



Emission Monitoring System (EMS)

User Manual

Rev 1.6

Standard OffRoad System

DOCUMENT REVISION HISTORY

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1. GENERAL

1.1. System description

MRS Emission monitoring system (MRS EMS) is a complete, standalone solution for monitoring the status of the diesel particles and diesel particulate filter. Its function is achieved through continuous measurement, display and logging of exhaust gas temperature, back pressure, engine speed (rpm) and NO_x / O₂ (optionally).

The values received from the sensors are evaluated and compared with preconfigured settings to determine whether user intervention or maintenance is needed. For example, if the back pressure values become too high (indicating that the filter is clogged) or too low (indicating that the filter is damaged), the system will both alert the user with a visual and audible alarm and save the event in the logger memory.

Alarms generated by an event, together with the visual indications, remain active until the source (e.g., measured value) returns to normal levels. Audible notifications are switched off after the alarm is acknowledged by the user.

The driver can observe the system operation by checking if the exhaust system temperature is within optimal values for filter operation. If a back-pressure alarm is generated, the driver can raise the temperature of the exhaust gases by increasing the engine speed and therefore can initiate the system cleaning. When the back pressure is within the normal values again, visual warning will be turned off.

Additionally, the monitoring system can be connected to the PC software for online data monitoring, data examination or system programming.

For more information regarding the MRS EMS system and other solutions, please visit the official MRS website www.mrs-electronic.com.

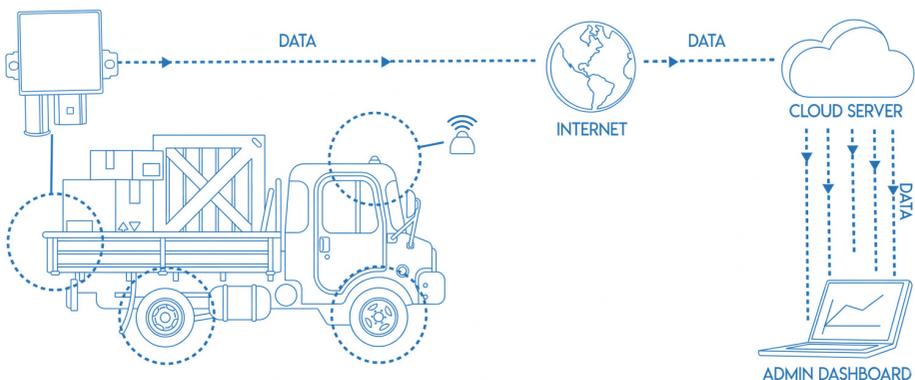


Figure 1.1. System overview

2. INSTALLATION

2.1. Unpacking the box

In the MRS EMS box you can find:

Nr.	Component name	Quantity
1	MRS LogBase 04	1 pc
2	MRS OpticsPanel OffRoad	1 pc
3	Pressure sensor connection kit (optional)	1 set
4	Temperature sensor connection kit	1 pc
5	Cable harness	1 set
6	Battery connection fuse kit	1 set
7	MRS Terminal connection interface (optional)	1 pc

Table 2.1. The components contained inside the box

Temperature sensor probe is included with the Cable harness!

2.2. System components

LogBase 04 has integrated pressure sensor, inputs for the temperature sensor probe and single I/O pin which can be used as frequency input (engine speed/rpm) or alarm output. It also has a CAN bus interface which is used to connect NOx sensor and OpticsPanel or MRS Terminal software.



Figure 2.1. MRS LogBase 04

OpticsPanel OffRoad is the user’s communication interface that is used to communicate with the logger unit. OpticsPanel displays the online data, alarms the user, and shows the system errors (cannot be used to parametrize the system). User can also acknowledge the alarm using confirm button.



Figure 2.2. OpticsPanel OffRoad

Pressure sensor connection kit (optional) has all the necessary components to connect the pressure sensor with a filter. It is consisted of a stainless-steel pipe, ¼ NPT fitting, high temperature hose and moisture separator (optional).



Figure 2.3. Pressure sensor connection kit

Temperature sensor connection kit has all the necessary components to connect the temperature sensor with a filter. It is consisted of a ¼ NPT fitting and the temperature sensor itself is a part of the pre-connected cable harness.

Cable harness is a complete connection kit (wired and tested) that simplifies the system installation. Cable harness itself is modular which means it's consisted of separate smaller cable harnesses for each system component.

Power supply cable harness is used to connect LogBase 04 device to the EMS. Power supply and I/O are to be connected to corresponding outputs / supplies. Temperature sensor comes pre-attached. Optics panel OffRoad is connected using a Deutsch connector.

Harness can be further extended using additional cable harness extensions, i.e. if a customer wants NOx or Connected Logger functionality.



Figure 2.4. Power supply cable harness

Battery connection fuse kit has all the necessary components to connect the system to the battery and acts as an overcurrent protection.



Figure 2.5. Battery connection fuse kit

MRS Terminal connection interface (optional) is used to connect the system to the MRS Terminal software running on a Windows PC. This adapter has 4 pin Deutsch connector from one side and DB9 connector on the other side. It is necessary to have a [PCAN-USB](#) adapter for this purpose.



Figure 2.6. MRS Terminal connection interface

2.3. Schematic overview

A schematic overview of the MRS EMS system and its components is given in the figure below:

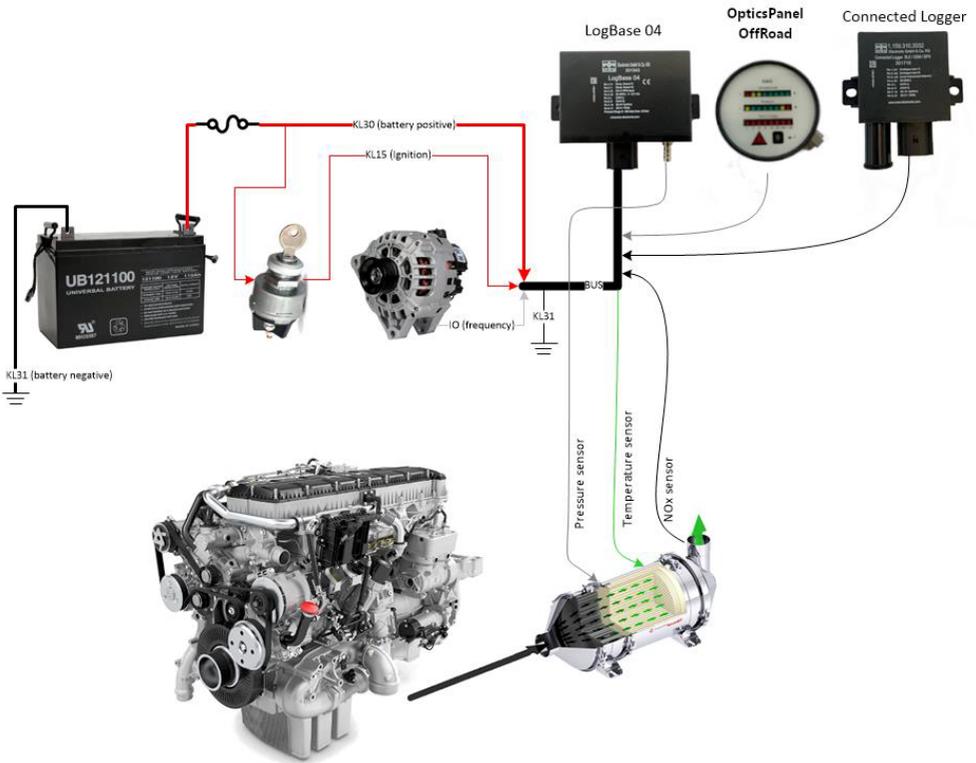


Figure 2.7. Schematic overview of the system installation

2.4. Installation instructions

IMPORTANT: DISCONNECT THE BATTERY PRIOR TO THE INSTALLATION!

2.4.1. LogBase 04 installation

The LogBase 04 is to be vertically mounted (i.e., its connector positioned downwards), securely fixed and installed in a position protected against water, excessive heat, and mechanical shock.

The device has two mounting holes, one on each side, with the pressure connection and device connector being located next to each other.

The connector plug on the logger connects to the cable harness and has a security lock to prevent unwanted disconnection. To remove the connector from the plug, press the black locking tab firmly and pull connector from the plug.



Figure 2.8. LogBase 04 front panel connections

2.4.1.1. Pinout

LogBase 04 pinout is listed below:

Pin number	Pin description	Wire color
1	Temperature sensor P	(green)
2	Temperature sensor N	(white)
3	Input / Output or RPM	(white / black)
4	KL30 / B+	(red)
5	CAN L	(green)
6	CAN H	(white)
7	KL15 / Ignition switch	(red / black)
8	KL31 / Ground	(black)

Table 2.2. LogBase 04 pinout

2.4.2. OpticsPanel OffRoad

MRS OpticsPanel OffRoad is designed to withstand harsh environmental conditions. It can be attached on the body / console or flush installed into the console (using a universal 75mm crown). For a flush installation, required depth is 55mm. The sturdy design meets the requirements of IP 67.

OpticsPanel OffRoad is connected to the cable harness via the Deutsch 4 pin connector.



Figure 2.9. OpticsPanel OffRoad

2.4.3. Pressure sensor

LogBase 04 uses an integrated pressure sensor which needs to be connected to the diesel particulate filter connection point using the pressure sensor connection kit. The connection between the sensor and the filter should be properly sealed and secured from excessive heat sources (e.g., nearby heated components).

To prevent build-up of condensate, connection should be made in the rising direction (i.e., pointing upwards). Minimum length between the filter and sensor should be 150 cm. The stainless-steel pipe should be inserted into the filter approx. 3 cm deep and connected using the provided ¼ NPT fitting.

Important: The stainless-steel pipe should not be cut to length but wound into multiple coils with the coils facing up (rising upwards). Any looping, twisting, or pinching of the high temperature hose is forbidden.

To prevent deposit build-ups which can cause the pressure probe to malfunction, a standard moisture separator (optional component) must be installed between the pressure probe and the stainless-steel pipe.

Stainless-steel pipe is then connected onto the high temperature hose which is ultimately connected to the MRS LogBase 04.



Figure 2.10. DPF pressure and temperature monitoring points for a ¼ NPT fittings

2.4.4. Temperature sensor

LogBase 04 uses a standard automotive grade K-Type sensor probe that comes as a part of the cable harness. The connection between LogBase 04 and filter should be properly secured from excessive heat sources (e.g., nearby heated components).

Temperature sensor probe should be inserted into the filter approx. 5 cm deep and connected using the provided $\frac{1}{4}$ NPT fitting. The sensor tip should be facing directly into the flowing exhaust gases. If this is not possible then the probe should be inserted deeper into the filter, while making sure that the filter is not damaged by it. The temperature sensor cable should be secured to the fixed components, and away from the heated ones.



Figure 2.11. Temperature sensor probe

2.4.5. Cable harness

IMPORTANT: DISCONNECT THE BATTERY PRIOR TO THE INSTALLATION!

When installing the cable harness, make sure that all the system components (sensors, display devices), as well as the power supply connections to the battery are made before connecting the LogBase 04 to its cable harness connector.

The red wire (logger power supply) of the cable harness should be connected to the battery connector using the fuse kit. The red/black wire (ignition signal) should be connected to the ignition switch. The black wire (ground connection) should be connected to the chassis. The white / black wire (RPM input) should be connected to the W terminal of the alternator or similar RPM sensing output. If the Input/Output, i.e., RPM, wire is left unconnected, make sure it is properly insulated to avoid unwanted short circuit connections.

After all the above connections are made, connect the battery connectors to the battery itself, power up the vehicle, and check if the EMS system is powered up and running.

Cable harness itself is modular and therefore makes the installation easier.

2.5. Initial setup

Initial setup (i.e., configuration) of the system needs to be performed after all the previously mentioned installation steps are done for it to function properly.

For the system to log the data correctly, the time / date should be set. Also, if the engine speed is monitored, alternator frequency factor should be set.

Important: If the device is not connected to the power supply for more than 10 days, the time / date should be set again after the system is powered up. Otherwise, the data will not be logged correctly.

Default system settings are listed below. Check to make sure whether they are appropriate for your system, and, if not, adjust them accordingly. The OffRoad version is set up using the MRS Terminal software (unlike the OnRoad version which can be set up using the OnRoad Panelbox).

Parameter name	Parameter value
L(L) - Lower pressure limit	15 mbar
L(U) - Upper pressure limit	150 mbar
T(L) - Lower temperature limit	150°C
T(U) - Upper temperature limit	750°C
FRQ /10 -	Off
M	10 sec

Table 2.3. Default parameter values

3. OPERATING THE SYSTEM

3.1. OpticsPanel OffRoad

OpticsPanel OffRoad is used to display parameters of the DPF monitoring system but cannot be used to define system parameters. To parametrize the system please use MRS Terminal software.

Operating the system with OpticsPanel OffRoad is very easy. The Panel has Temperature, Pressure and Error Code LED-s that inform the user of the system current state.

Temperature and Pressure values are being displayed by the block of LED's. The actual value (stage) that will be displayed is controlled by LogBase 04. Value goes from GREEN (normal), YELLOW (warning) and RED (alarm). Under normal conditions the LED colour will be green, and other colours could occur at higher engine loads or if the filter is clogged.

Alarm Code number is acquired by adding the active Error Code numbers.

Example 1: if Error Code 1,4 and 16 are active, Alarm Code 21 is active.

Example 2: if Error Code 1, 2, 4, 8 and 16 are active, Alarm Code 31 is active.

For Alarm Codes explanation, please check page 19.

User can acknowledge events by using the confirm button ↵.

4. ALARM CODES

Error number	Problem explanation / solution
Error 11	One of the keys on the Panel has jammed Solution: press the keys (if necessary, repeatedly) until the fault is corrected.
Error 12	Check the display for damages
Error 21	No communication between the LogBase 04 and Panel Solution: check CAN bus connection
Error 22	12C-Bus/Pointer Search Solution: please contact your distributor if error repeats
Error 23	Parameterization incorrect/unreadable Solution: please contact your distributor if error repeats
Error 31	Break in the pressure hose or pressure pipes, or damage to the filter Solution: check the pressure connection and look for the filter damage. If problem were not detected, please contact your distributor
Error 32	No pressure 10 minutes after the ignition has been switched on Solution: (1) Engine is not running → Switch on engine (2) Faulty connection or pressure pipe blocked → Reconnect and secure pressure pipe or clean out pressure hose as per maintenance instructions.
Error 33	Temperature unchanged 10 minutes after the ignition is switched on Solution: make sure engine is running and temperature sensor probe is still correctly attached to the filter.
Error 34	Damaged temperature-sensor probe T1 Solution: replace the cable harness with the new one.
Error 35	Back pressure too low (Serious error!) Solution: filter cannot function anymore
Error 36	Back pressure too high Solution: raise the exhaust-gas temperature by increasing the engine load in an appropriate manner or start regeneration procedures. Important note: Do not allow the engine to overheat!
Error 37	RPM input connection to alternator loss Solution: if the engine is running, check the connection between LogBase 04 and alternator
Error 41	Measured Data cannot be recorded Solution: please contact your distributor
Error 42	Memory Error Solution: data structure is damaged, please contact your distributor
Error 51	The date could not be verified and logged Solution: repeat the procedure. If error is still present, please contact your distributor
Error 52	Time could not be verified and logged Solution: repeat the procedure. If error is still present, please contact your distributor
Error 55	Temperature too high

Table 4.1. List of alarm codes

5. MAINTENANCE

It is necessary to perform regular maintenance for the system to function properly. The components requiring regular maintenance are the temperature sensor and the pressure sensor's connection kit.

5.1. Temperature sensor maintenance

MAINTENANCE PERIOD: Once a year / every 100,000 km

The temperature sensor must be inspected for damage, removed from the filter, and cleaned to remove oil, grease and residue. Afterwards, the probe is to be reinserted as instructed in par 2.4.4.

5.2. Pressure sensor connection kit maintenance

MAINTENANCE PERIOD: Once a year / every 100,000 km / ERROR 31 or 32 shown

The pressure sensor connection kit must be inspected for damage, disconnected from the filter, and cleaned to remove oil, grease, and residue. First, loosen the fitting connecting the pipe to the filter, remove all cable ties and disassemble the rest of the system. Perform the cleaning process and reassemble the system as instructed in par 2.4.3.

6. TROUBLESHOOTING

6.1. Symptoms and solutions

If you notice any unexpected system operation, first check the section Alarm codes, par 4. If you are still having issues, please follow the procedures listed below:

Symptom	Procedure / solution
Panel / LogBase 04 does not work	<ul style="list-style-type: none"> - check if engine is running - check the connection between Panel and LogBase 04 - check for the blown fuse - check the battery connection - check the system connections
Pressure sensor issues	<ul style="list-style-type: none"> - check if engine is running - check if the pressure sensor connection hose is damaged, clogged or has the water residue inside sensor
Temperature sensor issues	<ul style="list-style-type: none"> - check if engine is running - check if temperature sensor is securely attached - check if the temperature sensor is damaged, bent, broken, etc - check the temperature sensor connections
RPM issues	<ul style="list-style-type: none"> - check if the engine is running - if Panel displays off rpm, check if alternator factor is set up - check the RPM connection - check the alternator / generator for malfunction

Table 6.1. Troubleshooting symptoms and solutions

If you are still having the problems, please contact your distributor.

7. TECHNICAL SPECIFICATIONS

7.1. MRS LogBase 04

TECHNICAL DATA	
Housing	Waterproof cast, Plastic housing
Connector	8 pin Molex 2x4 Dual Row
Housing dimensions	130 x 87,5 x 36 mm (incl. tabs and connector)
Weight	230 g
Environmental protection	Up to IP68
Operating voltage	9 – 32 V
Overvoltage protection	≥ 33 V
Quiescent current	60 µA (12 V), 110 µA (24V)
Operating current	Up to 100mA

7.2. MRS OpticsPanel OffRoad

TECHNICAL DATA	
Housing	Metal housing with glass cover
Connector	Deutsch DT04-4P
Housing dimensions	Φ 86,5 x 51 mm
Weight	180 g
Environmental protection	IP67
Operating voltage	9 – 32 V
Overvoltage protection	≥ 33 V

7.3. Temperature sensor probe

TECHNICAL DATA	
Version	Stainless steel curved protection tube
Thermocouple	NiCr-Ni, type K according to DIN EN 60584, class 1
Outside material	Inconel 600, W.-Nr. 2.4816
Sensor diameter	3 mm
Probe length	40 mm
Protection tube	Stainless steel W.-Nr. 1.4571 6 mm right angle bent; laser marked logo 80 mm
- <i>material</i>	
- <i>diameter</i>	
- <i>leg length</i>	
Protection spring	Stainless steel tension spring
Heat shrink tube	shrink 20 mm under tension spring
Connection cable	5000 mm flexible silicone thermocouple cable, 2 x 0.5 mm ² Teflon insulated wires
Protection	water and oil resistant

7.4. Pressure sensor

TECHNICAL DATA	
Version	internal mounted sensor
Relative pressure range	0 – 600 mbar
Relative pressure max	3 bar
Output voltage	0.5 – 4.5 V
Input voltage	4.5 – 5.5 V
Protection	IP 65

7.5. Cable harness

TECHNICAL DATA	
Material	FLRY-B wires insulated with corrugated protection hose
Operating temperature	from -40°C to 105°C
Protection	good resistance to ozone, aging, acids and friction
Flammability	Self-extinguishing within 30 seconds

8. TECHNICAL SUPPORT

If you require our technical support, please feel free to reach us using the following:

E-mail	support@mrs-electronic.com
Website	www.mrs-electronic.com
Address	MRS ELECTRONIC GmbH & Co. KG Klaus-Gutsch-Str. 7 DE-78628 Rottweil Germany

9. TERMS OF USE

For details regarding Terms of use please refer to the MRS website (www.mrs-electronic.com).

10. SAFETY AND INSTALLATION INFORMATION

It is essential to fully read and understand the instructions before working with the device.

Please note and comply with the operating instructions and the information in the device datasheet, see www.mrs-electronic.com

Staff qualification: Only staff with the appropriate qualification can work on this device or in its proximity.

SAFETY

WARNING! Danger as a result of a malfunction of the entire system.

Unforeseen reactions or malfunctions of the entire system may jeopardize the safety of people or the machine.

- Ensure that the device is equipped with the correct software and that the wiring and settings on the hardware are appropriate.

WARNING! Danger as a result of unprotected moving components.

Unforeseen dangers may occur from the entire system during commissioning or maintenance.

- Switch the entire system off before carrying out any work and prevent it from unintentionally switching back on.
- Before putting the device into operation, ensure that the entire system and parts of the system are safe.

The device should never be connected or separated under load or voltage.

CAUTION! Risk of burns from the housing.

The temperature of the device housing may be elevated.

- Do not touch the housing and let all system components cool before working on the system.

PROPER USE

The device is used to control or switch one or more electrical systems or sub-systems in motor vehicles and machines and may only be used for this purpose. The device may only be used in an industrial settings.

WARNING! Danger caused by incorrect use.

The device is only intended for use in motor vehicles and machines.

- Use in safety-related system parts for personal protection is not permitted.
- Do not use the device in areas where there is a risk of explosion.

Correct use:

- operating the device within the operating areas specified and approved in the associated data sheet.
- strict compliance with these instructions and no other actions which may jeopardize the safety of individuals or the functionality of the device.

Obligations of the manufacturer of entire systems

It is necessary to ensure that only functional devices are used. If devices fail or malfunction, they must be replaced immediately.

System development, installation and commissioning of the electrical systems may only be carried out by trained and experienced staff who are sufficiently familiar with the handling of the components used and the entire system.

It is necessary to ensure that the wiring and programming of the device does not lead to safety-related malfunctions of the entire system in the event of a failure or a malfunction. System behavior of this type can lead to a danger to life or high levels of material damage.

The manufacturer of the entire system is responsible for the correct connection of the entire periphery (e.g. cable cross sections, correct selection/connection of sensors/actuators).

Opening the device, making changes to the device and carrying out repairs are all prohibited. Changes or repairs made to the cabling can lead to dangerous malfunctions. Repairs may only be carried out by MRS.

Installation

The installation location must be selected so the device is exposed to as low a mechanical and thermal load as possible. The device may not be exposed to any chemical loads.

Install the device in such a manner that the plugs are pointing downwards. This means condensation can flow off the device. Single seals on the cables/leads must be used to ensure that no water gets into the device.

COMMISSIONING

Commissioning can be done only by the qualified staff. This may only occur when the status of the entire system corresponds to the applicable guidelines and regulations.

FAULT CORRECTION AND MAINTENANCE

NOTE: The device is maintenance-free and may not be opened.

- If the device has damage to the housing, latches, seals or flat plugs, it must be taken out of operation.

Fault correction and cleaning work may only be carried out with the power turned off. Remove the device to correct faults and to clean it.

Check the integrity of the housing and all flat plugs, connections and pins for mechanical damage, damage caused by overheating, insulation damage and corrosion. In the event of faulty switching, check the software, switches and settings.

Do not clean the device with high pressure cleaners or steam jets. Do not use aggressive solvents or abrasive substances.

Subject to change following technical developments.



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