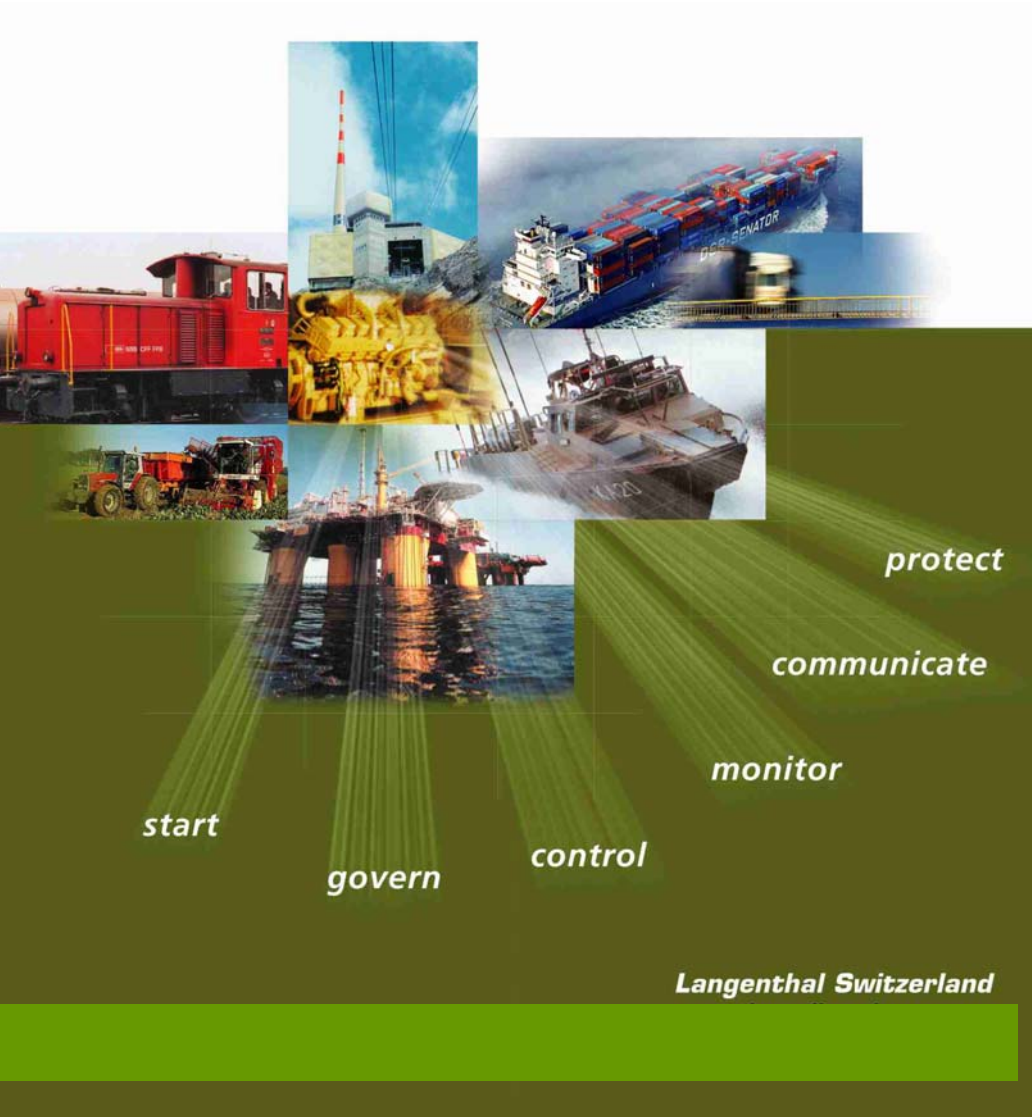
Jabbour DataKom sarl



Dual Fuel Engines and HT - JDK Equipment

Which are unique

Todays topics

- What is Dual Fuel
- What is important
- What is the Ratio
- How is the engine protected
- Which Engines can be converted
- Do we get support from Jabbour DataKom
- How to cooperate with Jabbour DataKom

•What is Dual Fuel

It means that Diesel Fuel is substituted by Gaseous fuel such as:

Natural Gas (NG)

Compressed Natural Gas (CNG)

Bio Gas

Coke Gas, etc

•What is Dual Fuel

!! Propane like LPG can not be used !!

The energy level of propane is way too high and will destroy the engine within short time

However, Diesel Fuel will always be there as the main igniter

What is Dual Fuel

The way to get the gas in to the engine is via an Air Gas Mixer.

Below you see as an example a Cummins KTA 19G air filter inlet to the turbo charger.

So this is the way to insert the gas in to the engine, via the mixer.

Just like magic, the Air Gas Mixer is mounted in between the air filter and the turbo charger.

And to control the correct amount of gas going in to the engine, the ATB Butterfly actuator is mounted on top of the mixer.

•What is Dual Fuel

The way to get the gas in to the engine is via an Air Gas Mixer.

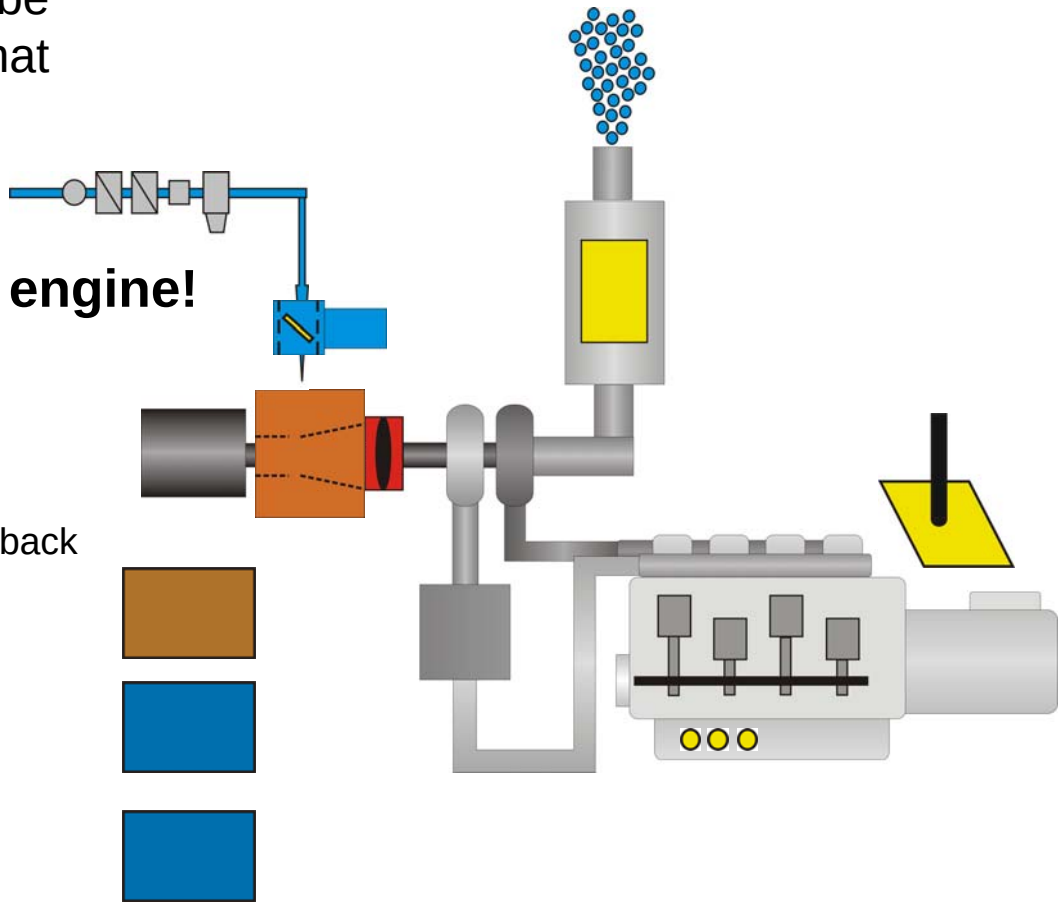
•What is important

HT & JDK offer a basic kit and an enhanced kit. Today we have several conversions in the field operating successfully with basic and enhanced kit.

We today **insist on certain components** and we also point out to the customer what needs to be done before we start converting an engine.

So let’s have a look and see what we can do.

Nearly any diesel engine can be converted to Dual Fuel. So what components do we need?



- **First, a customer with an engine!**

Mixer

Gas Street

Gas and Diesel Actuator with Feedback

DFM 100

Speed Control

Denox

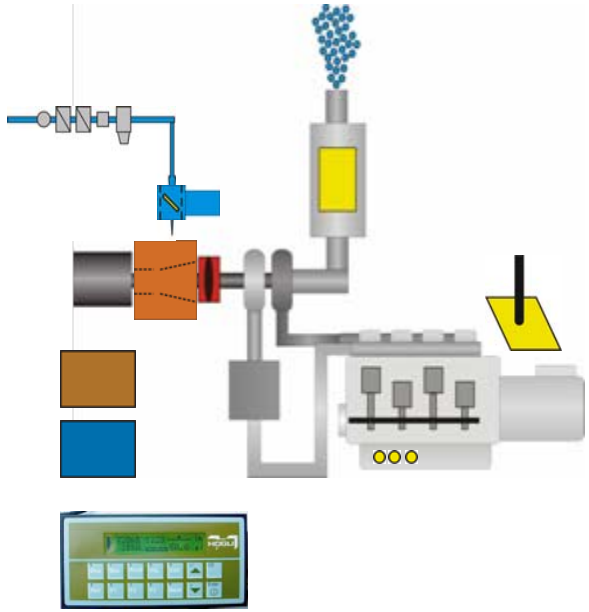
Knocking Sensors

This Gas Street always created problems and was not selected from us!

This is a perfect Gas Street and it works well, very well!

That’s why we insist on the components we select for the system!

This is called the <u>basic kit</u> and is the minimum of required components needed.

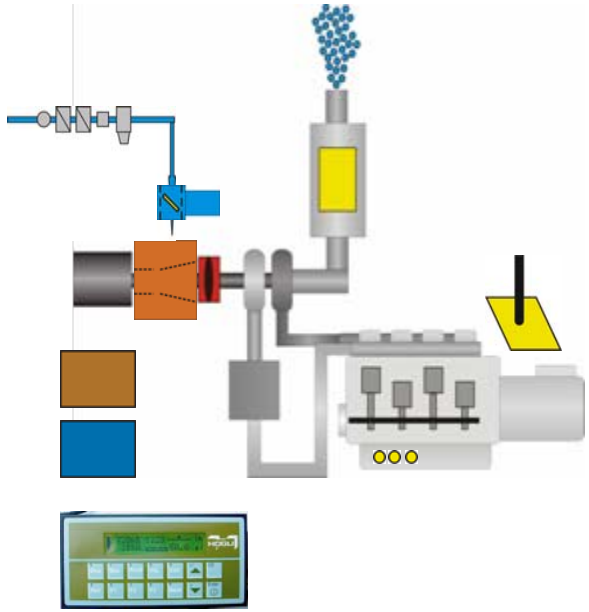


For a proper operation it is highly recommended to use IntelliSys. The reason are as following:

- Complete engine and gen set monitoring
- Gas Street check. **!!** Is gas available or not **!!**
- Switching between diesel and gas mode fully automatically
- Observation of critical engine parameters

The extended kit has some additional units and parts. One of the units which is also a master piece, is the TCM-2000.

Next to temperature monitoring, this unit will assure that the ratio remains constant over the entire load.



Lets have a closer look at some of the components used in the kit and start with the DFM 100

Ratio setting Diesel and Gas

Dynamic setting of feedback

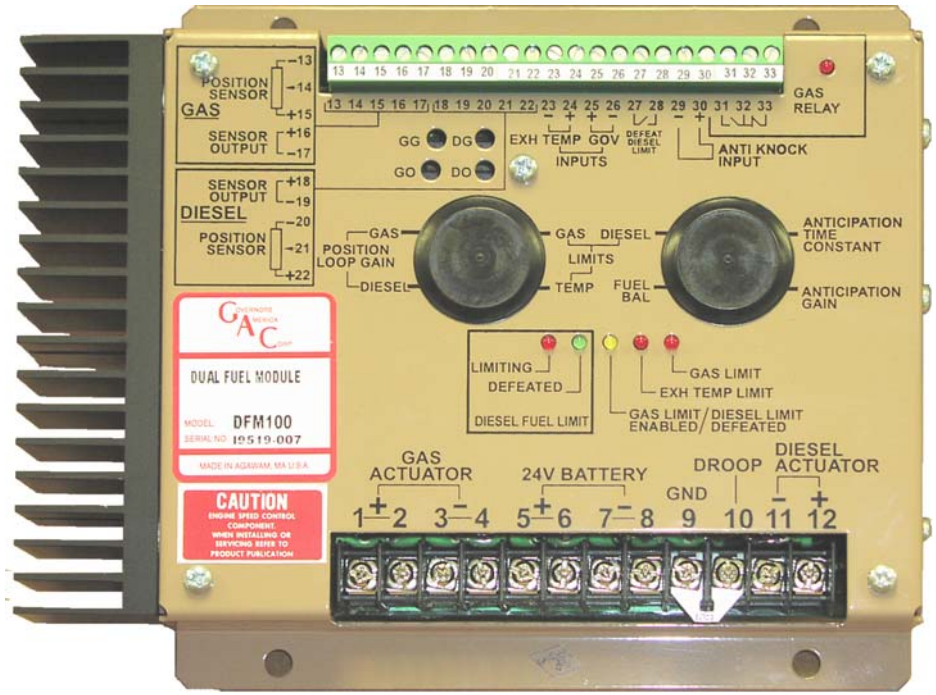
Gas and Diesel limit available

Analog output for ratio control

4-20 m Amp Input

Anticipation feature

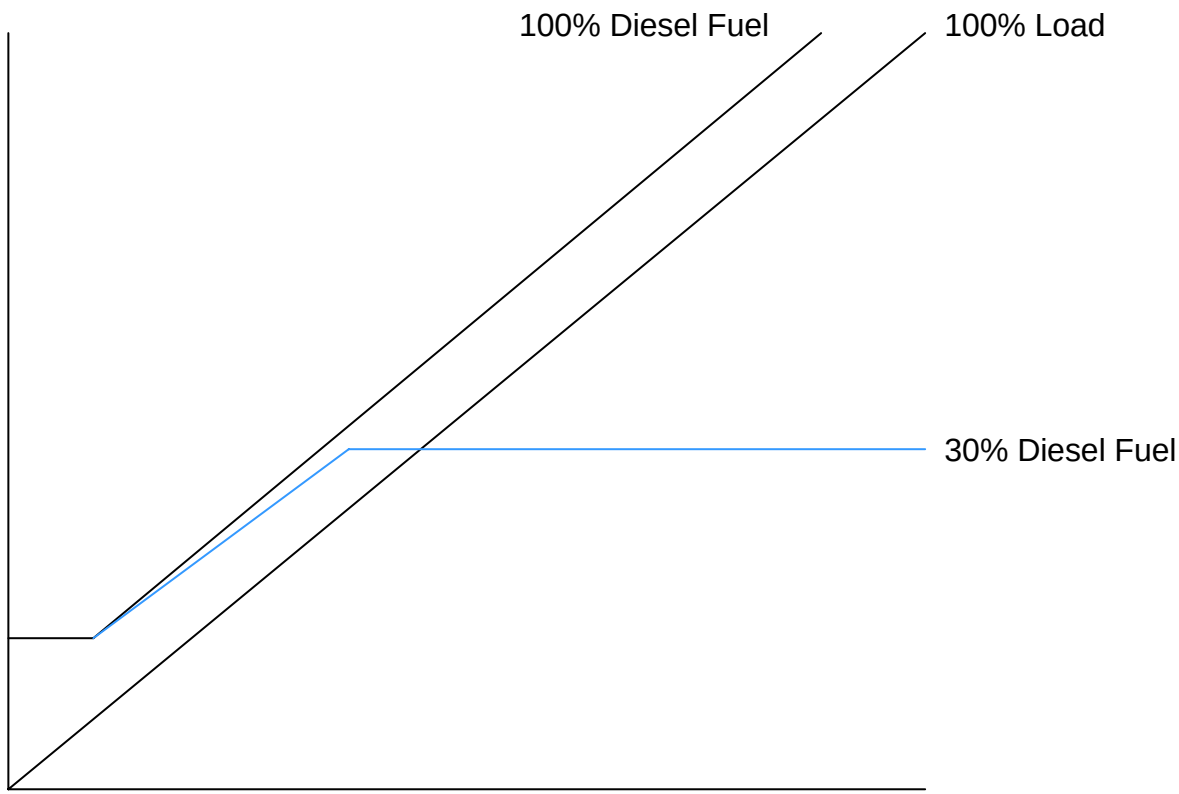
Binary relays output



A master piece, made for Dual Fuel

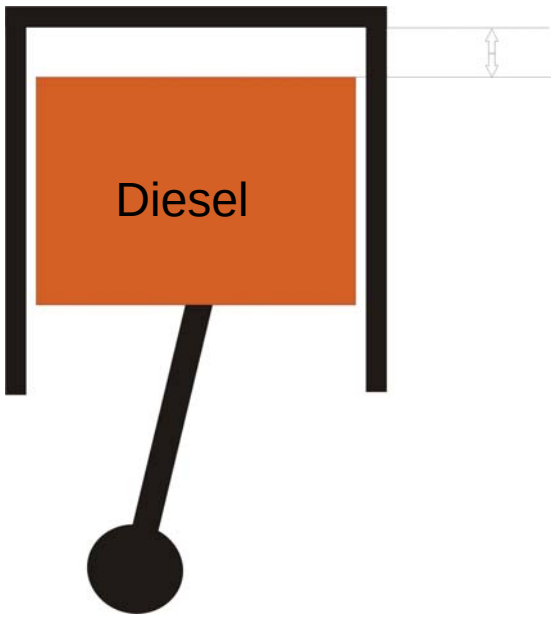
•What is the Ratio

Wait, don't think that's the end my friends……

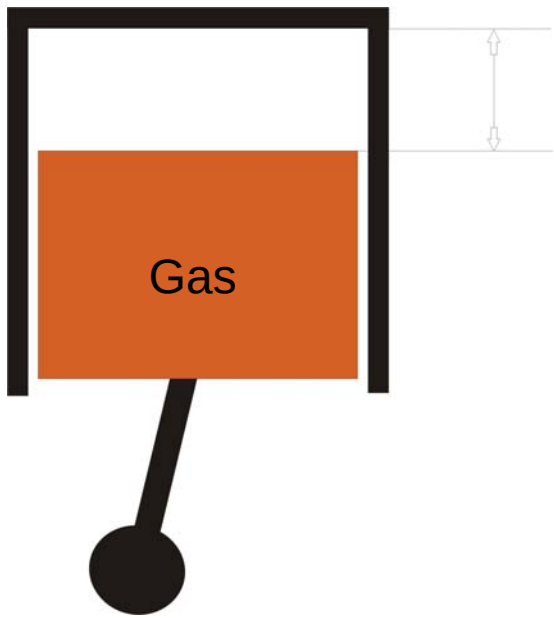


Often not thought about, is that the diesel engine is a high compression ratio engine.

This is a diesel engine piston which is at TDC, so the left over gap is the compression.



This is a gas engine piston which is at TDC, so the left over gap is the compression and is much less than a diesel.



Look, this is what happens if the temperature is rising…….

Due to temperature rising, it can be expected that the gas air mixture will self ignite shortly after entering the combustion chamber and this will cause severe damage.

Since Gas has a higher calorific value and therefore is used in a Diesel engine with high compression ratio (**above 12:1 like usual gas engines**) the temperature in the combustion chamber will rise sharply the more the engine is loaded!

•How is the engine protected

JDK

!!!!!! The temperature of the already mixed gas and air entering the combustioin chamber shall not exceed 50° Celsius !!!!!!!

!!!!!! Not higher than 50° Celsius !!!!!!

That is very easy, isn't it?

?????? Did you get this ??????

Well yes, but there is an issue to watch out for!

So to prevent the engine from knocking, we have to take a few precautions.

Since the temperature is rising and if the customer's application has no sufficient cooling system, such as external cooling towers, it is imperative to make sure that an additional cooling circuit is built in to the system.

This is not complicated at all and is also not that costly. Cost wise it won't impact much on the complete Dual Fuel system, but it will have a huge effect on fuel savings.

!!!! Then due to **port inlet temperature** can be kept low, the ratio between Diesel and Gas is much better and this simply means **faster return of investment !!!!**

In addition to a better cooling system, we also will optimize the ratio between Diesel and Gas

The DFM 100 will help us to do that since it has a Gas Limit

This means that we can keep a considerably low ratio at lower load, since the temperature will not rise that much until approx: 70% load.

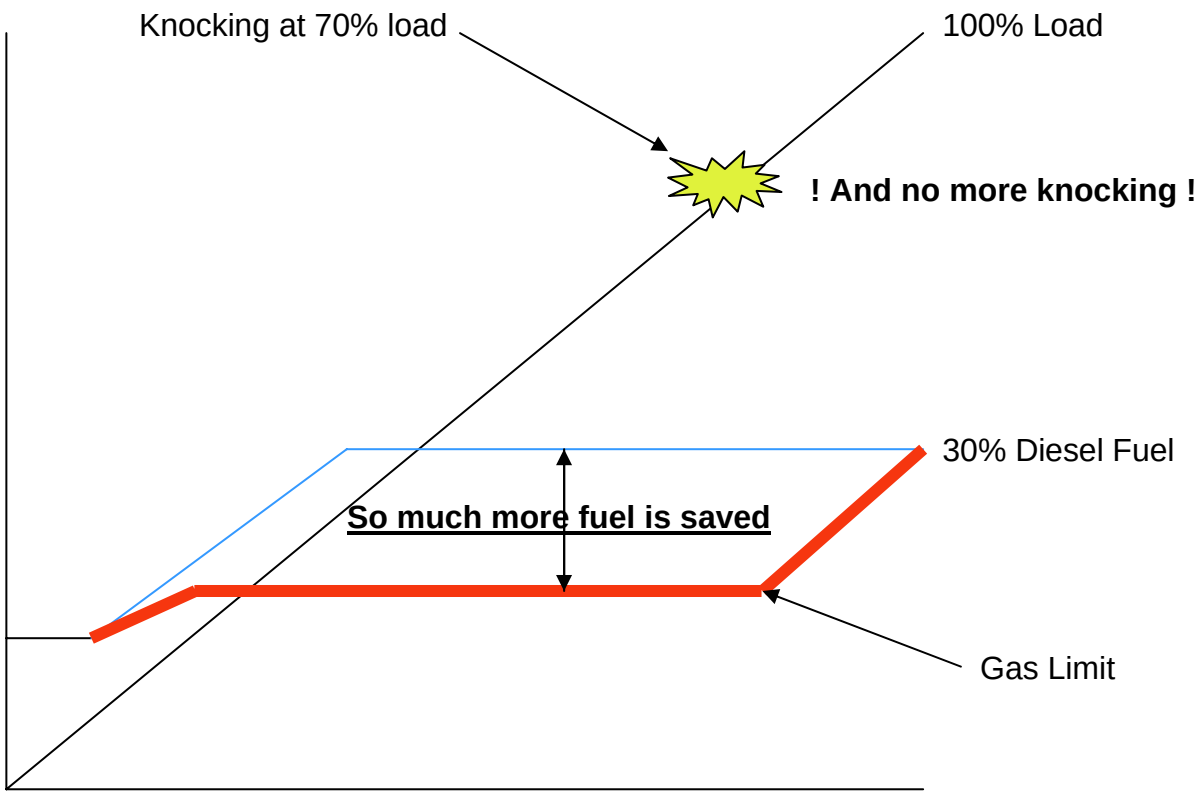
Once the engine load has reached 70%, the gas will remain constant and the rest up to 100% load is then taken by diesel fuel.

In other words, below 30% diesel up to 70% load

Now what is he talking about ??????

This we already know

And now with **Gas Limit setting** on the **DFM 100**



Now that was not so complicated, wasn't it.

So lets go a step further and look at some higher rated engines, something above 600kW or maybe a V-Engine

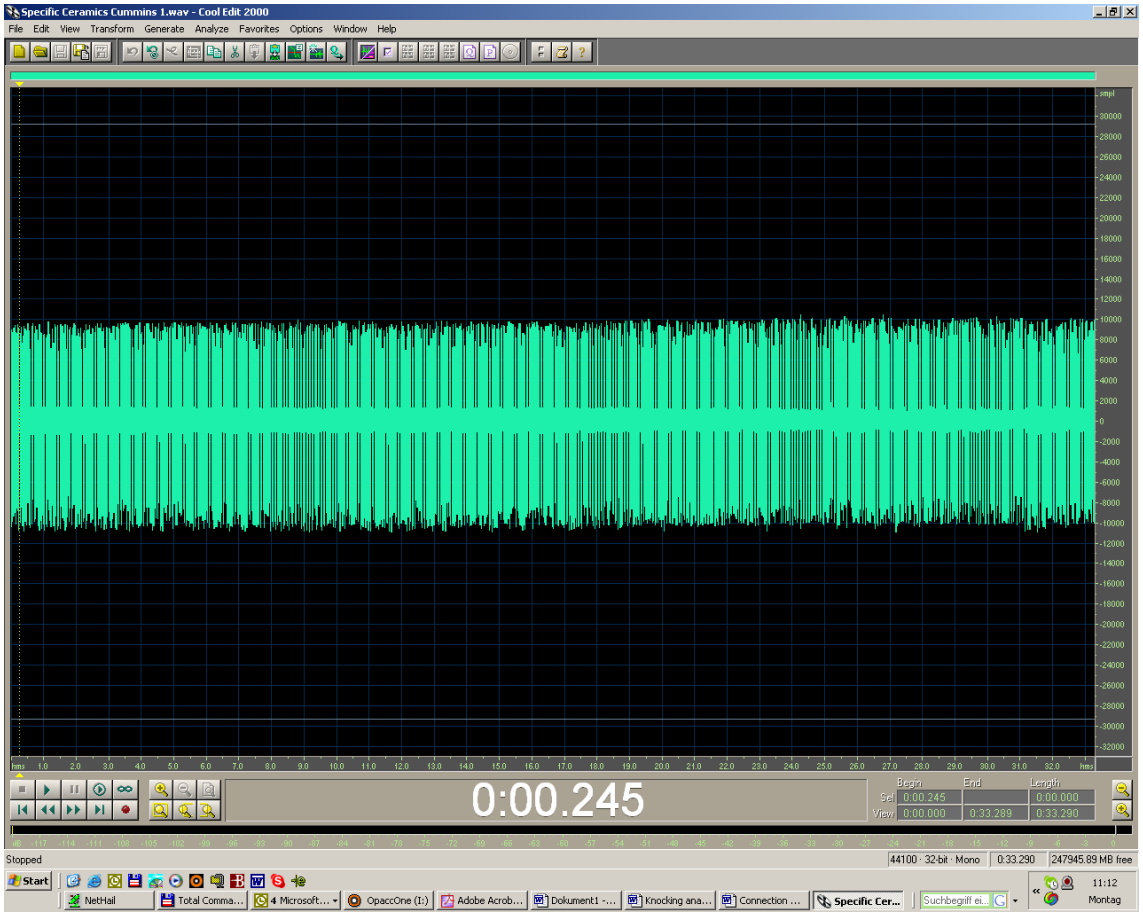
With such engines the combustion temperature issue will be a considerable higher issue. The knocking threshold will be lower and can be much more severe.

Therefore we will need to monitor the engine carefully with **knocking sensors**.

The knocking sensors are made out of piezo crystals. If the crystal is compressed by the vibration of the engine, it will send a small voltage signal. Therefore the sensors are possibly to be mounted on the side of the engine close to the combustion area.

Look, here a sample how the sensors are mounted on an NTA 855 Cummins

See, this is a sound record from a Cummins engine.



In order to read the signals from the knocking sensors and analyse if the engine is misfiring or not, the sensors are connected to Denox.

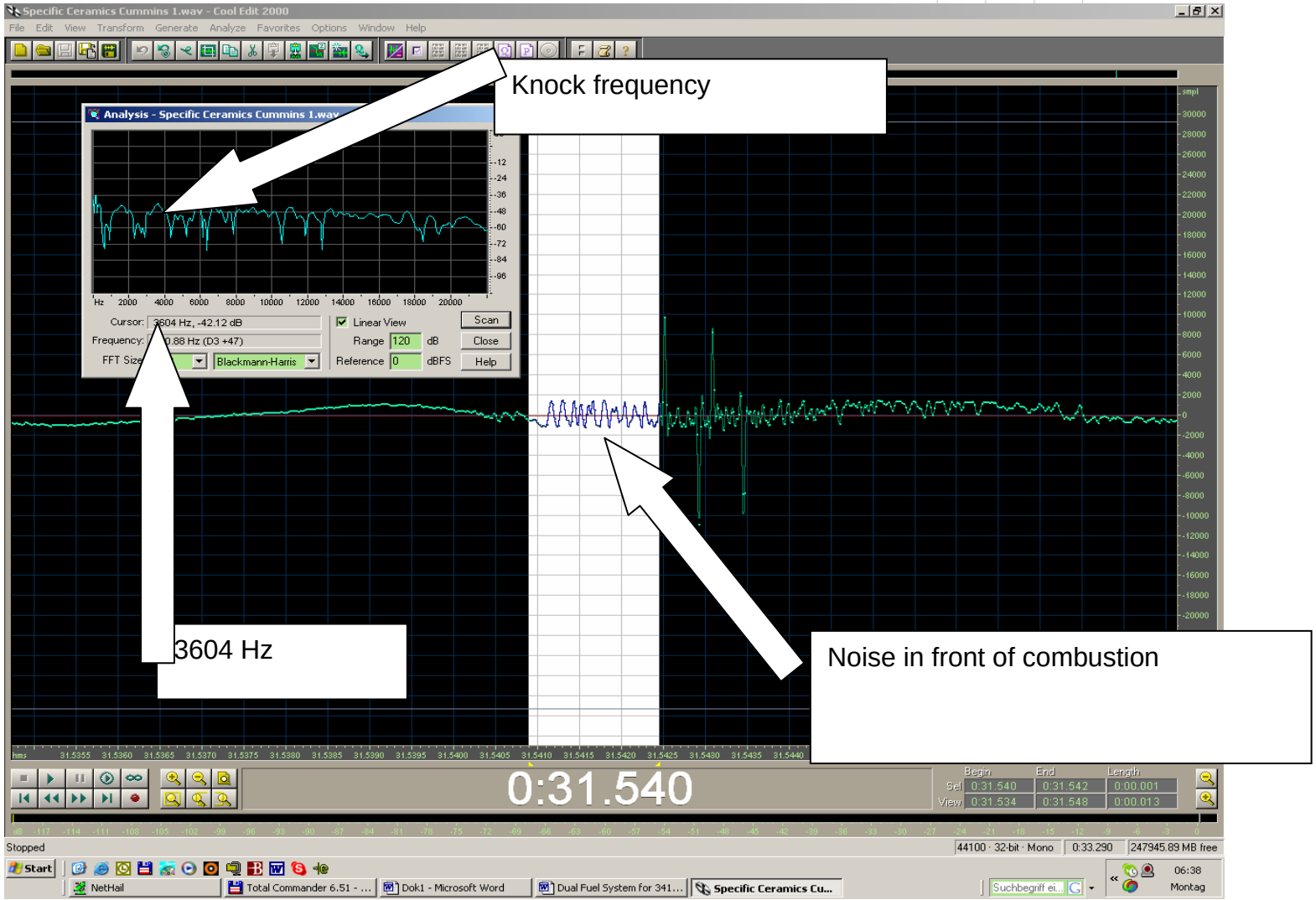
The Denox unit is configured via software for each individual engine, such as Inline or V engine, number of cylinders etc.

In order to listen to the engine carefully whilst commissioning, a basic sound software is used, which allows to record the sound of the engine via Denox.

Once recorded, a Blackmann Harris or Fourier analysis has to be made.

Don't worry, if you have missed class or have been taking a nap during your study course and can not recall who Blackmann Harris or Fourier was, the sound software will take care of that issue.

With a simple mouse click, it is then possible to analyse the knocking frequency



Now very simply we can insert the knocking frequency in to the Denox software

With some training and our help, you then can configure the other parameters of the Denox software. Such as……

Integration Time

Knock Frequency

Detonation Window

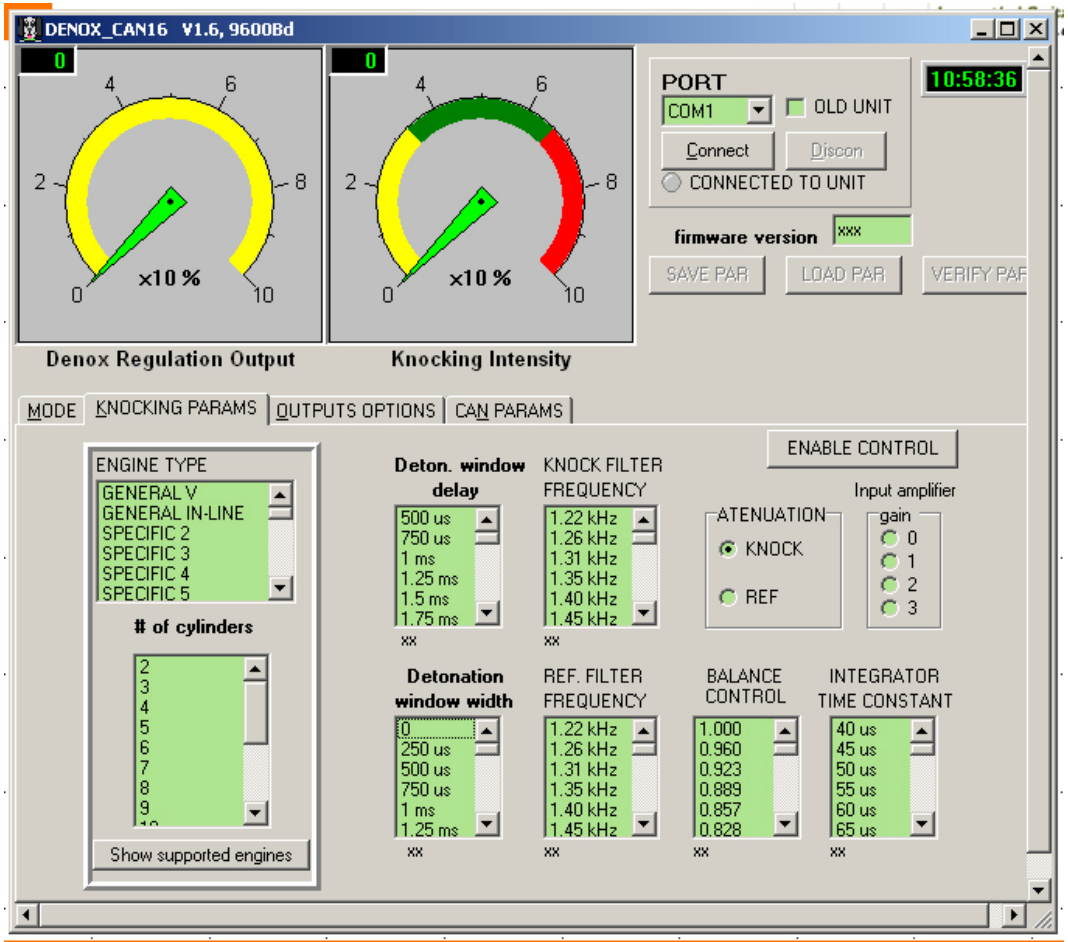
Atenuation

Balance Control

Balance features

Detonation With

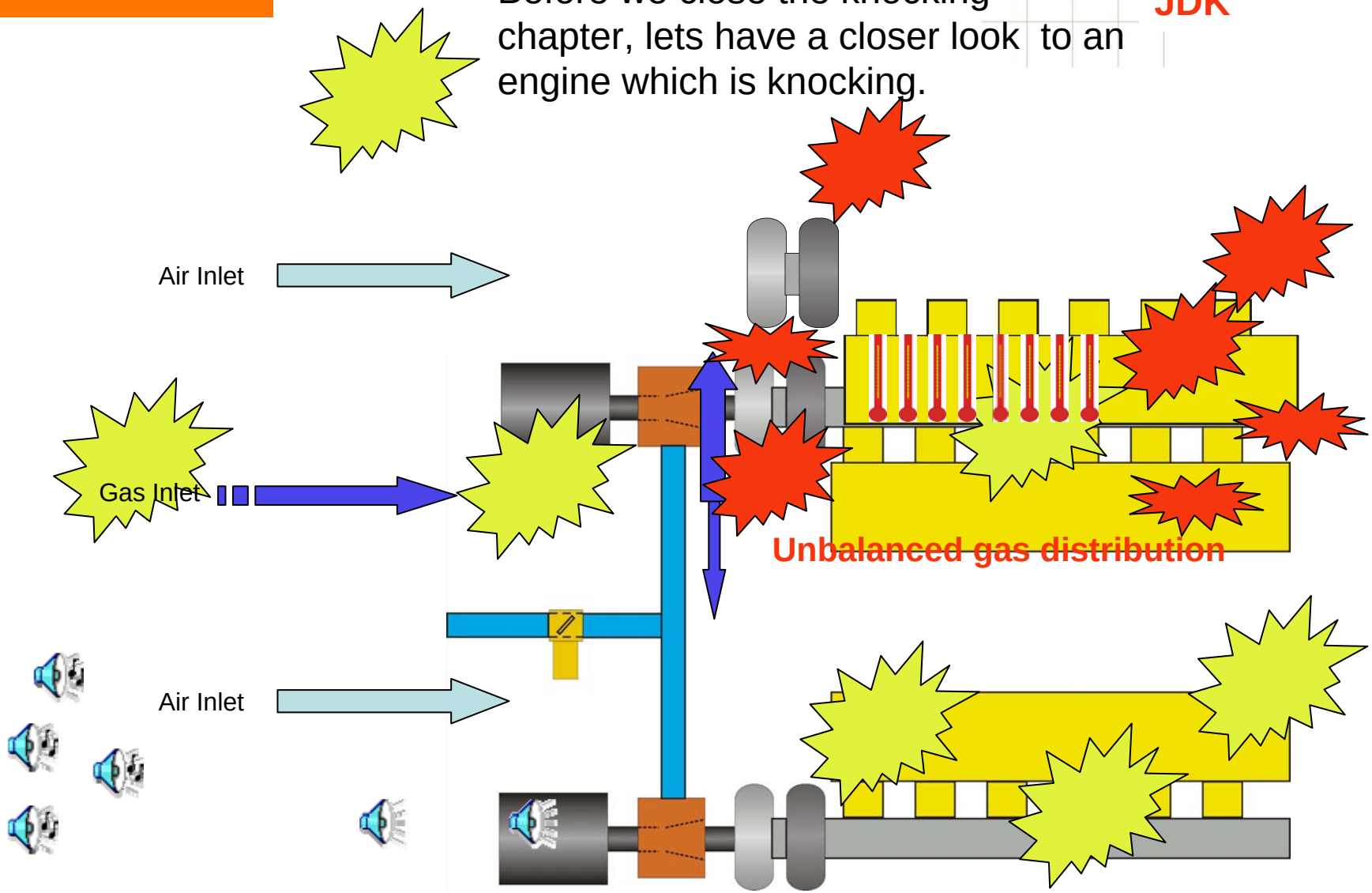
Engine parameter



Not that complicated isn't it ?

JDK

Before we close the knocking chapter, lets have a closer look to an engine which is knocking.



V-Engine Temperature Control

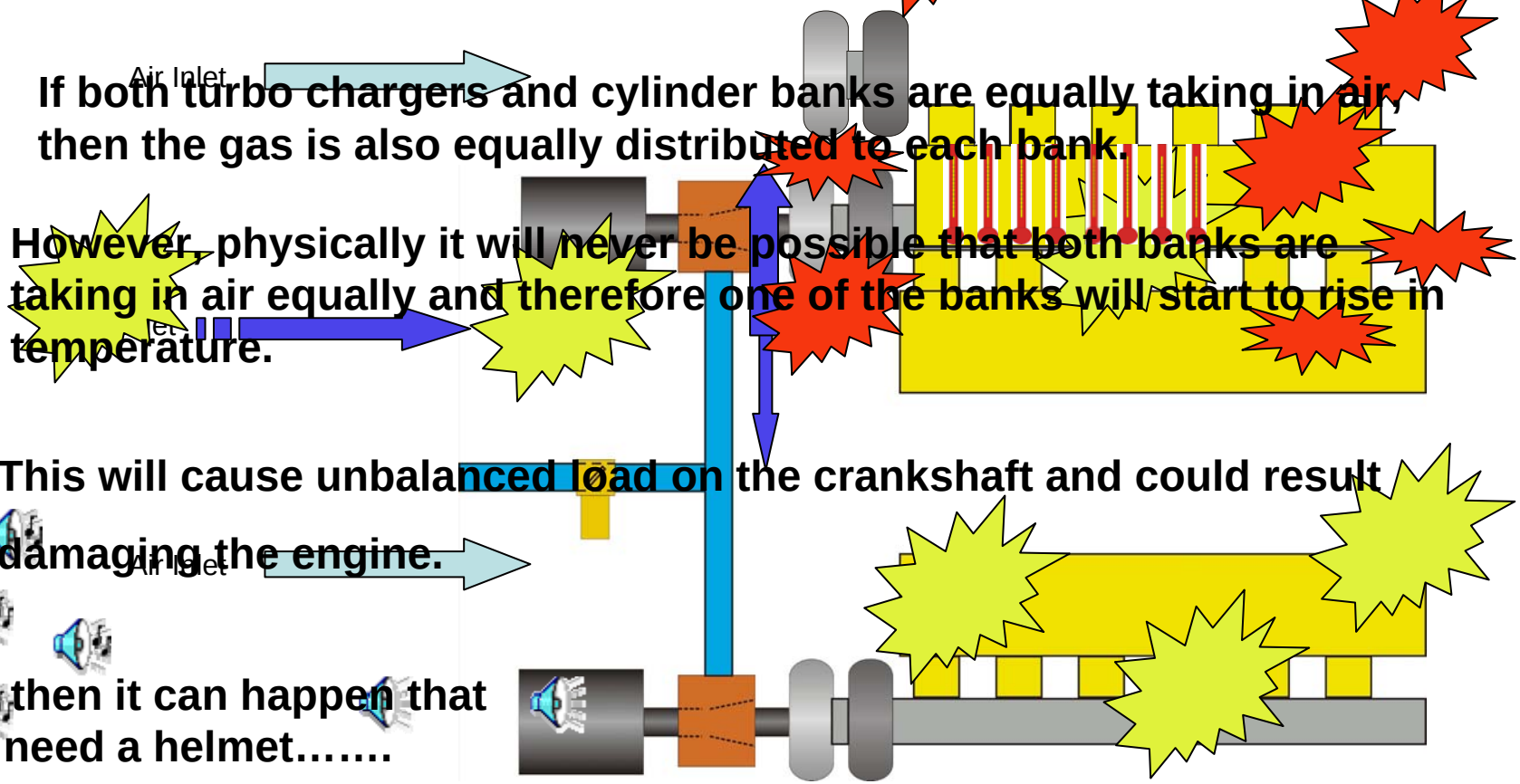
Here we have an additional issue which we need to take care of

If both turbo chargers and cylinder banks are equally taking in air, then the gas is also equally distributed to each bank.

However, physically it will never be possible that both banks are taking in air equally and therefore one of the banks will start to rise in temperature.

This will cause unbalanced load on the crankshaft and could result damaging the engine.

And then it can happen that you need a helmet…….



V-Engine Temperature Control

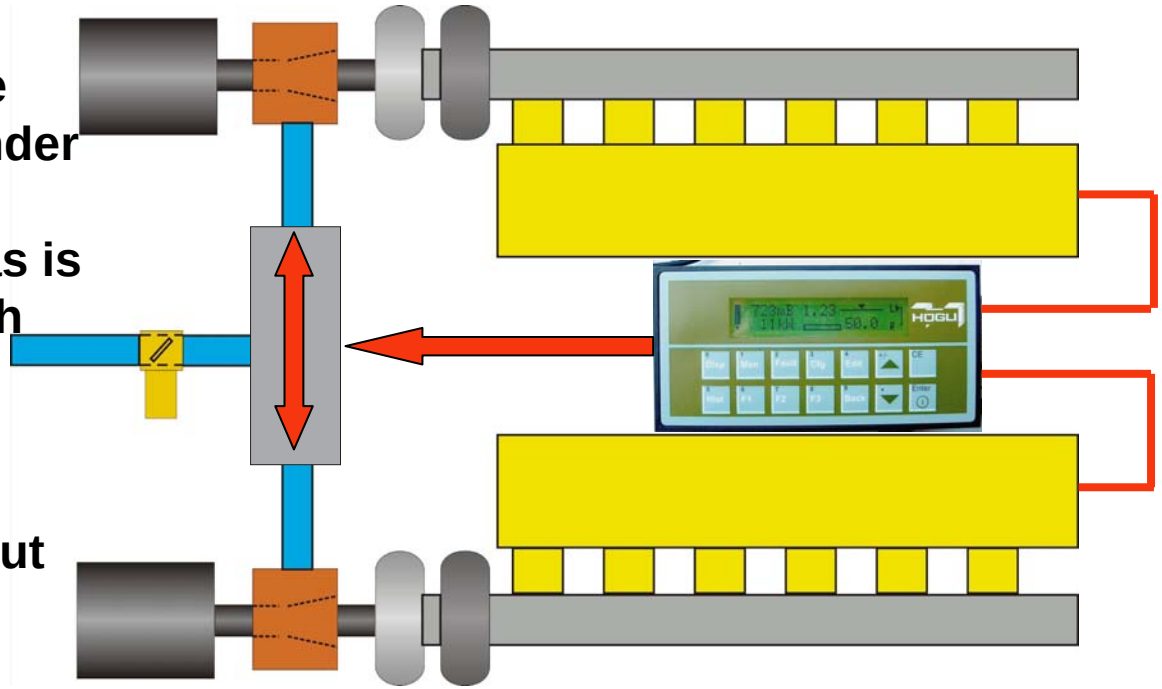
JDK

In order for you not to need to wear a helmet, we have designed a Y-Flap

Why a Y-Flap? And what does it do?

The Y-Flap is a T-section with an integrated valve system which allows to open or close the square section of the gas passage

An additional control unit, TCM 2000,will measure the temperatures of each cylinder bank and will signal the Y-Flap accordingly so the gas is distributed equally for each cylinder bank.

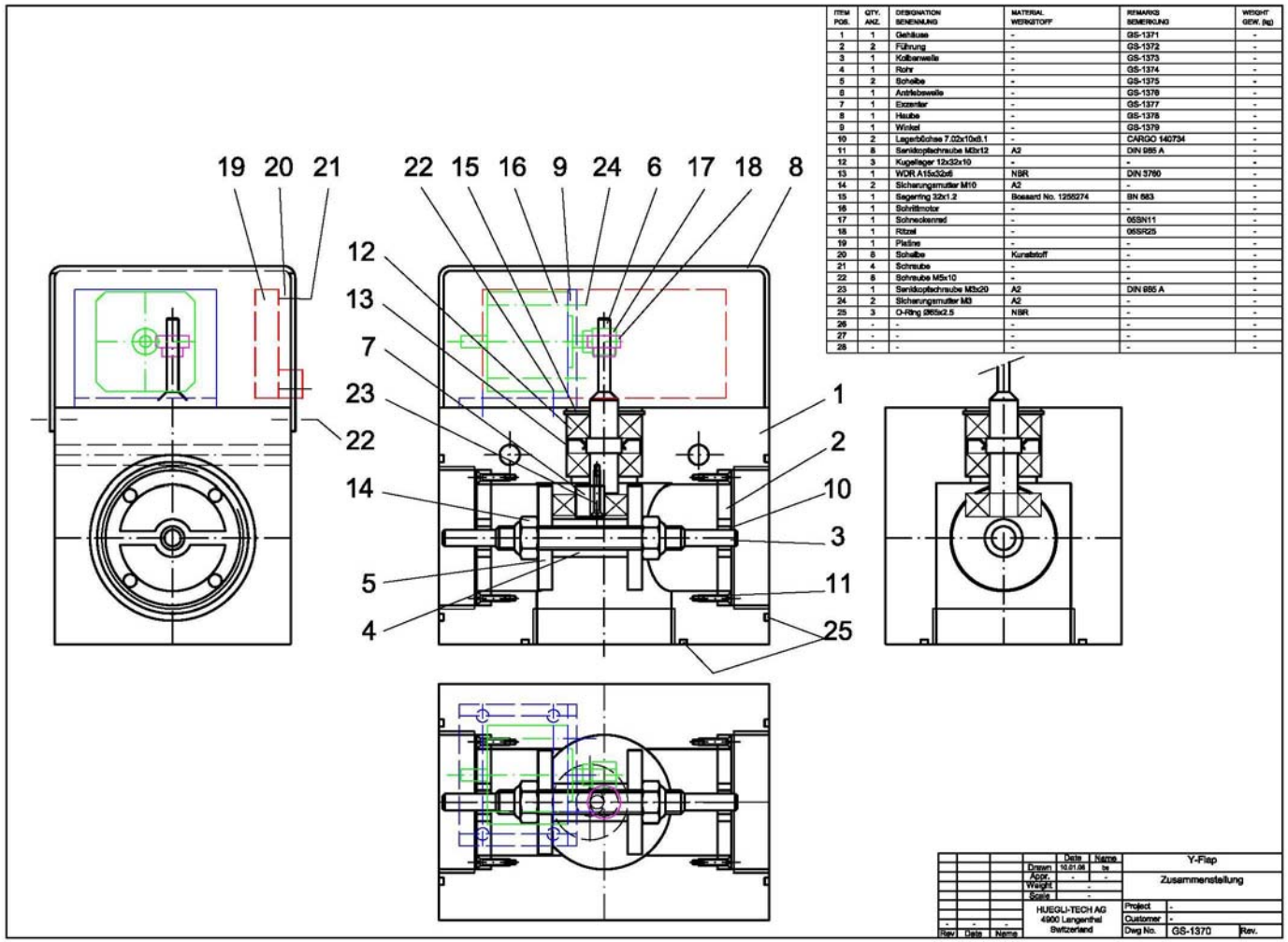


The TCM 2000 is a CAN operated unit which not only measures the temperature, but also has several other functions, such as:

Temperature management for Cylinder and Turbo

Constant Ratio monitoring and control

History file 200 lines



ITEM POS.	QTY. ANZ.	DESIGNATION BENENNUNG	MATERIAL WERKSTOFF	REMARKS BEMERKUNG	WEIGHT GEW. (kg)
1	1	Gehäuse	-	GS-1371	-
2	2	Führung	-	GS-1372	-
3	1	Kolbenwelle	-	GS-1373	-
4	1	Rohr	-	GS-1374	-
5	2	Scheibe	-	GS-1375	-
6	1	Antriebswelle	-	GS-1376	-
7	1	Exzenter	-	GS-1377	-
8	1	Haube	-	GS-1378	-
9	1	Winkel	-	GS-1379	-
10	2	Lagerbüchse 7,02x10x8,1	-	CARGO 140734	-
11	8	Senkkopfschraube M3x12	A2	DIN 965 A	-
12	3	Kugellager 12x32x10	-	-	-
13	1	WDR A15x32x6	NBR	DIN 3760	-
14	2	Sicherungsmutter M10	A2	-	-
15	1	Segering 32x1.2	Boesard No. 1250274	SN 563	-
16	1	Schrittmotor	-	-	-
17	1	Schneckenrad	-	05SN11	-
18	1	Ritzel	-	05SR25	-
19	1	Platine	-	-	-
20	8	Scheibe	Kunststoff	-	-
21	4	Schraube	-	-	-
22	8	Schraube M5x10	-	-	-
23	1	Senkkopfschraube M3x20	A2	DIN 965 A	-
24	2	Sicherungsmutter M3	A2	-	-
25	3	O-Ring Ø65x2.5	NBR	-	-
26	-	-	-	-	-
27	-	-	-	-	-
28	-	-	-	-	-

	Date	Name
Drawn	10.01.08	tw
Appr.	-	-
Weight	-	
Scale	-	

HUEGLI-TECH AG
4900 Langenthal
Switzerland

Y-Flap
Zusammenstellung

Project -
Customer -
Dwg No. GS-1370 Rev.

Finally, what is left over……

- **Which Engines can be converted**

Any high speed classical diesel injected engine.

Electronic injected engine not yet supported.

- **Do we get support from JDK and HT**
- **How to cooperate with JDK and HT**

Of course you get support. we will be able to conduct training into technical deep details.

We will assure that you can even adjust a Denox with your eyes closed.

Provide us as much technical information as possible. Fill the questionnaire provided by us.

Now you know what you have to do, we will help you wherever we can and support with our knowledge.

Our Dual Fuel System is **unique** and the only one world wide which can control a V-Engine to have equal balanced temperatures.

Very Unique and so are you.

!!! Thank you !!!