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HEINZMANN®

Solenoid Valve Technique

Order Information

DARDANOS III

MVC 03-8

 <p>Warning</p>	<p>Read this entire manual and all other publications appertaining to the work to be performed before installing, operating or servicing your equipment.</p> <p>Practice all plant and safety instructions and precautions.</p>
 <p>Danger</p>	<p>Failure to follow instructions may result in personal injury and/or damage to property.</p> <p>HEINZMANN will refuse all liability for injury or damage which results from not following instructions</p>
 <p>Danger! High Voltage</p>  <p>Danger</p>	<p>Please note before commissioning the installation:</p> <p>Before starting to install any equipment, the installation must have been switched dead!</p> <p>Be sure to use cable shielding and power supply connections meeting the requirements of the <i>European Directive concerning EMI</i>.</p> <p>Check the functionality of the existing protection and monitoring systems.</p>
 <p>Danger</p>	<p>To prevent damages to the equipment and personal injuries, it is imperative that the following monitoring and protection systems have been installed:</p> <p>Overspeed protection acting independently of the speed governor</p> <p>Overtemperature protection</p> <p>HEINZMANN will refuse all liability for damage which results from missing or insufficiently working overspeed protection</p> <p>Generator installation will in addition require:</p> <p>Overcurrent protection</p> <p>Protection against faulty synchronization due to excessive frequency, voltage or phase differences</p> <p>Reverse power protection</p>
	<p>Overspeeding can be caused by:</p> <p>Failure of the voltage supply</p> <p>Failure of the actuator, the control unit or of any accessory device</p> <p>Sluggish and blocking linkage</p>



Warning

Electronically controlled injection (MVC) will in addition require to observe the following:

With **Common Rail** systems a separate mechanical flow limiter must be provided for each injector pipe.

With **Pump-Pipe-Nozzle (PPN)** and **Pump Nozzle (PNE)** systems fuel release may be enabled only by the movement of control piston of the solenoid valve. This is to inhibit fuel from being delivered to the injection nozzle in case of seizure of the control piston.



Warning

The examples, data and any other information in this manual are intended exclusively as instruction aids and should not be used in any particular application without independent testing and verification by the person making the application.



Danger

Independent testing and verification are especially important in any application in which malfunction might result in personal injury or damage to property.

HEINZMANN make no warranties, express or implied, that the examples, data, or other information in this volume are free of error, that they are consistent with industry standards, or that they will meet the requirements for any particular application.

HEINZMANN expressly disclaim the implied warranties of merchantability and of fitness for any particular purpose, even if **HEINZMANN** have been advised of a particular purpose and even if a particular purpose is indicated in the manual.

HEINZMANN also disclaim all liability for direct, indirect, incidental or consequential damages that result from any use of the examples, data, or other information contained in this manual.

HEINZMANN make no warranties for the conception and engineering of the technical installation as a whole. This is the responsibility of the user and of his planning staff and specialists. It is also their responsibility to verify whether the performance features of our devices will meet the intended purposes. The user is also responsible for correct commissioning of the total installation.

Contents

1 General Information	1
2 Injection System	2
2.1 System	2
2.2 Solenoid.....	2
2.3 Suction Throttling Valve	3
3 Engine Data.....	4
4 Measuring Methods for Determining the Crankshaft Angle.....	5
4.1 Measuring Accuracy.....	5
4.2 Measuring Methods.....	5
5 Sensors.....	10
5.1 Pickups	10
5.2 Setpoint Adjuster.....	11
5.3 Pressure Sensors	12
5.4 Temperature Sensors	13
6 Switch Inputs (Digital Inputs).....	14
7 Digital Outputs	15
7.1 Digital Power Outputs – PWM, high side switching, $I_{source} < 2A$	15
7.2 Digital Power Outputs – PWM, high side switching, $< 12A$	16
7.3 Digital Outputs, low side I_{source} , $< 500mA$	16
8 Frequency Output	18
9 Configuration Data	19
9.1 Speeds.....	19
9.2 Speed Ramp.....	19
9.3 Droop.....	20
9.4 Engine Start	20
10 Injection Maps.....	21
10.1 Pump-Pipe-Nozzle resp. Pump-Nozzle-Unit.....	21
10.1.1 Map of Injection Duration.....	21

10.2 Common Rail.....	23
10.2.1 Map of Injection Duration.....	23
10.2.2 Map of Injection Pressure	23
10.3 Map of Start of Delivery.....	24
11 Quantities Limitations	25
11.1 Speed dependent Quantity Limitation.....	25
11.2 Boost Pressure dependent Quantity Limitation.....	26
12 Monitoring Functions	27
12.1 Speed dependent Oil Pressure Monitoring.....	27
13 Harness.....	28
13.1 Engine Plug	29
13.2 Vehicle Plug	30
14 Further Details.....	31

1 General Information

Customer

Company:

Contact Person:

Phone:

Fax:

E-Mail:

Order-No.

Customer:

HEINZMANN:

Connection Diagram-No.

ESK:

Engine

Type:

Power: kW at rpm

Application

Generator

Industrial Engine

Vehicle

2 Injection System

2.1 System

- PPN (Pump-Pipe-Nozzle)
- PNU (Pump-Nozzle-Unit)
- CR (Common Rail)

Manufacturer:

Designation:

2.2 Solenoid

- HEINZMANN-Solenoid Type:
- other Type:

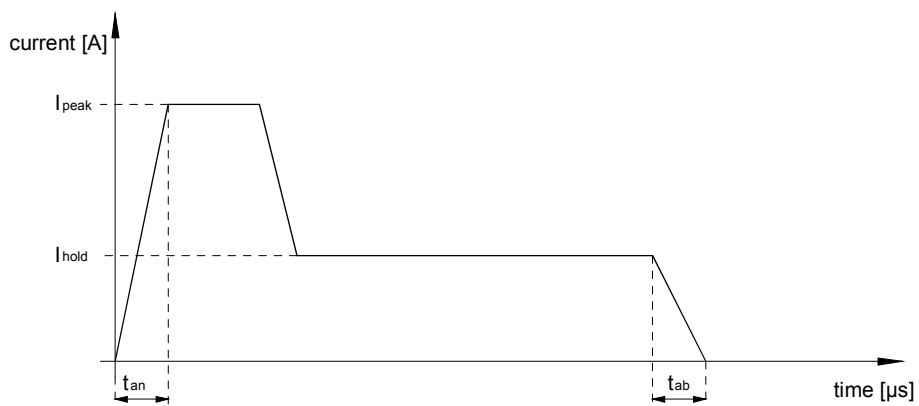


Fig 1: Current Curve

Supply Voltage:	V =	V
Boost Current:	I _{pea} =	A
	k	
Holding Current:	I _{hold} =	A
Boost Time:	t _{an} =	μs
Switch-off Time:	t _{ab} =	μs
Resistance:	R ₂₀ =	Ohm
Inductivity:	L =	mH
Adjusting Force:	F =	N
Pull-back Spring Force:	F ₁ =	N
Moved Mass:	m =	g

2.3 Suction Throttling Valve

Type:

Manufacturer:

Supply Voltage: $V =$ V

Steady Current: $I =$ A

Control Current: $I =$ A

Resistance: $R_{20} =$ Ohm

Inductivity: $L =$ mH

PWM-Frequenz: $F =$ Hz

3 Engine Data

Number of Cylinders:

Power per Cylinder:

kW/Cyl.

Engine Power:

kW at rpm

Firing Table:

For in-line engines, please use the letter 'A' to designate the individual cylinders. For Vee-type engines, use the letter 'A' to designate the first cylinder bank and the letter 'B' to designate the second cylinder bank. Please enter the TDC's specified in degrees crankshaft angle for each cylinder. In doing so, proceed in accordance with the firing order, i.e., the sequence of the TDC angles should be in ascending order.

Firing Order-No	Cylinder Designation	Top Dead Centre (° CS)
1	A1	0
2		
3		
4		
5		
6		
7		
8		

4 Measuring Methods for Determining the Crankshaft Angle

It is the position of the piston that decides on the right injection timing for each cylinder. In order to determine the exact position of the crankshaft and hence of the individual cylinder piston, several different measuring methods based on different mounting locations of the angular sensors are being offered.

4.1 Measuring Accuracy

As accuracy of crankshaft angle determination is crucial for injection accuracy there should be supplied new information on the angle for every 6 degrees crankshaft. This means that at least 60 teeth will be required when the sensor is mounted to the crankshaft, and 120 teeth when mounted to the camshaft. By preference, the teeth should be twice these numbers to obtain an accuracy of 3 degrees crankshaft.

To determine the angular position a specific measuring wheel with rectangular tooth profile should be used if possible.

4.2 Measuring Methods

To determine speed and angular position two speed inputs and one measuring pin input (phase sensor) are provided as a maximum.

The following figure offers an overview of the diverse measuring methods to be considered:

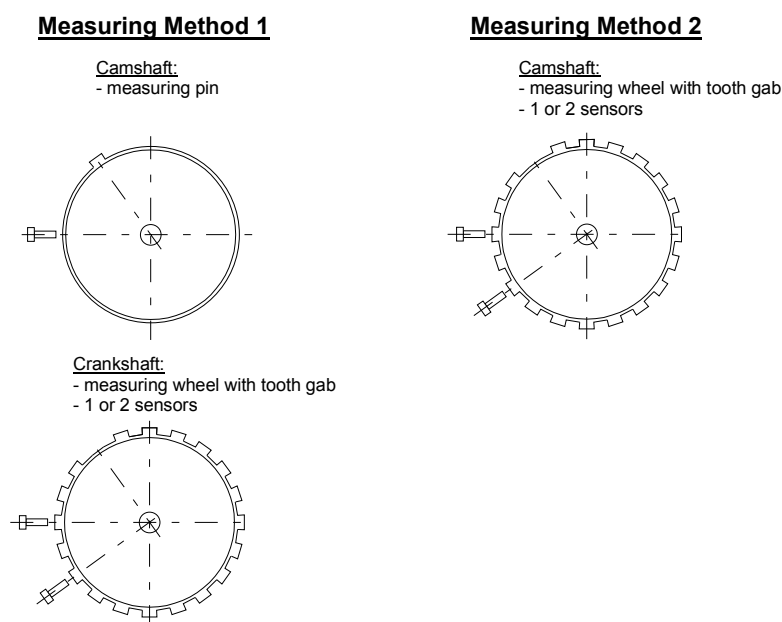
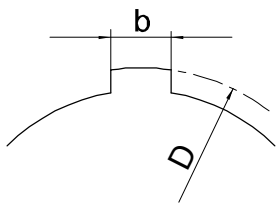


Fig 2: Method of Measuring

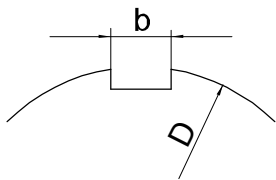
The standard measuring method (measuring method 1) uses one speed sensor on the crankshaft with a tooth gap and a measuring pin on the camshaft serving as a phase sensor. For reasons of redundancy a second crankshaft sensor can be provided.

The speed sensors can be mounted to either the crankshaft or the camshaft. Crankshaft mounting should be preferred since the number of teeth the sensor sees during one revolution will be greater and therefore enhance accuracy of angular measurement.

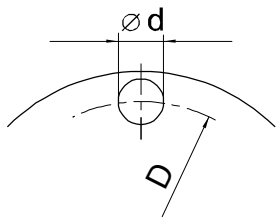
The measuring pin on the camshaft can be designed in various ways:



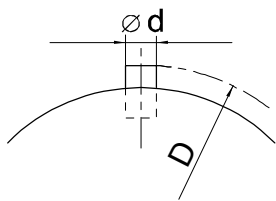
- Single Tooth
 b = mm
 D = mm



- Single Gap
 b = mm
 D = mm



- Single Pin
 d = mm
 D = mm



- Single Pin
 d = mm
 D = mm

For the measuring wheel, the following information is needed :

Tooth Breadth: $b =$ mm

Measuring Wheel Diameter: $D =$ mm

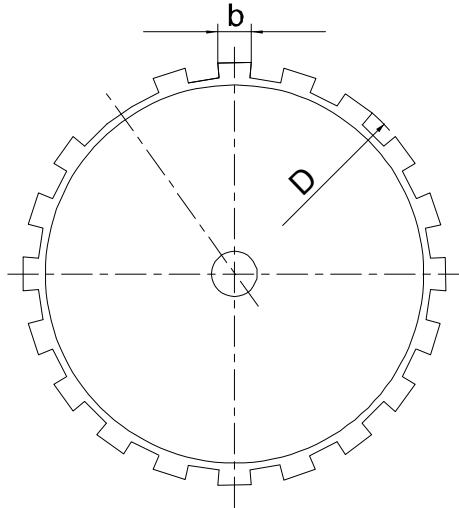


Fig 3: Tooth Gap and Measuring Wheel Diameter

The position of the tooth gap resp. of the measuring pin must be determined exactly. These values are crucial with regard to the angular accuracy of control. The ignition TDC of the cylinder selected first (cylinder A1, TDC is equivalent to 0° crankshaft angle) is to be used as a reference point. All distances (including that of the tooth gap or of the measuring pin on the camshaft) are to be specified in degrees crankshaft angle **before** TDC of cylinder A1.

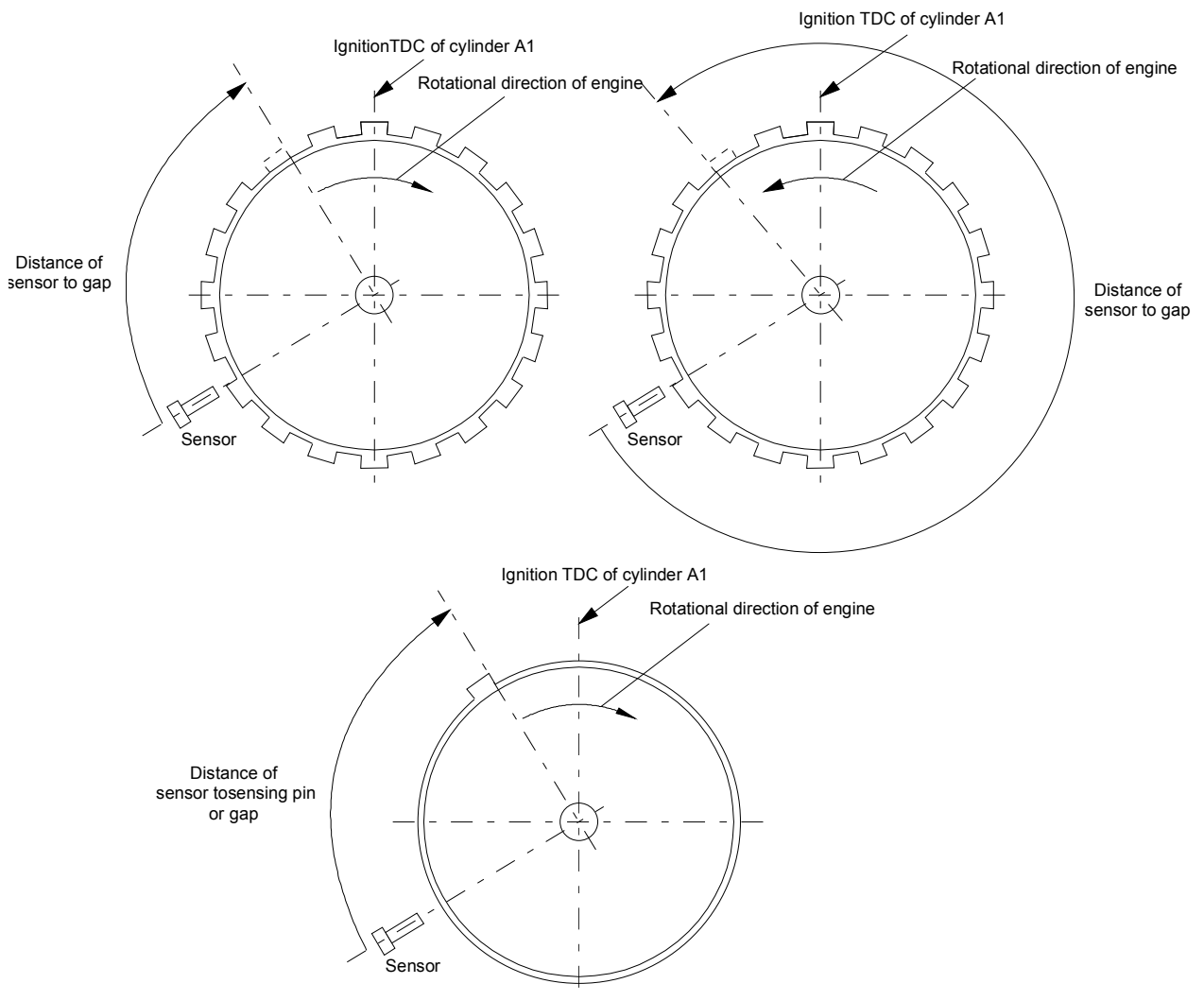


Fig 4: Distance from TDC to Measuring Gap resp. to Measuring Pin

To determine the distance, the crankshaft is rotated into a position where cylinder A1 is exactly at TDC (ignition TDC). With the engine in this position, the distance between the centre of the sensor and the beginning of the gap is measured by degrees crankshaft starting from the sensor in direction of engine rotation. In like manner, the phase sensor distance is to be determined.

Speed Sensor on Crankshaft

Number of teeth on crankshaft (gap is counted as one tooth) Teeth

Measuring Method 1: Speed Sensor on Crankshaft, Wheel with Tooth Gap

When using three sensors, this measuring method offers full redundancy in case any of the sensors should fail. If operation is without camshaft measuring pins or in case the pin is at fault, the gap position will be determined during start-up by means of a trial procedure (symbol 224 \f "Wingdings" \s 12 slightly delayed engine start).

- | | | | | |
|-------------------------------------|-----------------------------|--------|------------|------------|
| <input checked="" type="checkbox"/> | Speed Sensor on Meas. Wheel | Sensor | Centre-Gap | Beginning: |
| | °Crank | | | |
| <input type="checkbox"/> | Meas. Pin on Camshaft | Sensor | Centre-Pin | Beginning: |
| | °Crank | | | |
| <input type="checkbox"/> | 2nd Speed Sensor | Sensor | Centre-Gap | Beginning: |
| | °Crank | | | |

Speed Sensor on Camshaft

Number of teeth on crankshaft (gap is counted as one tooth) Teeth

Measuring Method 2: Speed Sensor on Camshaft, Wheel with Tooth Gap

When using two sensors, this measuring method offers full redundancy in case one of the sensors should fail. As sensor location is on the camshaft, accuracy of angular measurement should be ensured by using a measuring wheel with a number of teeth sufficiently large.

- | | | | | |
|-------------------------------------|-----------------------------|--------|------------|------------|
| <input checked="" type="checkbox"/> | Speed Sensor on Meas. Wheel | Sensor | Centre-Gap | Beginning: |
| | °Crank | | | |
| <input type="checkbox"/> | 2nd Speed Sensor | Sensor | Centre-Gap | Beginning: |
| | °Crank | | | |

As regards other measuring methods arrangements can be made with **HEINZMANN** any time.

5 Sensors

The below table gives an overview of the numbers and types of sensors which can be connected to the MVC 03 - 8:

Type	Number
Magnetic Pickups	3
Temperature Sensors	5
Extendet Voltage Input	1
Current Inputs	2
Voltage Inputs	8

All sensors are described in the Manual “DARDANOS II“ No. MV 02 002-e.

5.1 Pickups

It is recommended to use Hall sensors by **HEINZMANN** as angular position sensors. These sensors have been specially developed for precise determination of angular positions.

The suitability of Hall sensors by other manufacturers can be examined on request.

Pickup 1:

- HEINZMANN**-Hall Sensor HIA 31 – 46
- HEINZMANN**-Hall Sensor HIA 31 – 76
- HEINZMANN**-Hall Sensor HIA 31 – 102
- other

Type:

Pickup 2:

- HEINZMANN**-Hall Sensor HIA 31 – 46
- HEINZMANN**-Hall Sensor HIA 31 – 76
- HEINZMANN**-Hall Sensor HIA 31 – 102
- other

Type:

Pickup for Measuring Pin:

- HEINZMANN-Hall Sensor HIA 31 – 46
- HEINZMANN-Hall Sensor HIA 31 – 76
- HEINZMANN-Hall Sensor HIA 31 – 102
- other

Type:

5.2 Setpoint Adjuster

There is a maximum of 2 analogue inputs for setpoint adjustment available.

- Setpoint 1
 - HEINZMANN Setpoint Potentiometer SW 01 - 1 - b
 - HEINZMANN Setpoint Potentiometer SW 02 - 10 - b
 - other:
 - Current Input 4..20 mA
 - Voltage Input 0..5 V
 - Range:

- Setpoint 2
 - HEINZMANN Setpoint Potentiometer SW 01 - 1 - b
 - HEINZMANN Setpoint Potentiometer SW 02 - 10 - b
 - other:
 - Current Input 4..20 mA
 - Voltage Input 0..5 V
 - Range:

5.3 Pressure Sensors

The pressure sensor inputs are configured for voltage signal (0..5 V).

Boost Pressure

Boost pressure sensor without additional die cast housing

HEINZMANN Sensor DSL 01 - 02 (Range 0..2 bar)

HEINZMANN Sensor DSL 01 - 05 (Range 0..5 bar)

HEINZMANN Sensor DSL 01 - 10 (Range 0..10 bar)

other:

Type:

Manufacturer:

Range: bar up to bar

Voltage Input 0..5 V

other:

Oil Pressure

HEINZMANN Sensor DSO 01 - 06 (Range 0..6 bar)

HEINZMANN Sensor DSO 01 - 10 (Range 0..10 bar)

other:

Type:

Manufacturer:

Range: bar up to bar

Voltage Input 0..5 V

other:

Rail Pressure Sensor (required for Common Rail)

Type:

Manufacturer:

Range: bar up to bar

Voltage Input 0..5 V

other:

5.4 Temperature Sensors

There are up to 5 temperature sensor inputs configurable.

- Cooling Medium Temperature
 - HEINZMANN** Sensor TS 01 - 28 - PT 1000
 - other:

- Boost Pressure Temperature
 - HEINZMANN** Sensor TS 01 - 28 - PT 1000
 - other:

- Oil Temperature
 - HEINZMANN** Sensor TS 01 - 28 - PT 1000
 - other:

- Fuel Temperature
 - HEINZMANN** Sensor TS 01 - 28 - PT 1000
 - other:

- HEINZMANN** Sensor TS 01 - 28 - PT 1000
 - other:

- HEINZMANN** Sensor TS 01 - 28 - PT 1000
 - other:

6 Switch Inputs (Digital Inputs)

The functionality of the switch inputs, such as switches for idle speed or fixed speeds, change-over of droop, etc., is discussed in the manual „Basic Information Electronically Controlled Injection Systems, Level 6“ No. MV 99 003-e and should be decided upon in coordination with **HEINZMANN**.

No.	Activity	Function
1	<input type="checkbox"/> active with contact closed <input type="checkbox"/> active with contact open	Engine Stop
2	<input type="checkbox"/> active with contact closed <input type="checkbox"/> active with contact open	
3	<input type="checkbox"/> active with contact closed <input type="checkbox"/> active with contact open	
4	<input type="checkbox"/> active with contact closed <input type="checkbox"/> active with contact open	
5	<input type="checkbox"/> active with contact closed <input type="checkbox"/> active with contact open	

7 Digital Outputs

7.1 Digital Power Outputs – PWM, high side switching, $I_{\text{source}} < 2\text{A}$

Output 1

.....
 high active

low active

Output 2

Common Alarm

high active

other:

high active

low active19

Output 3

Emergency Stop

low active

other:

high active

low active

Output 4

high active

low active

Output 5

high active

low active

Output 6

high active

low active

Output 7

high active

low active

Output 8

high active

low active

7.2 Digital Power Outputs – PWM, high side switching, <12A

Output 9

high active

low active

7.3 Digital Outputs, low side Isource, <500mA

Output 10

high active

low active

Output 11

high active

low active

Output 12

high active

low active

Output 13

high active

low active

8 Frequency Output

Output

9 Configuration Data

The following lists are to specify the most relevant configuration data for first commissioning the installation.

The possibilities of pre-defining setpoints are covered by the manual „Basic Information for Electronically Controlled Injection Systems, Level 6“ No. MV 99 003-e and should be coordinated with **HEINZMANN**.

9.1 Speeds

Minimum Speed (Idle Speed)	rpm
Maximum Speed	rpm
Overspeed	rpm
<input type="checkbox"/> analogue Speed Setpoint 1	
<input type="checkbox"/> analogue Speed Setpoint 2	
<input type="checkbox"/> Switch Inputs „Increase Speed / Decrease Speed“ (Motor Potentiometer)	
<input type="checkbox"/> Fixed Speed	
Fixed Speed 1	rpm
Fixed Speed 2	rpm
<input type="checkbox"/> Temperature dependent Increase of Idle Speed	
Idle Speed to Increase to	rpm
Temperature for Normal Idle Speed	°C
Temperature for Increased Idle Speed	°C
<input type="checkbox"/> Switch-over to Second Speed Range	
Minimum Speed 2	rpm
Maximum Speed 2	rpm

9.2 Speed Ramp

<input type="checkbox"/> Speed Ramp	
Rate of increasing Speed Change	rpm/s
Rate of decreasing Speed Change	rpm/s

9.3 Droop

Droop 1

Droop 1 = 0 % (isochronous)

Droop 1 %

Rated Speed rpm

Zero-load Injection Quantity mm³/stroke

Full-load Injection Quantity mm³/stroke

Switch-over to Droop 2

Droop 2 = 0 % (isochronous)

Droop 2 %

Rated Speed rpm

Zero-load Injection Quantity mm³/stroke

Full-load Injection Quantity mm³/stroke

9.4 Engine Start

Starter Speed (approx.) rpm

Fixed Starting Quantity Adjustment

Starting Quantity mm³/Hub

Variable Starting Quantity Adjustment

Starting Quantity 1 mm³/stroke

Starting Quantity 2 mm³/stroke

Time for Starting Quantity 1 s

Ramping Time for Starting Quantity 1 → Starting Quantity 2 s

Temperature dependent Starting Quantity Adjustment

Starting Quantity for cold Engine mm³/stroke

Starting Quantity for warm Engine mm³/stroke

Temperature of cold Engine °C

Temperature of warm Engine °C

Start Ramp

Start Ramp to begin at rpm

Rate of Increasing Speed Change rpmps

10 Injection Maps

10.1 Pump-Pipe-Nozzle resp. Pump-Nozzle-Unit

10.1.1 Map of Injection Duration

With these systems, injection pressure is produced by the camshaft via an injection cam. Injection pressure will therefore depend on speed and injection quantity.

On the other hand, the duration of injection will have to be adjusted to obtain equal injection quantities at different speeds. In order to be able to correctly adjust injection duration the characteristic pump map is required.

As start of injection will additionally affect injection duration, the possibility of entering characteristic pump maps for four different injection beginnings has been provided. There is linear interpolation for intermediate map values.

Please, enter in the following characteristic maps the durations of injection specified in degrees crankshaft angle in dependence of engine speed and injection quantity. It is absolutely necessary that the map starts with injection quantity 0 mm³/stroke and that the lowest speed point is provided for engine start.

This map must be entered for four different delivery beginnings. The values for engine speed and injection quantity must be identical for all maps.

Map 1: Start of Delivery: ° crank shaft before top dead centre

Inj. Quantity [mm ³ /stroke]	Engine Speed [rpm]				
0					

Map 2: Start of Delivery: ° crank shaft before top dead centre

Inj. Quantity e [mm ³ /stroke]	Engine Speed [rpm]				
0					

Map 3: Start of Delivery: ° crank shaft before top dead centre

Inj. Quantity [mm ³ /stroke]	Engine Speed [rpm]				
0					

Map 4: Start of Delivery: ° crank shaft before top dead centre

Inj. Quantity [mm ³ /stroke]	Engine Speed [rpm]				
0					

10.2 Common Rail

10.2.1 Map of Injection Duration

Common rail systems offer the possibility of generating the injection pressure independently of engine speed and load. To inject the correct amount of fuel at a certain pressure will require a characteristic map indicating duration of delivery in dependence of injection pressure and injection quantity.

Duration of injection is to be specified in milliseconds. It is absolutely necessary that the map starts with injection quantity 0 mm³/stroke and that the lowest speed point is provided for engine start.

Inj. Quantity [mm ³ /stroke]	Injection Pressure [bar]					
0						

10.2.2 Map of Injection Pressure

In order to optimally adjust injection pressure for every working point of the engine, a injection pressure map has been provided. This map should list the injection pressures in dependence of engine speed and injection quantity.

Inj. Quantity [mm ³ /stroke]	Speed [rpm]					

10.3 Map of Start of Delivery

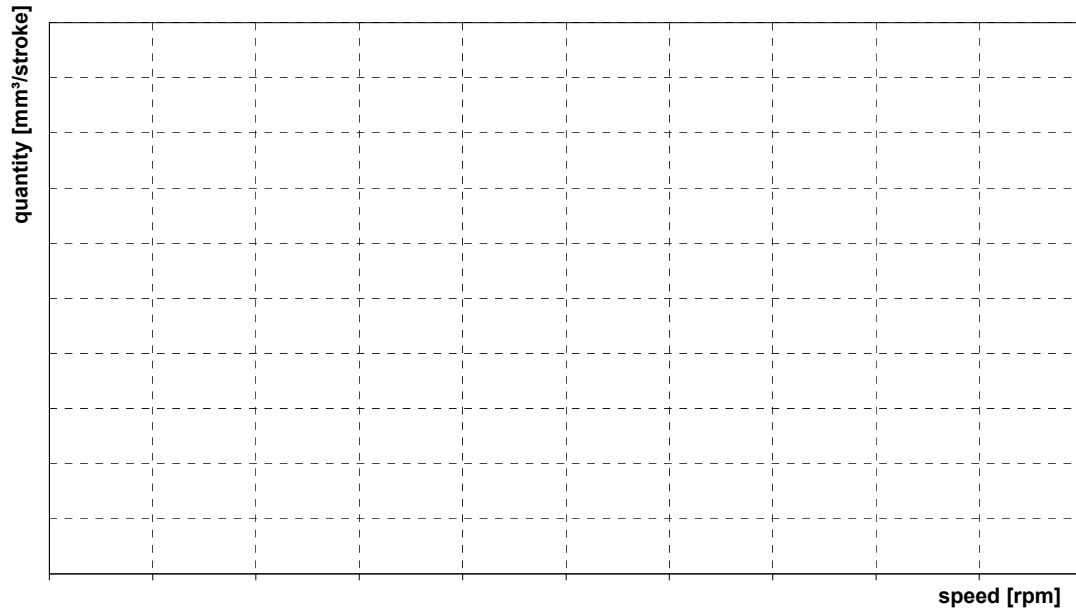
Start of delivery may be varied in dependence of speed and load. By this, it will be possible to tune the engine for optimum consumption and exhaust gas values.

The values to be entered in the start of delivery map are the starts of delivery specified in degrees crankshaft before TDC in dependence of engine speed and injection quantity.

Inj. Quantity [mm ³ /stroke]	Speed [rpm]							

11 Quantities Limitations

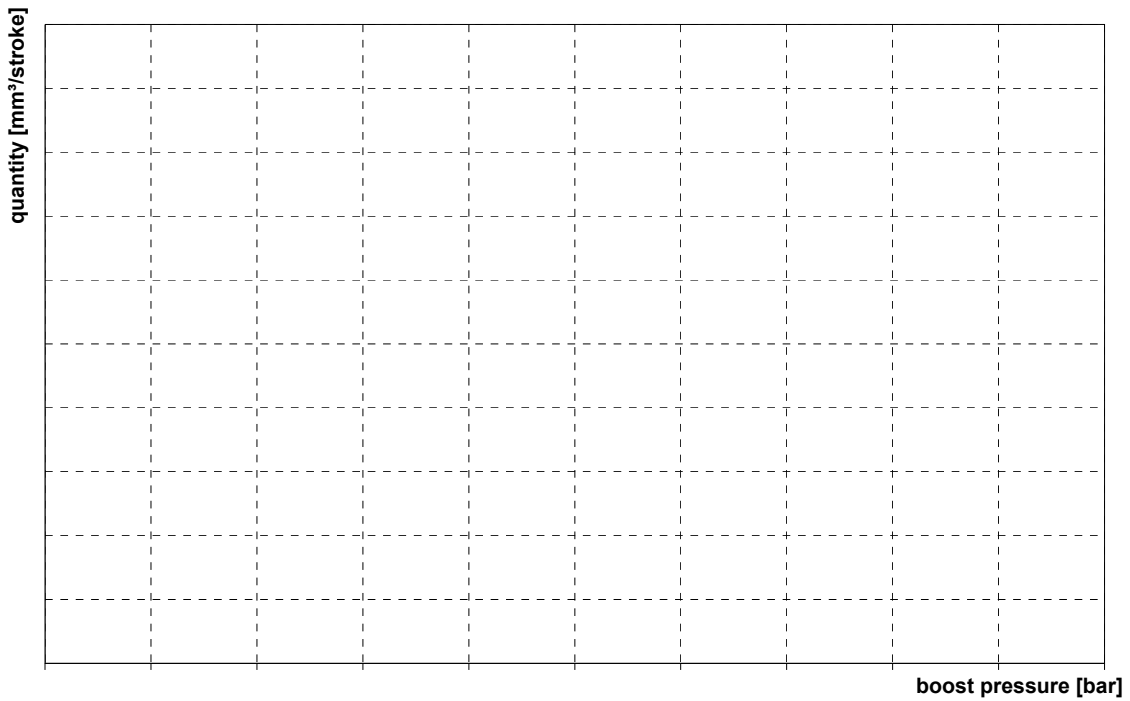
11.1 Speed dependent Quantity Limitation



No.	Speed [rpm]	Quantity [mm ³ /stroke]
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

No.	Speed [rpm]	Quantity [mm ³ /stroke]
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

11.2 Boost Pressure dependent Quantity Limitation



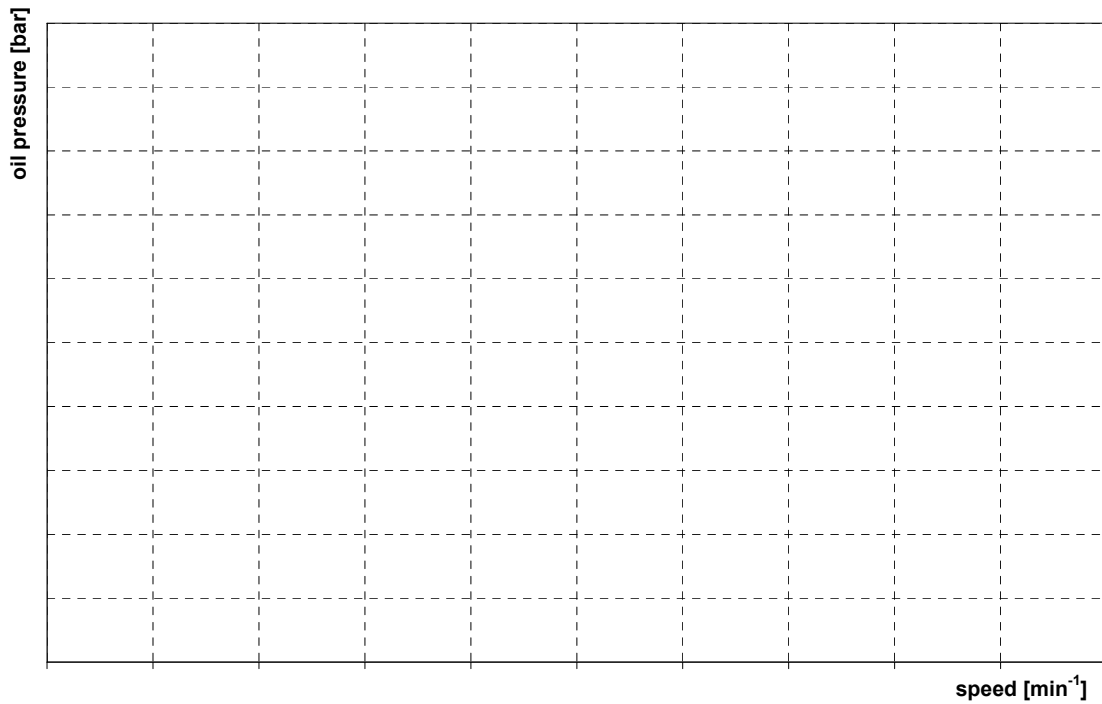
No.	Boost Pressure [bar]	Quantity [mm ³ /stroke]
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

12 Monitoring Functions

12.1 Speed dependent Oil Pressure Monitoring

Oil Pressure Warning

Oil Pressure Emergency Stop



No.	Speed [rpm]	Warning [bar]
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

No.	Speed [rpm]	Emergency Stop [rpm]
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

13 Harness

To avoid undesirable disturbances during operation, care should be taken that suitable cable materials, sufficient line cross sections and correct cable shielding be used for cabling. It is therefore recommended to order the cable harness together with the other components directly from **HEINZMANN**. Every cable harness will be manufactured according to the following customer specifications and subsequently tested.

Which cables are required will depend on the type of application and on the number of sensors.

13.1 Engine Plug

Pin No.	Cable	Length
33	CU - Speed-/Angle Sensor 1	cm
32	CU - Speed-/Angle Sensor 2	cm
34	CU - Camshaft Index Sensor	cm
48	CU - Suction Throttling Valve 1	cm
25	CU - Suction Throttling Valve 2	cm
45	CU - Bank A Solenoid Valve 1	cm
44	CU - Bank A Solenoid Valve 2	cm
43	CU - Bank A Solenoid Valve 3	cm
42	CU - Bank A Solenoid Valve 4	cm
41	CU - Bank A Solenoid Valve 5/ Bank B Solenoid Valve 1	cm
40	CU - Bank A Solenoid Valve 6/ Bank B Solenoid Valve 2	cm
39	CU - Bank A Solenoid Valve 7/ Bank B Solenoid Valve 3	cm
38	CU - Bank A Solenoid Valve 8/ Bank B Solenoid Valve 4	cm
18	CU - Temperature Sensor 2	cm
20	CU - Temperature Ssensor 3	cm
36	CU - Temperature Sensor 4	cm
35	CU - Temperature Sensor 5	cm
26	CU - Analogue Input Signal 3	cm
27	CU - Analogue Input Signal 4	cm
28	CU - Analogue Input Signal 5	cm
29	CU - Analogue Input Signal 6	cm
30	CU - Analogue Input Signal 7	cm
31	CU - Analogue Input Signal 8	cm
17	CU - Digital Input Signal 1	cm
22	CU - Digital Output Signal 7	cm
46	CU - Digital Output Signal 8	cm
70	CU - Digital Output Signal 9	cm
69	CU - Digital Output Signal 13	cm

13.2 Vehicle Plug

Pin No	Cable	Length
1	CU - Power Supply 1	cm
25	CU - Power Supply 1	cm
2	CU - Power Supply 2	cm
13	CU - CAN-Bus 1	cm
14	CU - CAN-Bus 2	cm
35	CU - Temperature Sensor 1	cm
33	CU - Analogue Input Signal 1	cm
34	CU - Analogue Input Signal 2	cm
30	CU - Analogue Input Signal 9	cm
31	CU - Analogue Input Signal 10	cm
32	CU - Analogue Input Signal 11	cm
18	CU - Digital Input Signal 2	cm
19	CU - Digital Input Signal 3	cm
40	CU - Digital Input Signal 4	cm
41	CU - Digital Input Signal 5	cm
17	CU - Digital Input Signal 6	cm
4	CU - Digital Output Signal 1	cm
5	CU - Digital Output Signal 2	cm
6	CU - Digital Output Signal 3	cm
27	CU - Digital Output Signal 4	cm
28	CU - Digital Output Signal 5	cm
29	CU - Digital Output Signal 6	cm
22	CU - Digital Output Signal 10	cm
23	CU - Digital Output Signal 11	cm
46	CU - Digital Output Signal 12	cm
70	CU - Frequency Output Signal	cm
15	CU - Communication Plug	cm

14 Further Details