	(any)	*8	*8	(any)
NO (p1)	(any)				*10	(any)		(ON)	(ON)	(ON)		(any)	(any)	(any)				(any)	(any)	(ON)		(any)		
NC (p2)	(any)				*10	(any)	(ON)	(ON)		(any)		(any)	(any)	(any)				(any)	(any)	(ON)		(any)		
⊗ Alarm		*6																						
V1									(ON)			*4		*4				(ON)						
V2							(ON)					*4							*4					
▷◁ LGV								(ON)	(ON)	(ON)	(ON)		(ON)		(ON)		(ON)		(ON)					
Type 2					(ON)	(ON)	(ON)	(ON)	(ON)	(ON)				(ON)	(ON)		(ON)	(ON)						
▶											(ON)		(ON)					(ON)						

MFV *1 *6 P40

	-	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
MFA ⚠ P41, P42																								
MFA ☺			(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)		(ON)		(ON)	(ON)		(ON)		(ON)					
MFA [V]		(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	(ON)	
MFA ⏚											(ON)		(ON)		(ON)		(ON)		(ON)					
MFA ☺																								

Operating modes

	-	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
T-Start ▶			1	2	3	4	5	6	7	8	9	10	11	-	-	-	-	-	-	-	-			12
T-Down ▷			1	2	3	*5	*5	*5	*5	*5	*5	4	5	-	6	7	8	-	9	10	11			12
T-Down optimised ▷+			1	2	3	*5	*5	*5	*5	*5	*5	4		5a	6a	7a	8a	5b	6b	7b	8b			9

Legend:
- ■ Output: ON
- □ Output: OFF
- ▨ (grey) Output: dependency
- ▨ (///) Input: ON
- □ Input: OFF
- ▥ (|||) Input: any

V1/V2 LED indicators	
{r}	Red ON or with flash code
g	Green ON
gf	Green flashing (1 Hz)
gf	Green slowly flashing (approx. 4 s off, then 0.125 s on)
rf	Red flashing (1 Hz)

Notes on the test sequence	
*1	The multifunction output can be configured via parameters.
*2	Signals ≤ 0.9 s are tolerated. Per parameter P14, the control can be deactivated to OFF.
*3	DIP switch positions have priority over parameters
*4	In these states, an automatic burner control system or a PLC opens the valve outputs V1 and V via V1in or V2in.
*5	Under certain conditions, the test is also carried out during the start phase, for example after a power failure, if an error has been detected in the previous sequence, or if too much time (P24) has elapsed since the last test (parameter-dependent, only for "T-Down optimised" - shutdown optimised).
*6	Black = ON here means: the signal on IN (e.g. L1) is connected to OUT with a jumper
*8	The response to the removal of the test request can be deactivated via parameter P33.
*9	This state takes 1/16 s in the operating modes LC-mode, TStart (start) and T- Down optimised (shutdown optimised) . In the T-Down mode (regular shutdown), the duration of this state is defined by P25 (as-delivered configuration P25: 3 s).
*10	Per parameter P15, an idle state control of Pp can be activated during the start phase (state 3), i.e., Pp NO must be Low and Pp NC must be High.

Modification of the program sequence by an application-specific setting of the B/C DIP switches

A	B	C
0000	0000	0000

AAAA BBBB CCCC
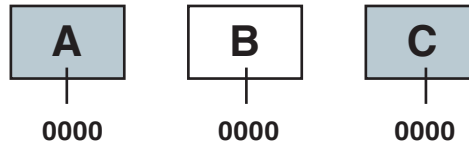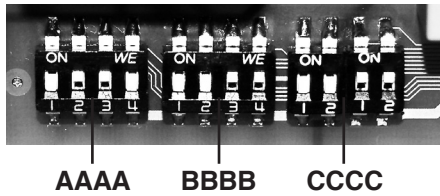
A Test sequence		**B** t_{test} V1, V2 test time		**C** Number of venting or filling attempts	
1100	Test during the start phase before burner ignition	1100	10 s	1100	Venting 10 (❶) Filling 1
		0110	22 s VPM-VC	0110	Venting 1 Filling 1
		1001	30 s	1001	Venting 1 Filling 10
1001	Test after regular shutdown	0011	55 s The following can be changed via the software: P22 for test time V1 P23 for test time V2 If this switch position is used, parameter setting should be checked via the VisionBox.	0011	Venting 3 (❶) Filling 3 (❶) The following can be changed via the software: P32: Number of venting operations P31: Number of filling operations If this switch position is used, parameter setting should be checked via the VisionBox.
0011	Test after regular shutdown in reduced mode without additional operating cycles Operating mode "T- Down optimised": after regular switch-off, one valve is tested at a time alternatively, the other valve is kept open. The alternation takes place during release, when removing the test request next time. - burner with frequent starts - longer valve life - reduced power con- sumption	t_{test}	For the calculation of the test times, see p. 7 Setting must be higher than the calculated time. $t_{DIP} > t_{test\,V1}$, $t_{test\,V2}$ When the test times are long, a safety shutdown is already triggered at smaller leakage rates [Qp].	❶ ⚠	For more detailed explanations, see installation examples in the VPM-VC operating and mounting instructions. According to EN1643, 1 filling or 1 emptying attempt for max. 3 s into the burner chamber is admissible (DUNGS as-delivered configuration). At filling and emptying times of 1 s of the gas main valves, max. 3 attempts are admissible. If the number of venting attempts is higher, venting must be into a safe area (LGV vent valve).
As-delivered configuration					
0000		0000		0000	

Calculation, individual setting of the test time or DIP switch group BBBB

$$t_{test\,V1} = \frac{p_e \bullet V_p \bullet \ln(p_e/(p_e - p_{s1}))}{p_{atm} \bullet Q_p} \bullet 3600\ s/h \bullet S \qquad \begin{array}{l} t_{p22} = t_{test\,V1} \bullet 16/s \\ t_{p23} = t_{test\,V2} \bullet 16/s \end{array} \qquad t_{test\,V2} = \frac{p_e * V_p * \ln(p_e/p_{s2})}{p_{atm} * Q_p} * 3600\ s/h * S$$

xxxx 1100 xxxx xxxx 0110 xxxx xxxx 1001 xxxx		DIP mode for pre-defined test times of V1 and V2: Setting must be higher than the calculated time. $t_{DIP} > t_{test\,V1}$, $t_{test\,V2}$	V_P	[dm³]	Test volume between the valves to be monitored
xxxx 0011 xxxx		Individual setting of the test time via the software: Select DIP mode xxxx 0011 xxxx. Enter calculated value for t_{P22} in P22 and t_{P23} in P23.	Q_P	[dm³/h]	Admissible leakage rate according to EN1643. The leakage rate corresponds to 0.1 % of the burner's gas consumption at maximum burner load, but at least 50 dm³/h. A limit value of 200 dm³/h is recommended by DUNGS!
$t_{test\,V1}$	[s]	Test time for V1	p_e	[mbar]	Gas inlet pressure
$t_{test\,V2}$	[s]	Test time for V2	p_{s1}	[mbar]	Increasing switching pressure +15 %
t_{p22}	[ ]	to be entered in P22 Select higher value!	p_{s2}	[mbar]	Dropping switching pressure -15 %
t_{p23}	[ ]	To be entered in P23 Select higher value!	p_{atm}	[mbar]	Atmospheric pressure = 1013 mbar

Vp determination of the test volume

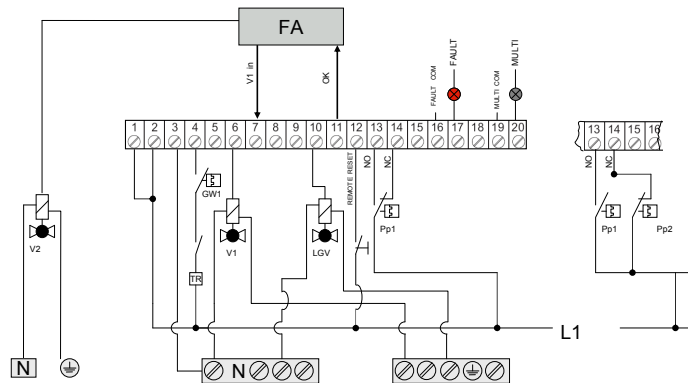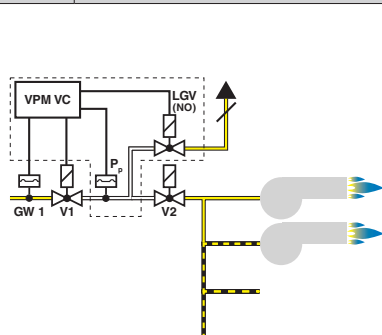|		
⚠	Depending on the selected installation (for examples, see pages 8-11) Include all valve and pipeline volumes of the test section.	
Vp	1. Determine the **V1 volume on the outlet side**. For Rp 1/2 - DN 80, see operating and mounting instructions.	**Example**
	2. Determine the **V2 volume on the inlet side**. For Rp 1/2 - DN 80, see operating and mounting instructions.	
	3. Determine the volume of all connecting pipe sections (3) For Rp 1/2 - DN 80, see operating and mounting instructions.	
	4. If present, determine the volume of the pilot valves.	
	5. VP = V (V1) + V (connecting pipe section(s) + V (V2) + V (LGV)	
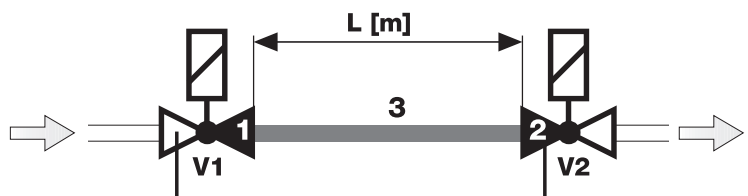
	Installation examples
⚠	The functional principle must be selected in accordance with the local regulations!
⚠	Prevent soiling by using appropriate gas filters
⚠	Use of pilot valves recommended

	Please note: Switch positions ❶ ❷ ❸ ❹					
❶	According to EN1643, 1 filling or 1 emptying attempt for max. 3 s into the burner chamber is admissible (DUNGS as-delivered configuration). At filling and emptying times of 1 s of the gas main valves, max. 3 attempts are admissible.	❷	When filling or emptying attempts are carried out via pilot valves, the situation described in ❶, shows that the specifications of EN1643 are also met with 10 filling or emptying attempts if pilot valves are used that can reach at most only 1/10 of the maximum gas flow of the main valves.	❸	If the valve check is carried after a regular shutdown, the system setup must ensure that locking the system prevents a valve check during a fault situation. This can only be achieved by safe interruption of the power supply to the VPM when a fault occurs.	❹	If this switch position is used, parameter setting should be checked via the VisionBox.

1a	**Direct valve check via LGV, venting through roof**
---	Valve check system component: VPM-VC, Pp, LGV

DIP-mode:
A: 1100
   1001 ❸
   0011 ❸ ❹
B: xxxx
C: 1100
   0110
   0011 ❶ ❹
Parameters:
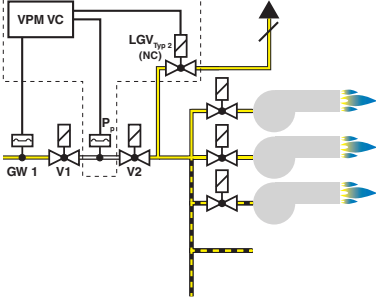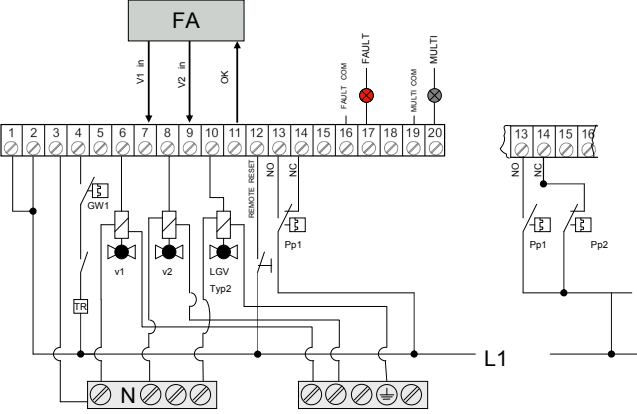
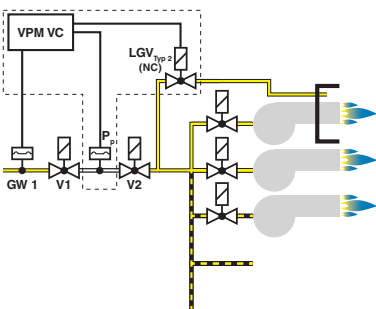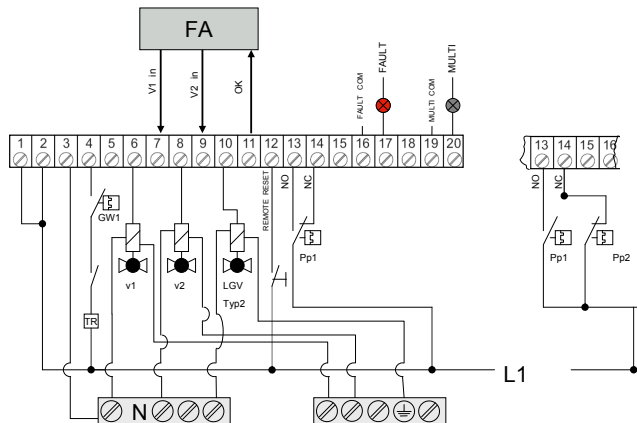
| **1b**	**Direct valve check via LGV, venting into the burner chamber**
---	Valve check system component: VPM-VC, Pp, LGV

DIP-mode:
A: 1100
   1001 ❸
   0011 ❸ ❹
B: xxxx
C: 0110
   0011 ❶ ❹
Parameters:
---

8 … 12

2	Valve check via pilot valves V3, LGV venting through the roof
---	Valve check system component: VPM-VC, Pp, V3, LGV

DIP mode:
A: 1100
1001 ❸
0011 ❸ ❹
B: xxxx
C: 1100 ❷
0110
1001
0011 ❷ ❹
Parameters:

3	Direct valve check
---	Valve check system component: VPM-VC, Pp

DIP mode:
A: 1100
1001 ❸
0011 ❸ ❹
B: xxxx
C: 1100 ❷
0110
1001
0011 ❷ ❹
Parameters:

4	Direct valve check via pilot valves, venting into the burner chamber
---	Valve check system component: VPM-VC, Pp, V3, V2

DIP mode:
A: 1100
1001 ❸
0011 ❸ ❹
B: xxxx
C: 1100
0110
0011 ❶ ❹
Parameter:
P12 = 1

5a	Valve check via pilot valves, venting to V2 via LGV type2 (normally closed)
---	Valve check system component: VPM-VC, Pp, LGV$_{Type2}$ (NC)
	The LGV type 2 is required for opening the gas flow behind V2 (to the burner chamber or atmosphere), allowing it to be emptied when V2 is deliberately (during the test) open. The pressure behind V2 must be able to escape, since otherwise V2, as response to "No gas pressure", allows gas to pass in the reverse direction during the test time, if there is still pressure behind V2. This allows the pressure to drop in the monitored interspace if V2 is leaking. During release (automatic burner control is working), the LGV type 2 is closed.

DIP mode:
A: 1100
    1001 ❸
    0011 ❸ ❹
B: xxxx
C: 1100
    0110
    0011 ❶ ❹
Parameters:
P11 = 1

5b	Valve check via pilot valves, venting to V2 via LGV type2 (normally closed) into the burner chamber
---	Valve check system component: VPM-VC, Pp, LGV$_{Type 2}$ (NC)
	The LGV type2 is required for opening the gas flow behind V2 (to the burner chamber or atmosphere). This allows the pressure to drop in the monitored interspace if V2 is leaking. Emptying takes place via LGV. During release (automatic burner control is working), the LGV and the LGV type 2 are closed.

DIP mode:
A: 1100
    1001 ❸
    0011 ❸ ❹
B: xxxx
C: 1100
    0110
    0011 ❶ ❹
Parameters:
P11 = 1

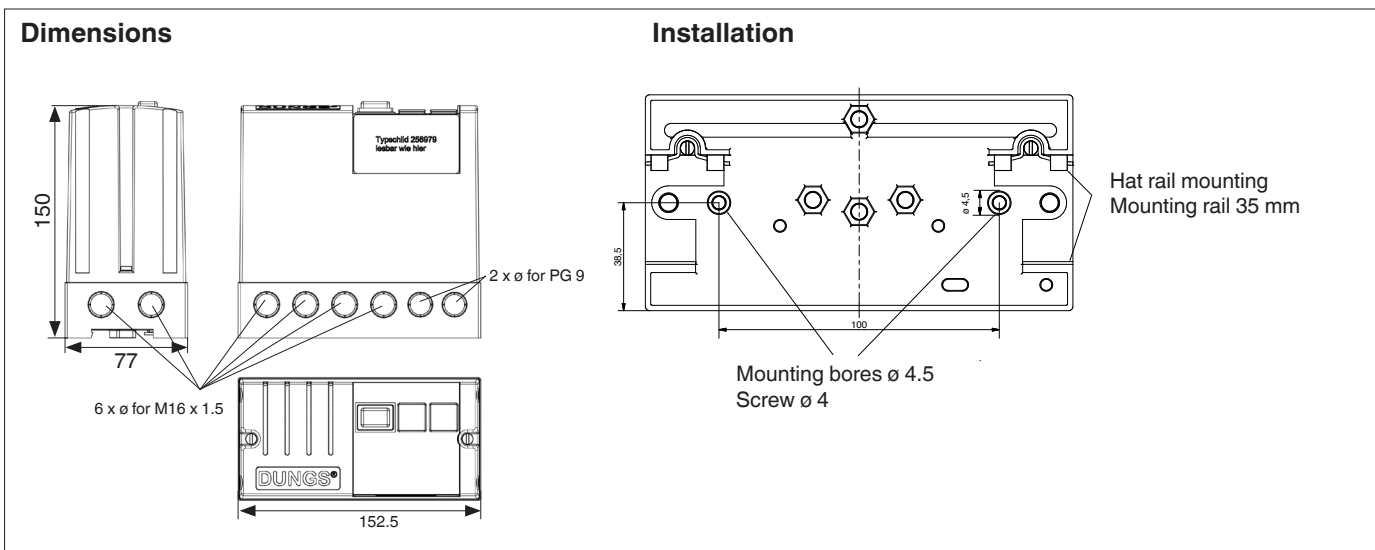| 6a | **Valve check via pilot valves and LGV, venting to V2 via LGV**$_{type2 (normally closed)}$ **Venting through roof** |
| --- | Valve check system component: VPM-VC, Pp, LGV, LGV$_{type2}$ (NC) |
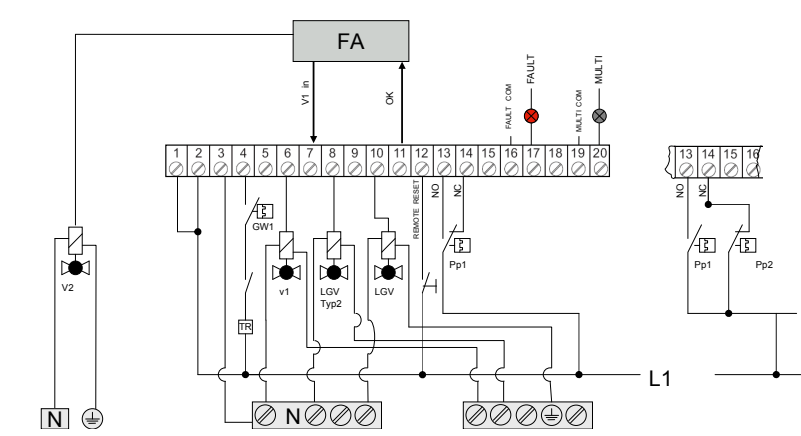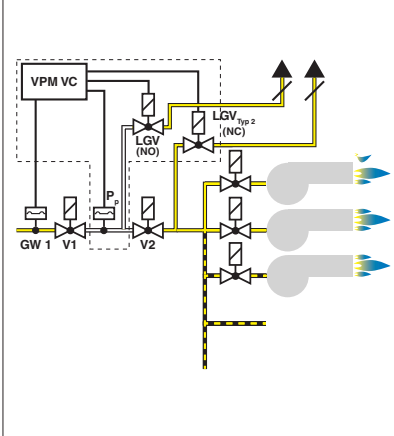
DIP mode:
A: 1100
1001 ❸
0011 ❸ ❹
B: xxxx
C: 1100
0110
0011 ❶ ❹
Parameters:
P11 = 1

| 6b | **Valve check via pilot valves and LGV, venting to V2 via LGV**$_{type2 (normally closed)}$ |
| --- | Valve check system component: VPM-VC, Pp, LGV, LGV$_{type2}$ (NC) |

DIP mode:
A: 1100
1001 ❸
0011 ❸
B: xxxx
C: 1100 ❷
0110
0011 ❶ ❹
Parameter:
P11 = 1

11 … 12
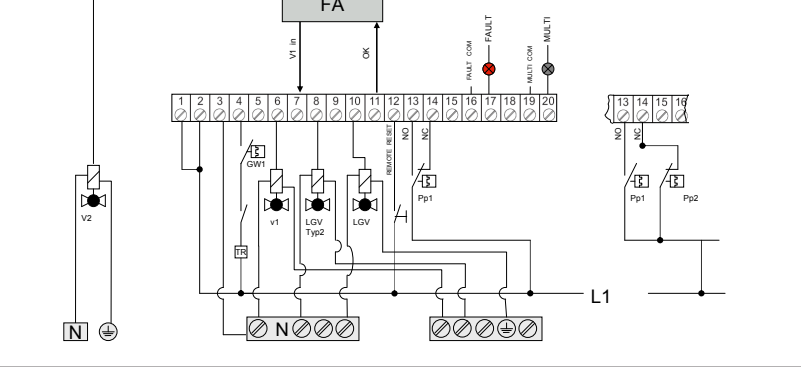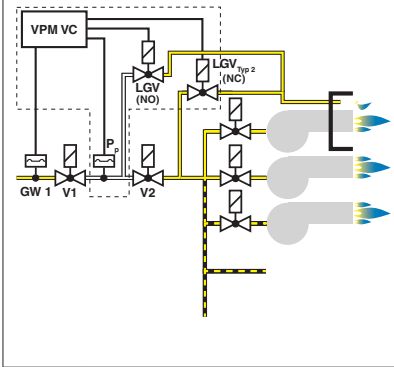
Control unit for system leakage tests

**Type VPM-VC
(Valve Check)**

Version		Description		Order No.
Complete device		VPM-VC cpl.	230 VAC	259 696
		VPM-VC cpl.	115 VAC	259 697
Top part		VPM-VC	230 VAC	258 625
		VPM-VC	115 VAC	258 890
Base		1 piece		259 694
		48 piece		259 695

Dimensions

150

77

6 x ø for M16 x 1.5

Typschild 256979
lesbar wie hier

2 x ø for PG 9

152.5

Installation

ø 4.5

38.5

100

Hat rail mounting
Mounting rail 35 mm

Mounting bores ø 4.5
Screw ø 4

Accessories	
	Gas pressure switch Depending on the operating pressure, see data sheets LGW...A4 (5.08) GW...A6 (5.01) GW...A4 HP (5.04)
	Pilot solenoid valves see data sheets DMV... (7.30, 7.37, 7.38), MV 502 (6.21) MVD ... (6.20)
	MPA VisionBox As addition to MPA parameterisation and service box for setting VPM parameters via a PC/laptop.

Subject to technical modification in the interest of technical progress.