

**HUEGLI TECH Gas Engine Management System**

**Product Features**

- Can-Bus communication
- CHP support (e.g. universal PID loops)
- Automatic synchronising and power control
- Automatic and Manual drive
- Fast response on load transient
- 2 Individual Graphical display
- 2 Separate History records (400 events)
- Password protection (3 level)
- Language selection
- Numerous I/O's
- Configurable In and Outputs

**Benefits**

- Complete integrated gen-set and engine solution - less wiring and components
- Communication among all components via CAN, RS485 and Internet
- Many types of communication easy supervision and servicing
- Perfect price/performance ratio
- Precise Lambda control
- O<sub>2</sub>-Drift compensation

The HT-Gas Engine Control System is a comprehensive solution in a modular concept, presently for gas engines up to 25 liter displacement: Three modules complete this system: IS-CU IntelliSys, AF-2000 Lambda controller and RM-814 or RM- 5 Mixer.

**IntelliSys** is a top end expandable controller for single and multiple generating sets operating in standby or parallel modes.

The **AF-2000** is a unique and enhanced Lambda Control unit combined with an I/O Module. A modern control platform with a powerful microprocessor and a large memory unleashes numerous features with great flexibility.

The **RM 814 or 25 Mixer** is an enhanced sophisticated Air Gas blender based on the approved ring gap principal. Due to a precise mechanical gear system an accurate Lambda control tolerance smaller than +/- 0.01 is guaranteed.

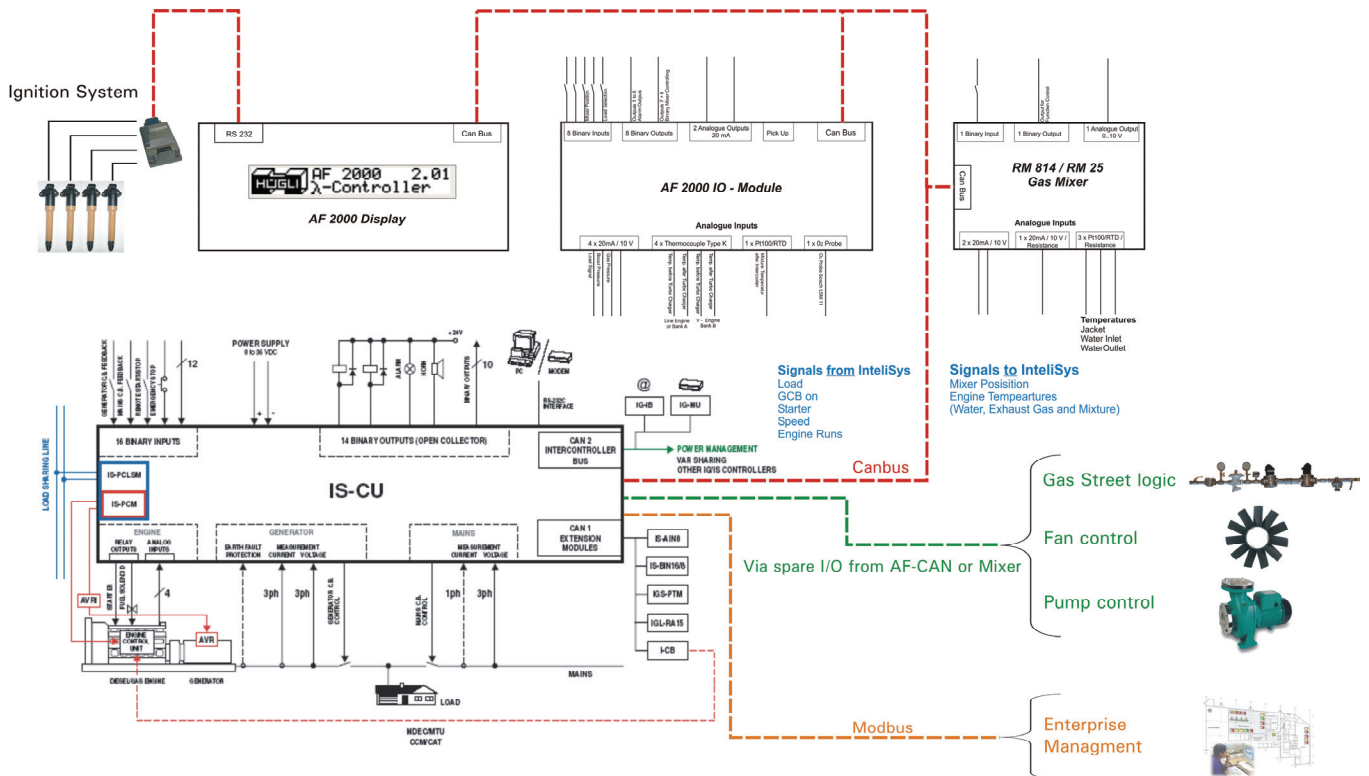
All 3 units together are communicating among each other via CAN Bus. Modularity results in a perfect price / feature ratio and allows reasonable expansion of I/O's at any time.

Contact our gas experts for more information and application detail.

[www.huegli-tech.com](http://www.huegli-tech.com)

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### Integrated Protection

#### Generator

- All standard IntelliSys gen-set and engine protection

#### Engine

- Exhaust temperatures
- Turbocharger temperatures
- Mixture temperature
- Gas temperature
- Various pressures

### Communication Extension

- IG-IB
- IG-MU

### Software

- WinEdit
- MultiEdit
- AF-2000-CFG
- Easy Fire (Ignition software release in 2007)

### Extention Features

#### IntelliSys

- All standard IntelliSys extentions
- BCD Ignition communication (2007)



### Product Features

- Precise Lambda control
- Can-Bus communication
- Graphical display
- History record (200 events)
- Password protected (3 level)
- Language selection
- Key pad control
- Numerous I/O's
- Configurable In and Outputs
- Display sealed IP65

### Advantage

- Perfect price performance ratio
- O<sub>2</sub>-Drift compensation
- Remote access via IS-CU
- Automatic set up for commissioning
- Reduced wiring
- Programmable via key pad

The AF-2000 is a unique and enhanced Lambda Control unit combined with an I/O Module. A modern control platform with a powerful microprocessor and a large memory unleashes numerous features and flexibility. It is used in all gas engine application such as stoichiometric and lean burn. Mapping power, pressure, temperature and other parameters result in a very precise and fast responding air fuel ratio control.

Monitoring combined with logic functions allows the user a wide combination and therefore the AF-2000 can be adapted to any application task.

CAN Bus communication to other peripherals facilitate remote access and wiring issues.

A powerful graphical display, icons symbols and bar graph for intuitive operation set a new standard for the gas engine controls.

Making the most use out of the AF-2000 is to combine it together with the RM series Mixer. This enables more features and is also cost saving for any application. Additional I/O's on the Mixer PCB prevent from using costly extensions.



Ask our gas experts for information.

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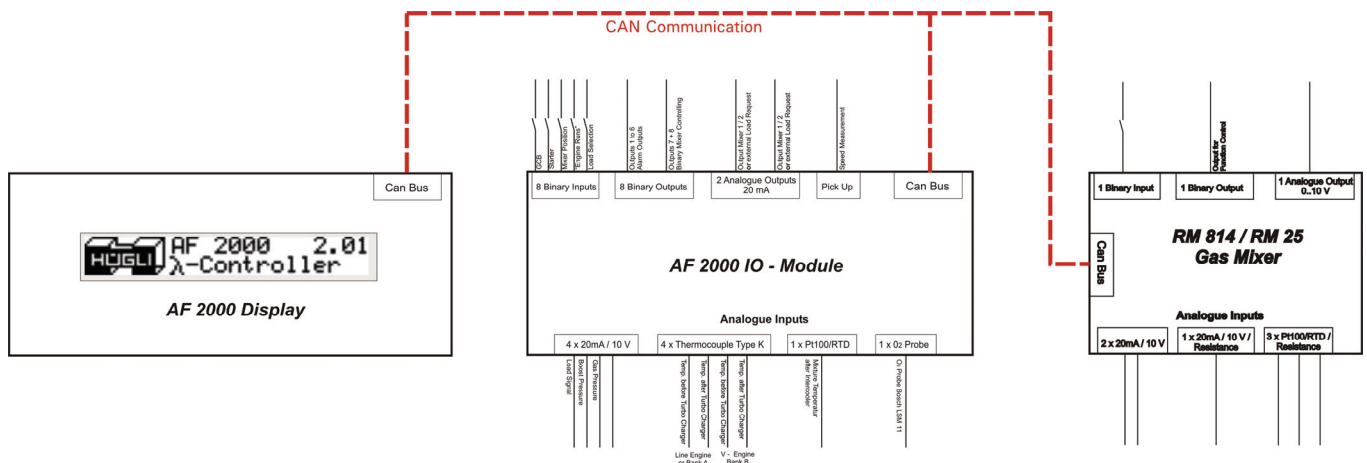
## Technical Specifications

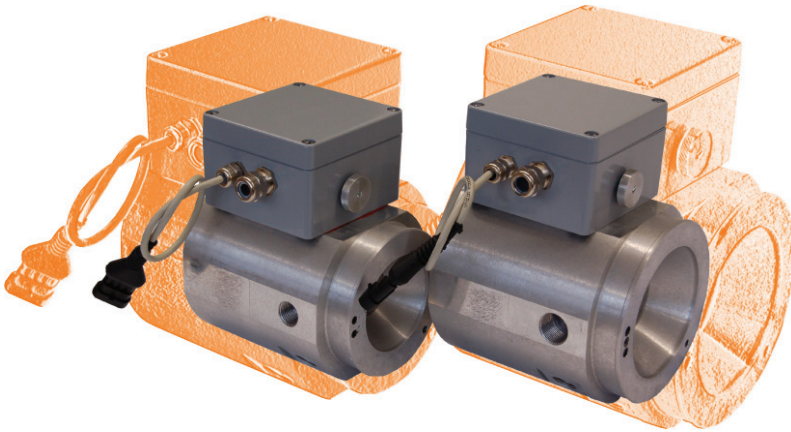
### Control Unit

- Supply Voltage: 24 V DC (+/- 25%)
- Current consumption: <0,6A
- Communication Interface: Can-Bus, RS 232 und RS 485
- Display: Graphical LC-Display, 120 x 16 Dots, Background illuminated
- Keypad: 4 System keys, 10 Function keys
- Housing: electro plated housing 141 x 69 x 32 mm
- Mounting hole: 137 x 65 mm
- Front Display: 144 x 72 mm
- Weight: 0,4 kg

### I/O Module

- Supply Voltage: 24 V DC (+/- 25%)
- Interface: Can-Bus
- Digital Input: 8 Input 24 V DC, Low threshold < 5 V, High threshold > 15 V
- Digital Out: 8 Output 24 V DC, max. 0,5 A, Whereas 2 can be used for PWM
- Analogue Input: 4 Input 0..10 V / 0..20 mAmp, 10 Bit  
4 Input for Thermocouple Typ K, max. 900°C, 10 Bit  
1 Input for Pt100, max. 120°C, 10 Bit  
1 Input for Lambda sensor, 10 Bit
- Frequency Input: max. 10 kHz Sine-wave
- Analogue Output: 2 Output 0..20 mAmp (0..10 V with Shunt), 10 Bit
- Dimensions: 183 x 72 mm
- Mounting: 35 mm DIN Rail





The RM Mixer is an enhanced sophisticated Air Gas blender based on the approved ring gap principal. Due to a precise mechanical gear system an accurate Lambda control tolerance smaller than  $\pm 0.01$  is guaranteed. Engineering and design has achieved a level which allows using the mixer for Natural, Bio and other gas application. Robustness and environmental protection makes this mixer unique and extremely user friendly.

An integrated, well protected electronics' PCB equipped with several Inputs and Outputs provides monitoring features for all important parameter like, gas inlet, air filter clock up, exhaust temperature etc. An analogue output can be used as a drive. CAN Bus communication allows flexibility together with IS-CU and the AF-2000 control system and cost savings for additional I/O's.

### Product Features

- Accurate gas metering
- Fast response to load transient
- CAN Communication (combined with AF-200)
- On board I/O's
- Automatic and Manual drive
- RM-814 (4-14 litre engine displacement)
- RM-25 (14-25 litre engine displacement)
- Status indication

### Technical Specification

- 12 and 24 VDC
- 6 Analogue Input [VDC, mAmp,  $\Omega$ ]
- 1 Binary Input
- 1 Binary Output
- 1 Analogue Output [VDC]
- IP-67 Protected

A brilliant combination of control units is to use the mixer together with the AF-2000 lambda controller and IS-CU gen-set control system. This unleashes pure control, logic and monitoring power and allows unbounded communication among all peripheries.



Ask us for information and talk to our gas application experts.

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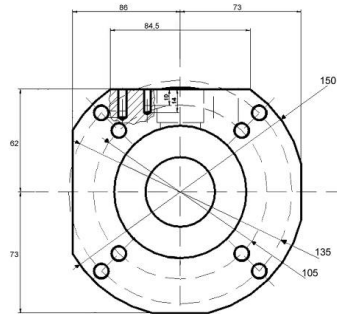
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## Dimensions

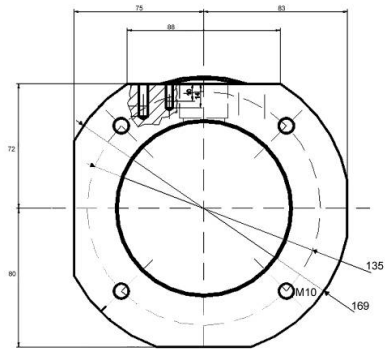
Engine side



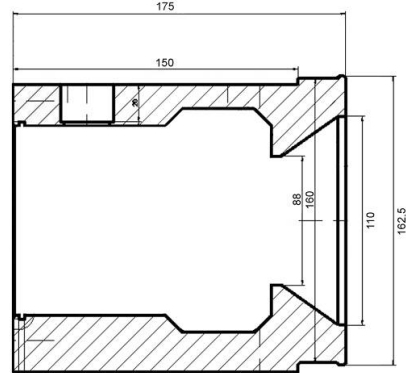
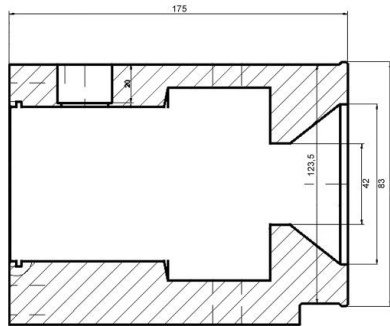
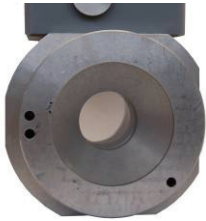
RM-814



RM-25

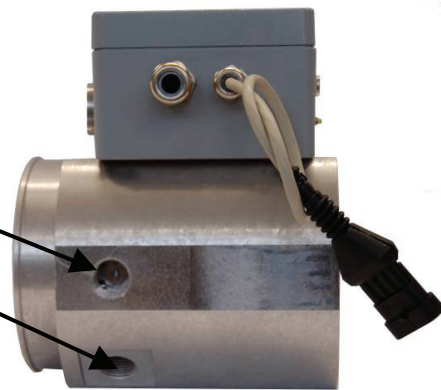


Airfilter Side



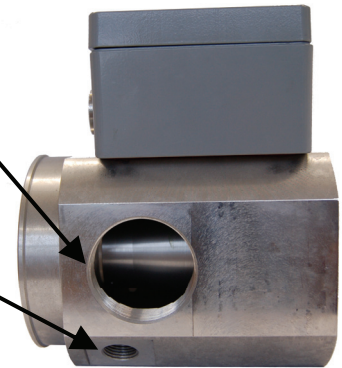
1/2" for crank case ventilation

1/2" for gas pressure sensor

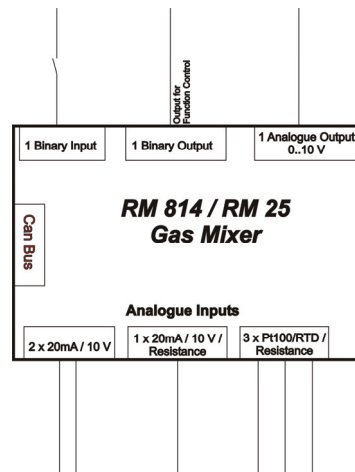


Gas Pipe 2"

1/2" for pressure regulator or negative pressure sensor



Gas pressure, manifold pressure, exhaust temperature, manifold temperature and other parameters can be connected directly to the mixer.



## The BCD Digital Ignition System



Industrial Version

### 1. Description of Control Module

The BCD1-8 is a microprocessor controlled ignition system that combines the advantage of the inductive and the capacitive type ignition in **one product**.

It can supply up to 8 Cylinders.

The BCD1-8 produces alternating current (AC) sparks, which reduces the wear of the spark plug.

The energy and the spark duration levels can be controlled, for best combustion and longest spark plug life.

The energy mode is selectable either via RS232 Link, or by modulation of the spark reference pulse in case of an engine control module (ECM).

Two spark energy modes exist: single strike (primary is driven once) and double strike (primary is driven twice).

The timing signal to the BCD is taken either from a ferrous trigger wheel, running at half engine speed (on the camshaft with one peg per cylinder plus one reference pulse), or it gets timing information from the engine's own ECM.

If a trigger wheel is used, a speed (rpm) related timing curve can be programmed. There is also provision for a fixed or variable timing offset through the RS-232 link.

If more than eight coil outputs are needed, two control modules can be cascaded for up to sixteen (16) coil outputs. The number of outputs is configurable in firmware. The sequence of firings starts when the module receives either the spark reference pulse (ECM) or the additional index pulse from the trigger wheel.

The control module firing order is primary coil 1 followed by coil 2, 3, 4, and up to the configured number of coils. The firing starts when the first trigger pulse following the reference pulse is received. When two modules are used in cascade mode the firing alternates between master (A) and slave (B). The firing order in cascade mode is A1, B1, A2, B2, A3, B3, and up to the configured number of coils.

**Note:** The combination of the AC spark with plug-mounted coils provides excellent combustion on Natural gas engines up to 5 liter/Cylinder, 2 MW power operation at Lambda 1.6

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## 2. The BCD features & Specifications

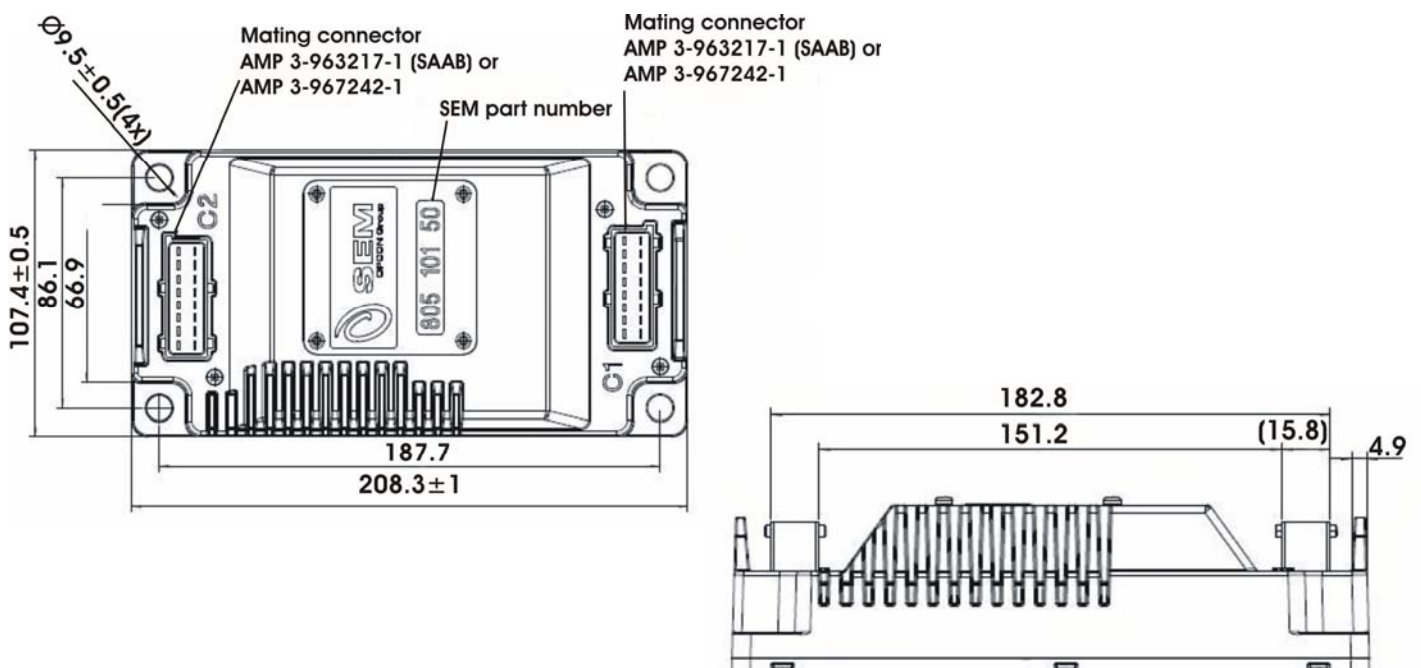
### 2.1 Features

- Combination of capacitive/inductive
- Alternating current spark (AC)
- User programmable ignition curve
- RS-232 communication link
- Two programmable energy levels
- Up to 8 cylinders. 12, or 16 cylinders are possible in cascade mode
- 2 outputs sinking up to 1Amp. at +25°C and up to 0.5 Amp. at +15°C
- 1 Sensor input 0-5V
- 2 general trigger inputs, VR (passive) or Open collector (active)
- Trigger signals from ½ engine speed disc or from Engine control module EMC
- Overspeed shutdown

### 2.2 Specifications

Supply Voltage range:	18 - 32 VDC
Power consumption:	Max 3.6A RMS
Trigger inputs:	Two separate with automatic detection of type of sensor: Variable reluctance (passive) 0.3-120V p-p or open collector (active) 5V logic, internal pull-up in module
Analog sensor input:	One, 0-5 VDC
Output: (Not assigned yet)	Two, max. load 30W, 30V, 1 Amp.
Communication port:	One, RS 232
Ambient temperature range:	-40 °C to +125 °C
Transient Voltage protection:	ISO 7637/2 to ISO 7637/3
EMC:	CISPR 25-2004/104/EC
Vibration:	IEC68-2-35 Fda
Sealing:	IP6k9k
Weight:	1.7 kg

## 3. Dimensions







## 4. CU2-05 High Tension Coil

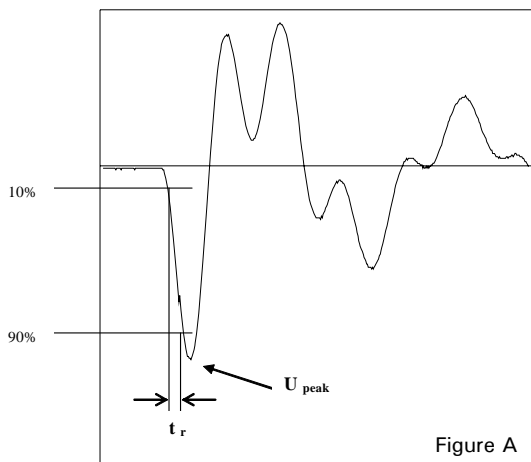
Dimensions as per drawing K805 100 05 (last page).

The CU2-05 Coils consist of the upper part, which is the coil itself, plus a screwed on extension that fits right on to the spark plug. Hence, no separate high tension cables are required.

The coil incorporates an integrated connector and two fixations to be screwed to a common bracket.

Unique is the internal insulation, it is a synthetic ester based insulating liquid, which does not restrict internal micro expansions, and which provides a self healing effect.

A feedback signal is available that can be used for combustion information and spark diagnostic.



### Secondary voltage

Is defined as the absolute peak value of the voltage during the first negative oscillation during discharge. ( $U_{peak}$  in figure A).

### Rise time $t_r$

Is defined as the time from that the secondary voltage has reached 10% of  $U_{peak}$  to the time that the voltage has reached 90% of  $U_{peak}$  without any load.

## 4.1 Ignition Characteristics

### Impedance characteristics

#### Ignition coil parameters

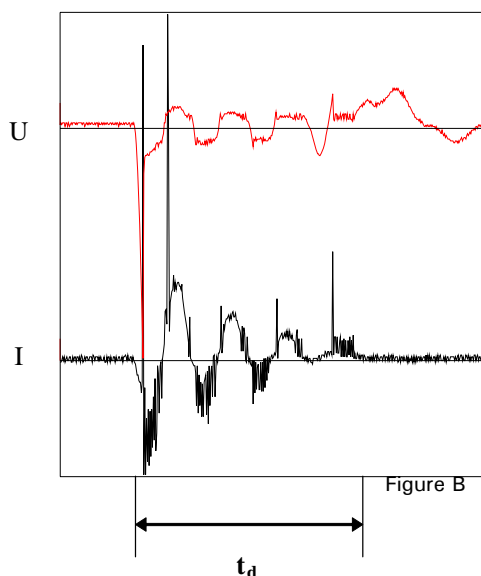
Name	Min	Nom	Max
Resistance (kOhm)	7.5	7.7	7.9
Secondary inductance (H)	8.5	9.2	10
Primary inductance (uH)	800	920	1000

### Primary current characteristic

#### Characteristics of primary current with 1.5uF charge capacitor

Name	Min	Nom	Max	Unit
Peak primary current		22		A
Coil drive voltage	350	370	400	V

## 4.2 Spark Characteristic



### Spark duration $t_d$

Is defined as either:

The time from that the current becomes greater than 1 mA to the time that the current becomes zero after the voltage no longer is limited (see figure B).

Or

The time from that the current becomes greater than 1 mA to the first time that the current becomes zero and then no longer reaches 1 mA.

### Spark characteristics for 370V charge voltage 1.5uF charge capacitor, double strike mode

Characteristic	Min	Nom	Max	Unit
Spark duration	400	430		$\mu$ s
Spark energy	24	28		mJ
Secondary voltage (load 500k $\Omega$ // 50 pF)	24	26	28	kV
Secondary voltage rise time (load 500k $\Omega$ // 50 pF)	18	20	22	$\mu$ s

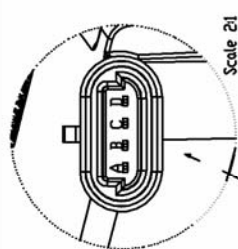
## 4.3 Installation

Due to its internal synthetic ester insulation, the coil should always be installed vertically, with the coil portion on top. The maximum inclination from the vertical line is 45° in either direction. See drawing K805 100 05. If the coils had been stored in a horizontal position for sometime, it should be left min 1 hour in its vertical operating position before the engine is started.

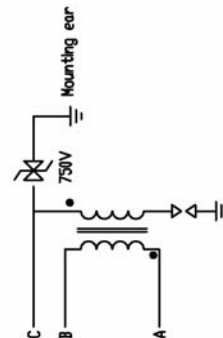
## 4.4 Protection

Each coil has a built in over voltage protection in case the spark return connection "C" to the BCD1-8 control is lost.

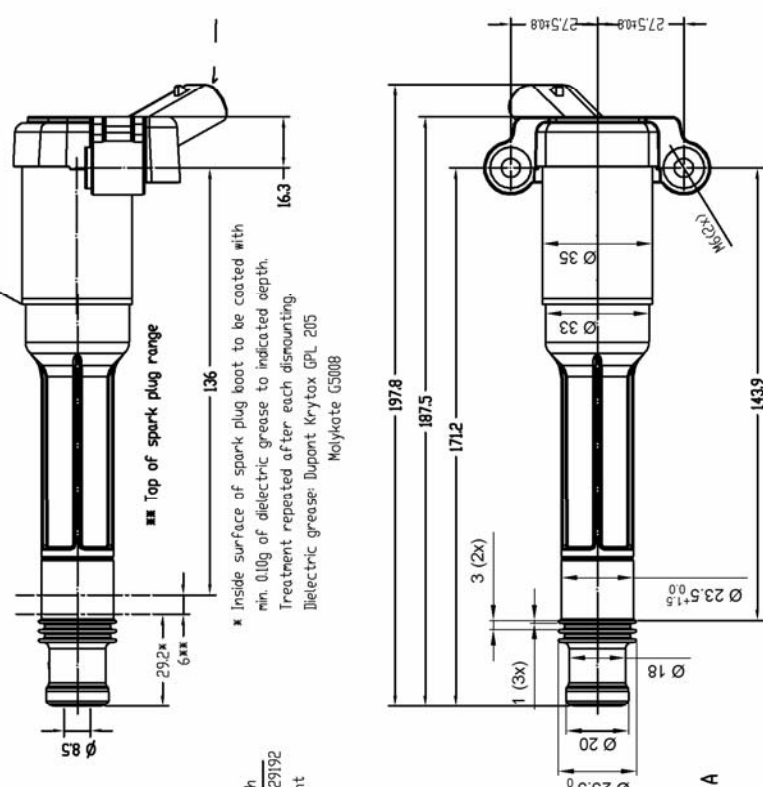
Pin	Definition
A	Charge voltage
B	Primary coil
C	Spark return
D	Not connected



Scale 2:1



750V  
Mounting ear



Colour code: blue

■ Top of spark plug range

\* Inside surface of spark plug boot to be coated with min. 0.10g of dielectric grease to indicated depth. Treatment repeated after each dismounting. Dielectric grease: Dupont Krytox GPL 205 Molykote G5008

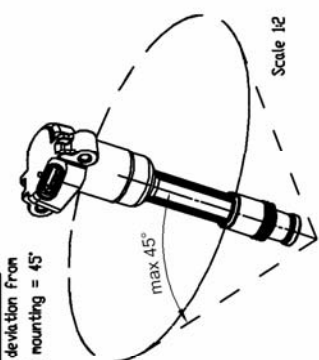
To mate with Packard 12129192 or equivalent

30°

**Mounting instruction:**  
 Maximum deviation from vertical mounting = 45°

max 45°

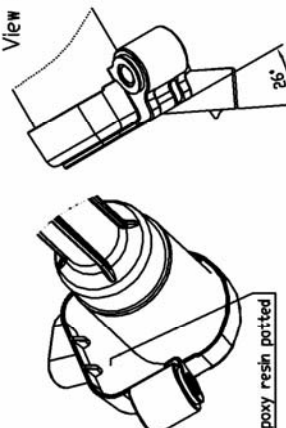
Scale 1:2



**COIL RESISTANCE (TYPICAL):**

Temp	Coil Primary	Secondary
-40°C	0,52Ω	5,7kΩ
+20°C	0,67Ω	7,7kΩ
+105°C	0,87Ω	10kΩ

**View A**



Epoxy resin potted

**Recommended installation torque for M6 mounting screws: 9 Nm.**

**Product specification 998 000 51**

Rev	Date	Name
-	-	-
-	-	-
-	-	-
-	-	-

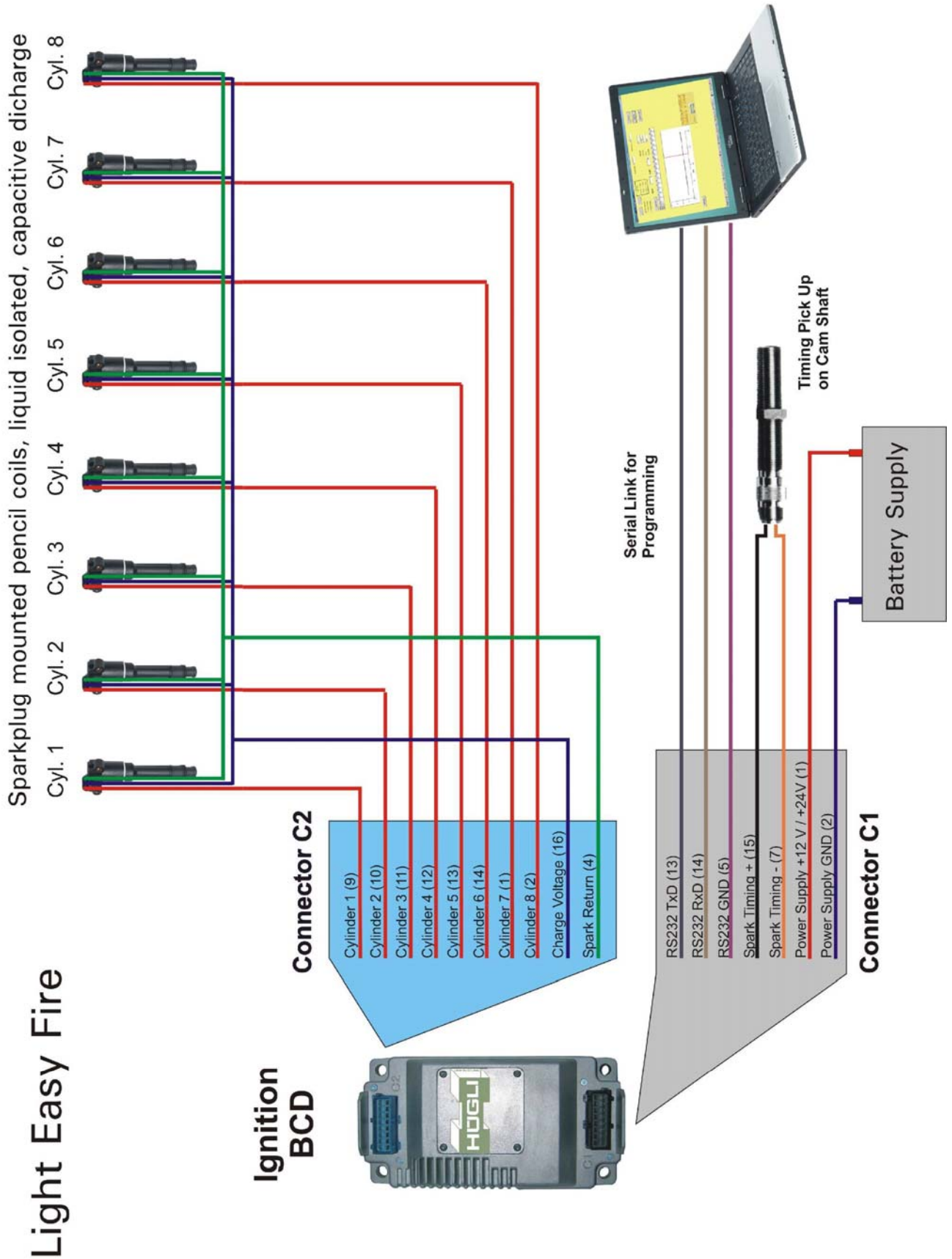
  

Date	Name
18.01.07	-
-	-
-	-
-	-
1:1	-

HUEGLI-TECH AG 4900 Langenthal Switzerland		Project	-
		Customer	-
		Dwg No.	K805 100 05

**Coil Unit CU2-05**



**Product selection guide and application hint**

**Selection of Mixer by engine parameter:**

In order to select the correct ring gap mixer, there are a few issues to watch out for:

- Engine capacity
- Displacement

A basic table helps to select the appropriate mixer:

Engine Type Inline [I] or V	Engine Displacement [lt]	Mixer Model	Quantity	Load [kW]
I	4-8	<b>RM-814-ZF</b>	1	~80
I	8-14	<b>RM-814F</b>	1	~200
I or V	14-25	<b>RM-25F</b>	1	~350
V (with 2 air filters)	28-50	<b>RM-25F</b>	2	~600
V (with 1 air filter)	28-60	<b>(RM-45) n.a.y</b>	1	~750
V (with 2 air filters)	50-85	<b>(RM-45) n.a.y</b>	2	~1100

n.a.y = not available yet

Still there needs to be paid attention to the design between the air filter, mixer and turbo charger.

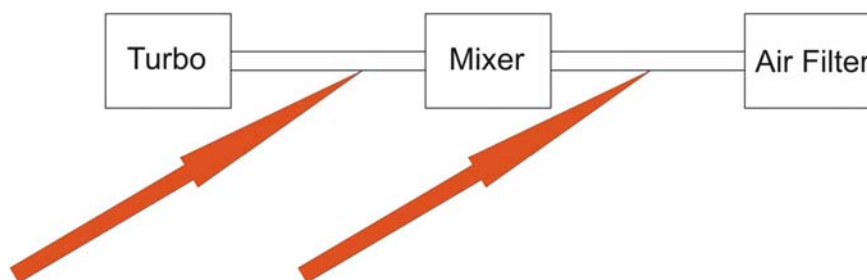
Restrictions in the design of the piping will cause loss of velocity of the air stream, which will decrease the efficiency of the mixer.

Hence, the suction piping needs to be as straight as possible.

See below drawing recommendation:

**Recommendation of piping:**

**Recommended array of piping**



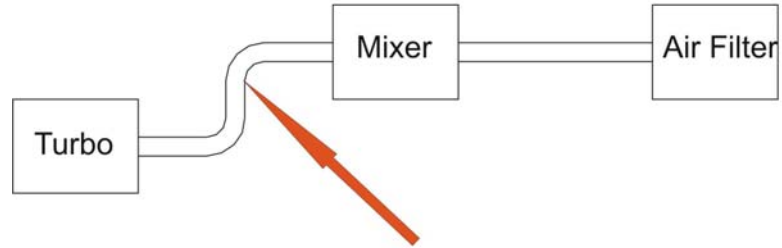
An inline piping between Airfilter, Mixer and Turbo causes no restrictions.

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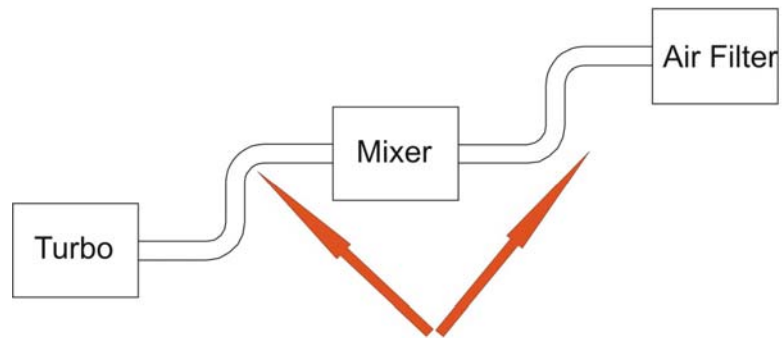
**Not recommended piping:**

**Not recommended array of piping**



Loss of velocity due to restricted array of piping

**Not recommended array of piping**



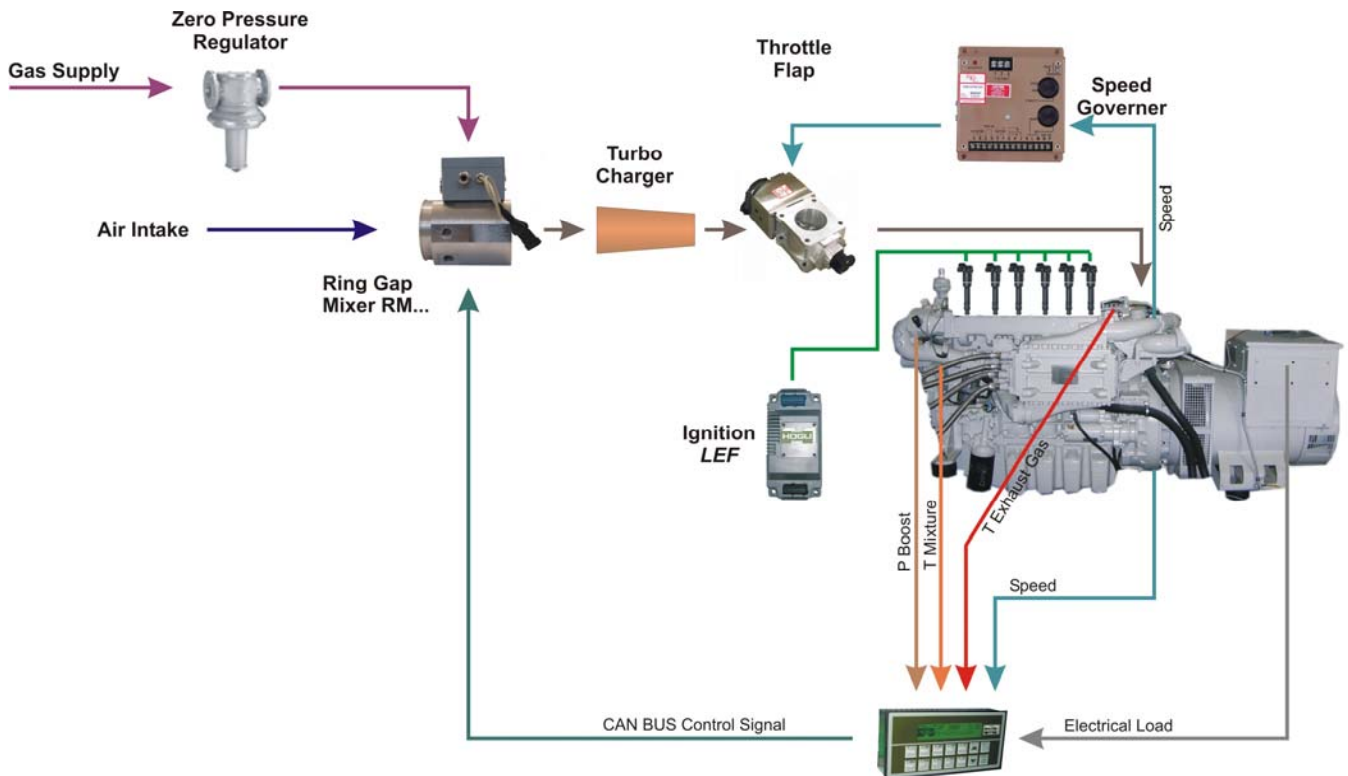
Loss of velocity due to restricted array of piping

**Selection of Mixer by engine type:**

Engine manufacturer	Engine model	N/A or TC	Lambda	Load [kW]	Mixer	Quantity
MAN	E0834 E 302	NA	Stoichiometric	54	RM-814-ZF	1
MAN	E0836 E 302	N/A	Stoichiometric	75	RM-814-ZF	1
MAN	E0836 LE 202	TC	Lean Burn	110	RM-814F	1
MAN	E2876 E 302	N/A	Stoichiometric	140	RM-814F	1
MAN	E2876 TE 302	TC	Lean Burn	150	RM-814F	1
MAN	E2876 LE 302	TC	Lean Burn	210	RM-814F	1
MAN	E2848	TC	Lean Burn	280	RM-25F	1
MAN	E2842 E 312	N/A	Stoichiometric	250	RM-25F	1
MAN	E2842 LE 312	TC	Lean Burn	400	RM-25F	1
Liebherr	G926TI	TC	Lean Burn	170	RM-814F	1
Jinan	4-190	TC	Lean Burn		RM-25F	1
Jinan	8V-190	TC	Lean Burn		RM-45F	1
SCANIA	SGI 12 ST	TC	Lean Burn	200	RM-814F	1

**Possible System Alignments:**

**Inline Engine Single Mixer and Single Throttle**



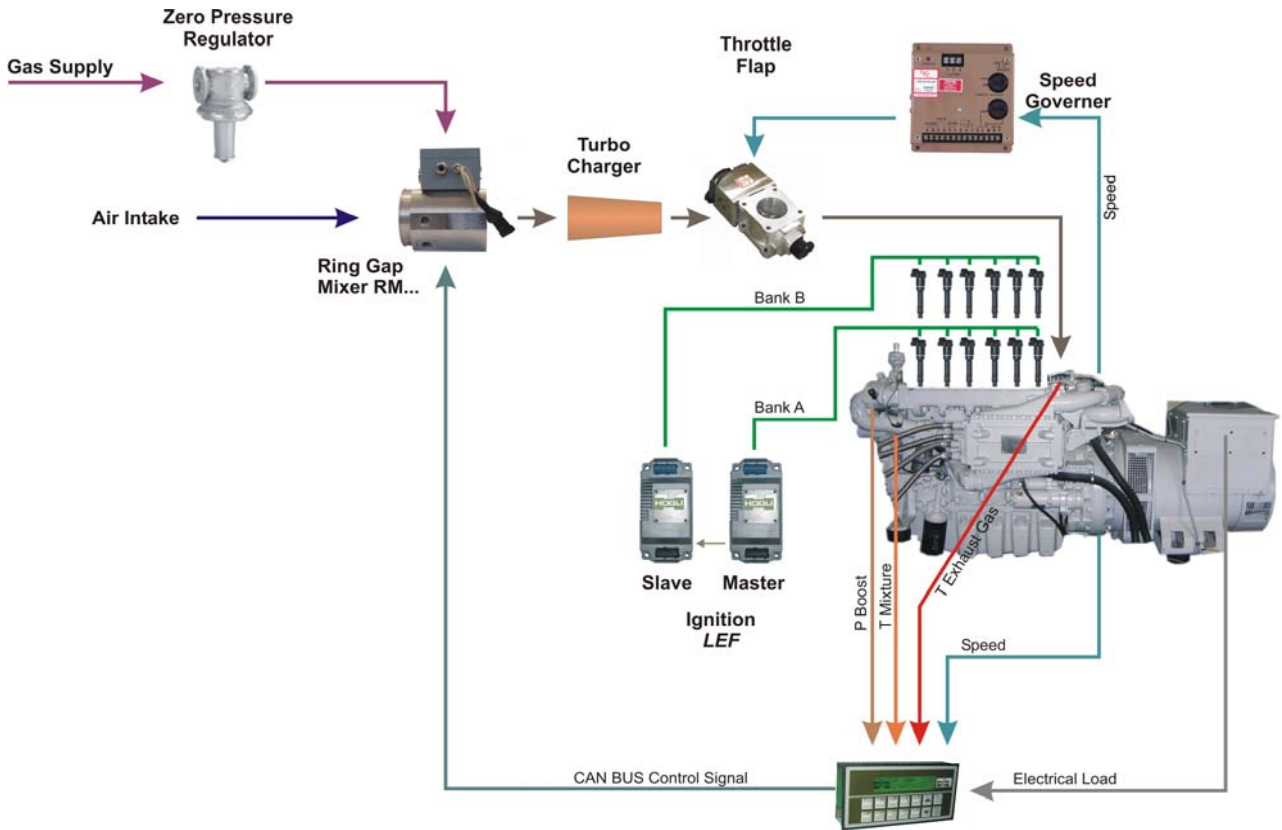
**Sensors to be used:**

**P Boost** = Pressure Sensor: DMU-01 / 0-2.5 bar absolute (On Huegli Tech supply list)

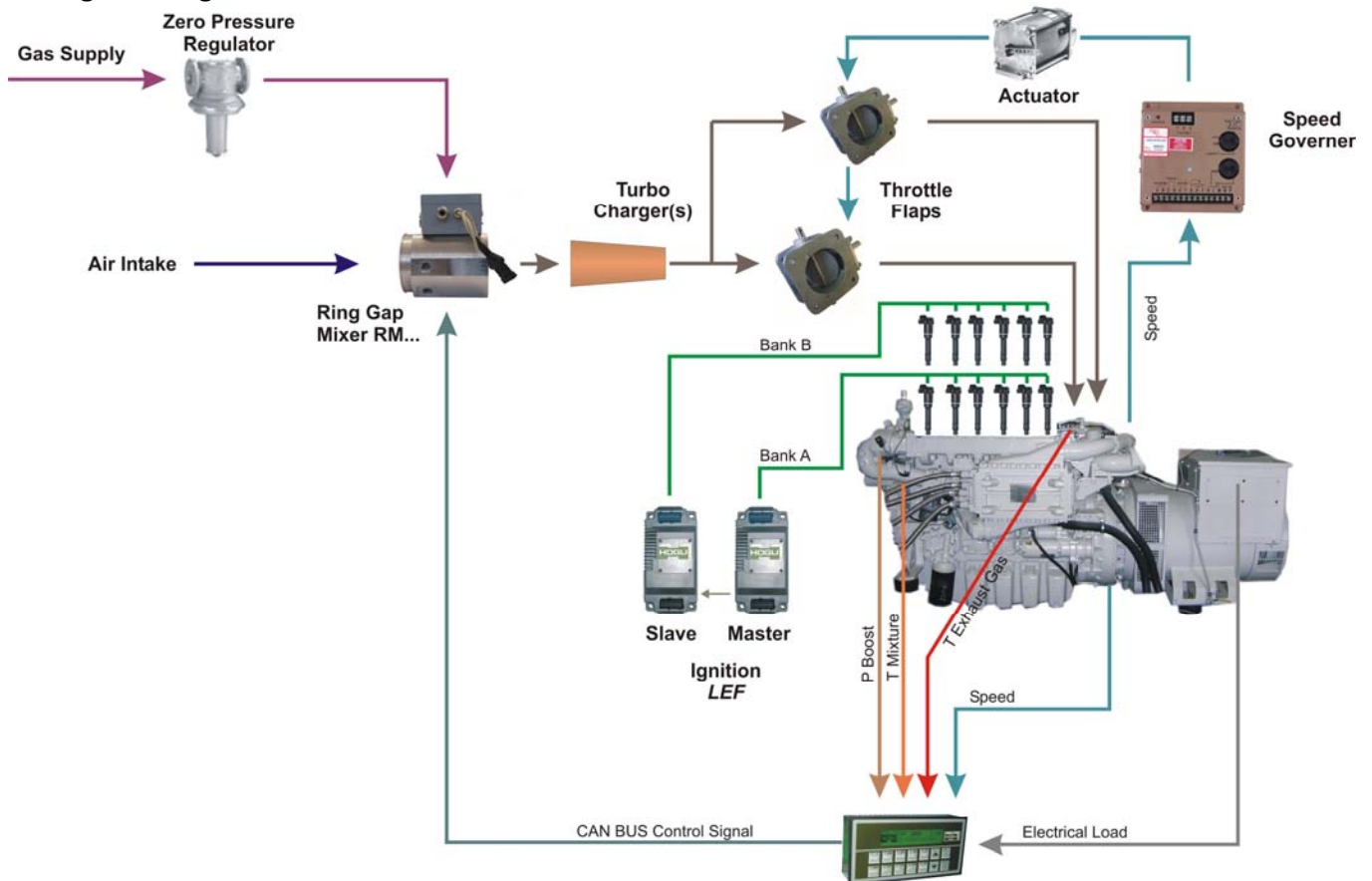
**T Mixture** = Manifold Temperature: PT 100

**T Exhaust Gas** = Exhaust Temperature: T-2472-3000 (On Huegli Tech supply list)

**V-Engine Single Mixer and Throttle**

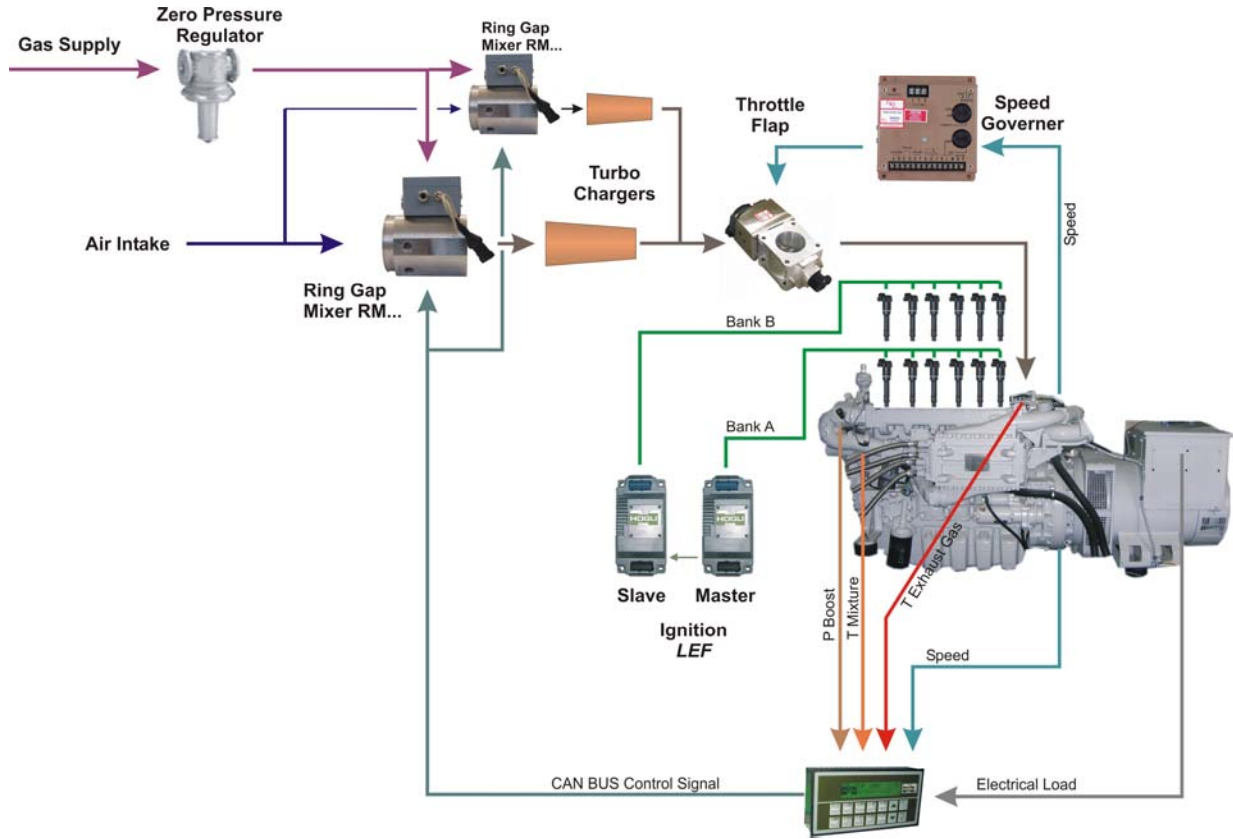


**V-Engine Single Mixer and Twin-Throttle**





**V-Engine Twin-Mixer and Single-Throttle**



**V-Engine Twin-Mixer and Twin-Throttle**

