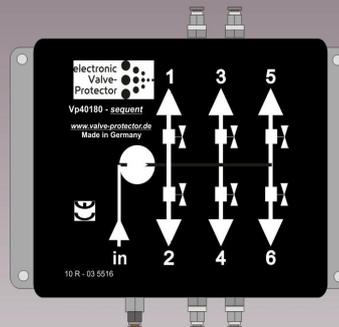




electronic
Valve-
Protector

electronic
Additiv Dosing System
sequential



Technical Manual

Installation Instructions
Safety Notices
Programming
Operation

SI-Elektronik GmbH * Max-Planck-Straße 5 * 63477 Maintal * www.valve-protector.de * 06181/9436-00

Congratulations

We congratulate you on your purchase of this electronic additive dosing system
“Electronic Valve Protector Sequential”
of highest quality and thank you for your trust.

Using this dosing system in combination with a suitable valve protection
additive can significantly reduce the wear of engine parts.

We recommend you read through these operating instructions carefully
before putting this device into operation. Please observe all safety notes and
all instructions on use, connection and settings.

Note

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Use only original replacement parts and accessories.

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this product.

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Introduction

Intended use:

Valve Protector Sequential is an electronically controlled dosing unit comprising the following components:

1. Additive tank including fill level sensor
2. Electronically controlled dosing module including wiring harness
3. Feed line connections
4. PA hose

Check the kit for completeness when unpacking.

The intended use is for dosing suitable and approved additives in internal combustion engines.

Valve Protector Sequential has been developed in accordance with prevailing safety guidelines and constructed for use in European countries.

The electronic additive dosing system **Valve Protector Sequential** allows volume-controlled or combustion-dependent introduction of additives or lubricants that reduce the wear of engine parts.

Use in LPG driven vehicles

In vehicles that do not have cylinder heads, valves or valve seats designed for running on LPG, an appropriate valve protection additive must be added into the combustion chamber by a suitable dosing apparatus in order to protect the affected components. Optimal introduction and distribution of the additive is especially critical here. Most additive manufacturers specify the recommended additive dosage in per-mille, as a ratio of the consumed quantity of LPG (observe the additive manufacturer's specifications for this).

The most critical factor influencing the additive's effectiveness is the correct additive dosage, which also involves a reliable supply to the relevant engine parts. The necessary dosage for the respective application is set using the software program.

The correct dose

Example for 1‰:

If your vehicle consumes 100 litres of LPG over a distance of 1000 km, then the optimum additive admixture dose is 100 ml.

That means a distance of 5000 km will require an additive dose of 500 ml.

Additive consumption is therefore a linear function of consumed LPG.

Additive consumption is therefore also greater in vehicles with higher LPG consumption.

This calculation is only provided as an example, and applies only to a dosage of 1‰.

Always observe the additive manufacturer's specific dosing instructions.

Valve Protector Sequential offers the following performance features:

1. Constant or consumption-dependent additive admixture over your engine's entire power band
2. LPG components do not come in contact with additive
3. No overdosage or underdosage
4. Ideal additive distribution by sequential feed into the combustion chambers
5. Additive tank fill level gauge including LED empty warning lamp
6. Output for safety shutdown of the LPG system when the additive tank is empty
7. Easy installation with a push-fit system
8. Additive consumption only when required
9. Easily refillable additive tank
10. Also ideal for retrofitting
11. All seals in the system made of high-grade FKM
12. Low acquisition cost
13. Also suitable for turbocharged engines and for direct LPG injection
14. Function monitoring by self-diagnosis of all inbuilt components

Functional Design

How does the Valve Protector Sequential work?

The system consists of an additive tank and an additive dosing unit with an inbuilt electronic controller. The additive dose requirement can be calculated either from the LPG jet timings or from the revolution speed:

1. Dosage calculated from LPG valve timings

This method achieves the most precise dosing of additive with respect to the amount of fuel consumed.

The timing of any one of the LPG jets is measured via the control input of the Valve Protector Module (purple) and multiplied by the given number of cylinders.

The longer the opening times of the jets, the more additive will be injected.

Since the dosing system starts working only when the LPG system is active, no unnecessary additive is introduced while running on petrol.

The microprocessor built into the dosing module adds up the individual timings until the set dosing threshold is reached. Then, an additive burst is triggered and the dosing calculator is reset to zero. Inbuilt electronic micro-magnetic valves distribute the additive sequentially over the individual cylinders. In turbo vehicles, a characteristic curve in the Valve Protector adjusts for the higher system backpressures and the resulting higher LPG quantities at the same injection times.

2. Dosage calculated from revolution speed

In engines without electronic injection, the revolution speed is the best alternative for additive dosage calculation. The speed pulses from an ignition coil or an equivalent sensor are measured via the control input of the Valve Protector Module (purple). The higher the revolution speed, the more additive will be injected.

Since the dosing system starts working only when the LPG system is active, no unnecessary additive is introduced while running on petrol.

The microprocessor built into the dosing module adds the speed sensor pulses until the set dosing threshold is reached. Then, an additive burst is triggered and the dosing calculator is reset to zero.

In turbo vehicles, a characteristic curve in the Valve Protector adjusts for the higher system backpressures and the resulting higher LPG quantities at a higher revolution speed.

3. Dosage calculated by interval

With this function, the additive feed is triggered in a fixed timing cycle. The time to the next additive burst can be set within a range of 1–999 seconds. This mode is intended for machines that operate under constant load and at steady LPG consumption. Accordingly, the additive can also be dosed at a steady rate.

The calculated additive dose is distributed evenly over all connected combustion chambers by individual magnetic valves on each cylinder.

Additive feed line:

The additive is fed separately into each cylinder sequentially. This has the major advantage that all cylinders are supplied with the correct quantity of additive. The following feed line connections can be used for feeding in the additive.

1. Feed over M 5 threaded sleeve into the intake tube of each cylinder:



2. Feed over additive shunt into the rubber hose (NW 5-6) after the LPG jet:



3. Feed over additive shunt into the PA hose (6 mm) after the LPG jet (inline):



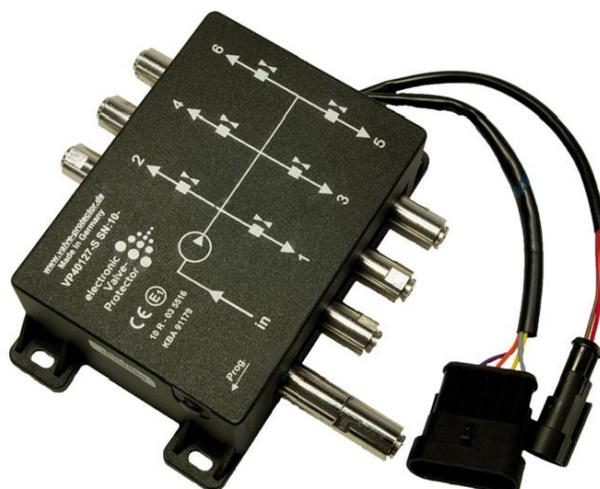
The additive tank

The additive tank holds about 600 ml of additive and is equipped with a fill level sensor, and gives early warning when additive has to be refilled. The tank is designed to allow easy, safe installation, and guarantees sturdy mounting. The hose connects to a pivoting quick push-on connector on the tank. The printed scale allows easy inspection of the additive dosage. The tank is easy to refill through the large screw cap, even without a funnel. Since the additive tank requires a ventilation opening – located at the top of the cap – the 600 ml mark should not be exceeded, so that no additive escapes while driving.



The dosing unit with sequential distributor

The dosing unit is available as 4 and 6 cylinder models, and is fully encased in a compact die-cast aluminium housing, including the controller circuit board. There are no specifications as to where it must be installed. The system monitors all micro-valves and the pump for correct function by an inbuilt pressure sensor. The line connections simply push together.



Electrical connection

The electronic dosing system is simple to connect.

Note that the Valve Protector system can draw a current of up to 6 A in bleeding mode. The voltage tap and ground connector must be designed for this power.

Establish the following circuit connections:

2-pin plug:

1. Brown	Ground	ground
2. Red	12 Volt ignition secured (terminal 15)	12 Volt ignition

5-pin plug:

1. Grey	Input of additive tank fill level sensor	level sensor
2. Yellow	LED signal output	signal output control lamp
3. Orange	12 Volt during LPG	12 V at LPG on
4. Violet	Control line of any LPG injector **	signal any LPG injector
5. White	Open collector output (switched minus max. 3 A)) for system stop	output ground at Stop

** If you are setting up dosage by revolution speed, then connect this wire to the ignition coil output

Connection note:

The LED signal lamp for empty or fault warnings connects to the red wire on the yellow line from the 5 pin plug. The blue LED wire is connected to ground.

Interpreting the control lamp:

OFF - System is ok

Slowly blinking (1-second intervals) – additive level low (approx. 100 ml remaining)

Blinking rapidly (0.2 sec. intervals) – additive empty, system has switched off (no additive dosing)

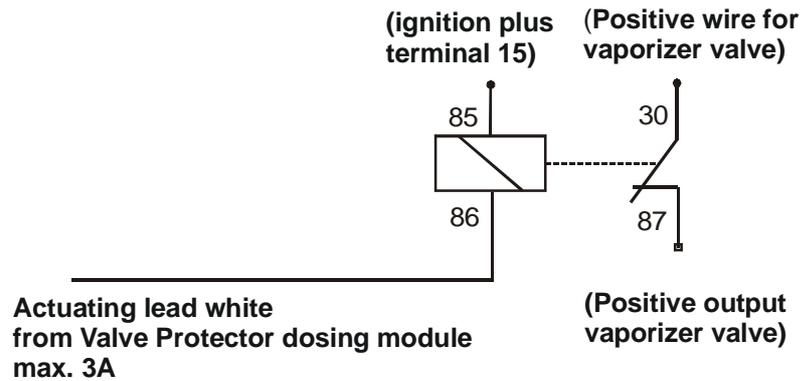
Constantly ON - system error – service required

The additive tank level sensor is connected as follows: Wire 1 (black) to Ground, Wire 2 (black) to the grey wire of the 5-pin plug.

The system stop output (white) is a connected ground output and can be loaded up to 3 A. This output can be inverted from the settings menu. It can be used to switch a relay or valve solenoid (such as tank release valve, vaporizer release valve or similar), and prevents LPG operation when the additive tank is empty. The input 12 Volt at LPG on (orange) from the 5-pin plug starts the Valve Protector Module function. Additive is only introduced if this input is active. (The mode can be set from the menu)

Wiring plan for LPG system cut-off relay upon empty additive tank

Basic circuit for cut-off relay



Installation and bringing into operation

1. Install the additive tank as vertically upright as possible at an accessible, cool place in the engine bay or car boot.
Make sure the ambient temperature does not exceed 80 degrees C.
2. Install the dosing module (in any orientation) at a cool, accessible place in the engine bay. When installing, make sure you can still reach the hose connections.
Make sure the ambient temperature does not exceed 80 degrees C.
3. Use the PA hose to connect the tank to the input of the dosing module. Trim the hose to fit without excessive slack between the output of the tank to the input of the module, then plug it in. (Caution: do not kink the hose, and only use a suitable hose cutter to trim it). Once trimmed, the hose must be inserted about 12 mm into the push-fit connection.
To remove the hose, press the ring on the quick-release fastener to loosen it and then pull the hose out.

4. Additive feed line connections, sequential.

There are three additive feed methods to choose from.

a. Additive feed into the manifold by M5 threaded sleeve

Drill a 4.2 mm hole into the manifold beside the LPG jet.

Tap an M5 thread into this hole. Screw in the additive jet, using thread sealant paste. The length of the thread can be sawn down if required. The end of the jet should not touch the wall inside the manifold.

(Caution!! No borings are allowed to get into the combustion chamber, otherwise they could cause considerable damage to the engine)

Using the additive hose, connect the push-fit connector on the threaded sleeve to the correct output on the sequential module.

Repeat this process for all cylinders.



b. Additive feed into the LPG injection hose after the LPG jet

Cut through the LPG injection hose at a suitable position after the LPG jet.

Insert the additive T-piece and secure it using suitable clip collars.

Using the additive hose, connect the push-fit connector of the additive shunt to the correct output on the sequential module. Repeat this process for all cylinders.



c. Additive feed for inline LPG injection with PA hose

Cut through the PA hose at a suitable position after the LPG jet.

Insert the ends of the LPG PA hose into the connections of the additive T-junction. Using the additive hose, connect the 4 mm push-fit connector of the additive shunt to the correct output on the sequential module. Repeat this process for all cylinders.



5. Now establish all necessary electrical connections.
(See wiring plan)

6. Now fill the additive tank with a suitable valve protection additive (max. 600 ml).
Check the system for leaks.

7. The system bleeds itself automatically when first put into operation!!!

An air-free additive line to the sequential module is extremely important for faultless functioning of the system. If there are any air bubbles in the additive feed line or pump, the necessary system pressure cannot be established and malfunctions can occur. The system therefore bleeds when it detects air bubble formation.

Start the engine and let it idle. The system will now try to build up the necessary system pressure. Since there is still no additive in the pressure reservoir, after about 15 seconds, the Valve Protector starts a bleeding process and draws additive. The positive pressure is delivered alternately to valve 1 and 2. The first time the system is operated, and if there are long additive feed lines, it could be necessary to repeat this process by switching the ignition off and on again. Once the system has bled itself and the necessary system pressure has built up, the Valve Protector Sequential operates according to the entered parameters.

There should now be no air bubbles left in the additive feed lines from the additive tank to the module. It is normal for air bubbles to form after the distributor module in the direction of the points of introduction, and this is not a fault.

Caution: Additives can cause damage to rubber or plastic parts. Immediately rinse off any escaping additive with plenty of water.

8. Use the programming cable on the dosing module to connect it to the USB port on your laptop or PC system.
Switch the ignition on – and now start the Valve Protector program.
The Connect indicator on the Valve Protector monitor should now display the connection to the dosing module

9. Now set the appropriate parameters for the vehicle in the Valve Protector program. Tips about the correct settings are given in the right field of the program.

10. While the engine is running on LPG, observe the live screen and check that it is functioning correctly. While the vehicle is LPG-fuelled, the injection timing monitor should display the current injection timings of the connected jets. The pump activity monitor should then fill up towards 100 %.

When 100 % is reached, an additive dosage is triggered and the pulse monitor reset to 00. An additive dose should be made into the idle LPG mixture every 20–180 seconds, depending on the engine characteristics.

The next activated cylinder will also be displayed.

11. The system is now fully installed and ready for operation.

Note

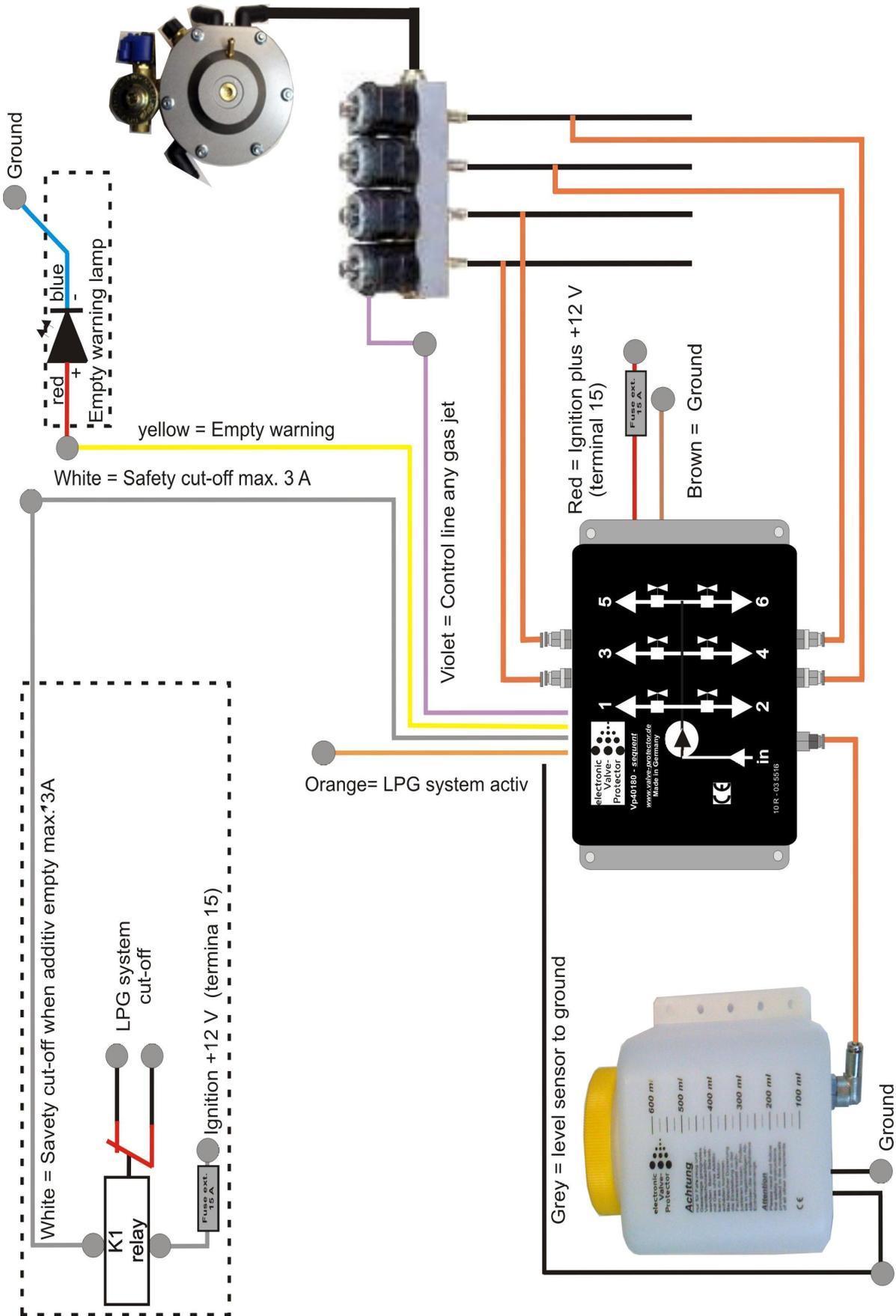
The quantity of additive withdrawn should be inspected after about 1000 kilometres have been driven on LPG. Always observe the additive manufacturer's instructions regarding the correct dosage.

If the amount of dosed additive is too high or too low, then decrease or increase the value 'Dosage' in the Settings program window.

The specified durabilities and applications are only "reference values" and do not absolve the customer of his responsibility to perform his own tests or evaluation of the suitability for the application.

Please note that elastomers have a limited service life, e.g. due to aging. We therefore recommend regular inspection and change intervals.

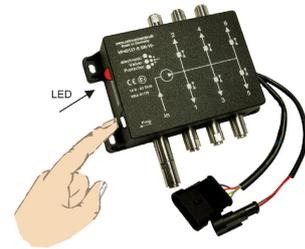
All information provided is correct to the best of our knowledge. We make no guarantee, however, as to the correctness and completeness of this information.



Quick start instructions – Amount setting

Additional to the PC-Programming

The Electronic Valve Protector module is equipped with a touch sensor (chrome ring). This metallic chrome ring reacts to touch by finger – just like a button. On the left side wall of the module, an LED is installed, which indicates the various functions with three colours (red-green-yellow) (see the following installation instructions).



Step 1: Start the vehicle and activate gas operation. The dosing module is now provided with power and remains in Set-up ready mode (LED lights up yellow) for 30 seconds.

Step 2: While the yellow LED is on, touch the metallic chrome ring with your finger until the LED lights up green. Then remove your finger.

Step 3: The LED now flashes x times and indicates the set amount of cylinders. You can set between 1 and 16 cylinders. To change the number of cylinders, simply tap on chrome ring with your finger until you have reached the required number of cylinders. The flash display will always show the number of cylinders set. Once level 16 has been reached, counting starts again at 1. **(Factory setting 4 cylinders)**

(Werkseinstellung 4 Zyl.)

Step 4: Once you have set the required number of cylinders, hold down your finger on the chrome ring until the LED light is red. You are now in the setting menu for dosage level setting.

Step 5: The LED now flashes x times red and displays the set dosage level. There are 15 dosage levels and one level for a quick test run. (Attention: Do not run test run excessively as otherwise too much additive is fed-in). Check the guide level table at the end of this page for the correct dosage level for your vehicle. **(Factory setting level 9)**

(Werkseinstellung. Stufe 9)

To change the dosage level correct simply tap on to the chrome ring with your finger until the required dosage level is reached. The flash display always shows the set dosage level. After level 16, counting starts again at level 1.

Step 6: Once you have reached the desired dosage level, (see required number of flashes), touch the tube connection until the LED light is yellow. For venting of the module the pump can switch on or off by pressing the chrome ring.

Step 7: Once you have reached the desired dosage level, (see required number of flashes), touch the chrome ring until the LED light is green. The settings are now stored and the module is in operation mode. The module remains in set-up ready mode (LED yellow) following each restart. If during this phase, the chrome ring is not touched, the module automatically changes into working mode (LED green) after 30 seconds. The setting Table is only a guide! The correct dosage must be checked after each installation and adjusted if required.

Display of LED built-in module

LED light is green: System has operating voltage but is not receiving control impulses from the gas injector.

LED flashes green: System has operating voltage and is receiving control impulses from the gas injector (operating mode)

LED slowly flashes red (every second): no input from level sensor into additive tank

LED quickly flashes red (every 0.25 sec.): additive depleted

LED flashes yellow (every 0.5 sec.): additive is being injected

Display of LED to be installed in passenger area

LED flashes 3 times for operation control. power on control

LED flashes slowly (every second): remaining additive level reserve approx. 100 ml

LED flashes quickly (every 0.25 sec.): additive depleted.

Guide level table for base amount setting per Cylinder

Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Cylinder capacity KW	4	5	7	8	10	13	16	20	26	32	40	56	64	80	112	Test
Cylinder capacity PS	5	7	10	11	14	18	22	27	35	43	54	76	87	108	152	Test

Safety Notices

Intended use:

Valve Protector is an electronically controlled dosing unit comprising the following components:

1. Additive tank, 2. Electronically controlled dosing module, 3. Feed line connection, 4. PA hose

The intended use is for dosing suitable and approved additives in internal combustion engines.

Valve Protector has been developed and constructed in accordance with prevailing safety guidelines.

It may only be used under the following conditions:

1. In technically faultless condition
2. After careful leak testing
3. Having been installed and brought into operation by a skilled professional
4. Used only for the intended purpose
5. Failure to observe the safety notices can lead to personal injury and material damage
6. Electrical lines and additive lines must always be laid in such a way as to rule out damage and chafing
7. Observe the additive manufacturer's safety guidelines
8. Compatibility between the additive and the components through which it flows has been checked and confirmed
9. Check for correct dosage at regular intervals
10. In the case of over/underdosage, have the system checked in an authorized service centre.
11. Driving with incorrect dosages can cause damage to your engine and/or exhaust system.
12. Rinse off any spilt additive with plenty of water
13. Refill the additive tank level when it gets low
14. Do not fill above the fill line
15. Never mix different additives
16. Use only approved and authorized additives
17. Using unauthorized additives can forfeit your operating licence
18. Use only original replacement parts
19. The specified durabilities and applications are only "reference values" and do not absolve the customer of his responsibility to perform his own tests or evaluation of the suitability for the application. Please note that elastomers have a limited service life, e.g. due to aging. We therefore recommend regular inspection and change intervals. All information provided is correct to the best of our knowledge. We make no guarantee, however, as to the correctness and completeness of this information.
20. The warranty period is 24 months from the date of purchase (against presentation of the sales slip or invoice). The warranty becomes void in the case of improper use of the device, use outside the technical specifications, use of an unapproved additive, improper operation or unauthorized interference. We are not liable for any damage resulting from these cases.
The exemption from liability also extends to all services performed by third parties that have not been ordered in writing by us.

Technical Data:

Power supply:	12V DC (10V–15V)
Current draw:	Idle 30 mA , Pump stroke up to 6 A
Pump pressure, max.:	5 BAR
Pump volume/stroke:	50 µl additive
Max. power:	180 ml/h
Weight:	1,250 g
Dimensions L/W/H:	145 mm x 95 mm x 56 mm
Device installation orientation:	Any
Temperature range:	-20/+85°C
Protection class:	IP54
Sealing materials:	FKM (Viton) / Elastomer with high temperature and weathering resistance. Suitable for many acids, bases, fuels and oils (including synthetic).

EC Declaration of Conformity

pursuant to
Annex I to the EC Directive
on Electromagnetic Compatibility
2004/108/EC
SI-Elektronik GmbH declares that
Product name: Valve Protector Sequential
Type: VP40127-S
Year of manufacture: 2009
conforms to the regulations of the abovementioned EC Guidelines.