AQUAMETRO OIL & MARINE

CONTOIL® DFM – Systems

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Safety instructions

Designed use
This unit is designed for acquisition, calculation, displaying and sending datas. Resulting from incorrect use or from use other than that designated, can suspend the operational safety of the devices. The manufacturer accepts no liability for damages being produced from this.

Installation, commissioning and operation
Installation, connection to the electric supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorised to perform such works. The specialist must have read and understood these Operating Instructions and must follow the instructions they contain. The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. Before working on electrical installation, make sure to disconnect the power supply and ensure that nobody can reconnect it without your permission.

Pay attention to the following points:
- Voltage, operation data
- Maximum transmission length
- Cable cross section, length
- Ambient temperature and mounting position

Operational safety
The manufacturer reserves the right to modify technical data without prior notice. Your local distributor will supply you with current information and updates to these Operating Instructions.

Return of the instruments
The following procedures must be carried out before a device requiring repair or calibration, for example, is returned to Aquametro Oil & Marine AG:
- Always enclose a fully completed “Repair Form” with the device. Only then Aquametro Oil & Marine AG can transport, examine and repair a returned device.

Notes on safety conventions and icons
The devices are designed to meet state-of-the-art safety requirements. They have been tested and left the factory in a condition in which they are safe to operate. They can, however, be a source of danger if used incorrectly or for use other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in these instructions by the following symbols:

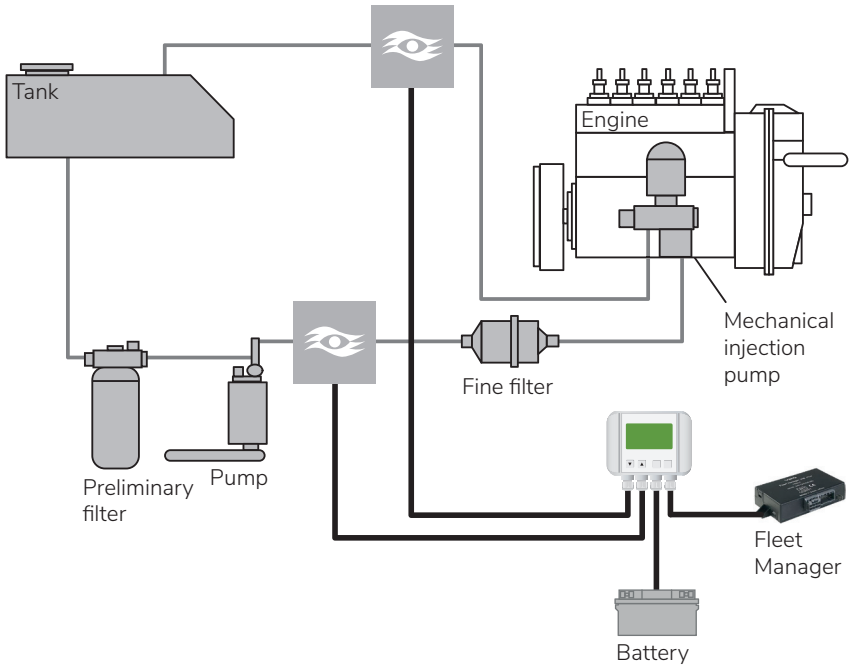
Warning!
“Warning” indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.

Caution!
“Caution” indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

Note!
“Note” indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

Configuration overview

Schematic of a differential fuel consumption configuration



The 2 flow meters are just as an example. Both can be changed with a compact one.

Installation Advices

- The flow meters always have to be protected by a fuel filter. The max. mesh size depends on the flow meter size. The original engine filter is ideal for all flow meter sizes.
- Be aware, that all the fuel which is passing through the supply line flow meter AND is not consumed by the engine, MUST return through the return line flow meter to the tank.
- A leak line of the injector MUST be returned on the return line and before the return flow meter
- If the flow meters are marked with S and R, install the S- flow meter in the SUPPLY-line and the R- flow meter in the RETURN-line.
- The arrow on the flow meters must be show in the flow direction.
- The flow meters must be absolutely free of gas inclusions.
- High pressure hammers from injection pump have to be avoided on flow meters (for example, with a min. 2 meter **rolled up** hose between flow meter in the supply line and the injection pump).
- Install the DFM-BC on the cabin floor, on the car dashboard or on the cabin top; but always in a good readable and accessible position.
- For a good and professional installation of the Board Computer (DFM-BC) we recommend the Mounting Bracket Kit (part number 80485)

For your Security...

- DO NOT program or change parameters while you drive. This may be dangerous for you and the other traffic participants.
- During the electrical installation disconnect the vehicle battery.
- Be careful when disconnecting the pipes (exit of fuel will occur).
- After installation check all pipes for leaks.

How to connect...

Before you start with the electrical connection of the system, you must have done a correct installation of the delivered components. This installation must be done by an authorized and certified company/person.
Please be aware: an incorrect installation may destroy the DFM-System and damage your vehicle. In this case, Aquametro will deny all responsibilities.

Double chamber flow meter to the Board Computer (DFM 8D to the DFM-BC)

Please read the **Installation Tips** before you start.

1. With the DFM-BC in front of you, open the side-wings of the box and unscrew the 4 screws. Put the upper part of the DFM-System careful a side. The upper part is connected to the base part with a flat cable.
2. Look at the print on the base. You will see a terminal block with 14 positions.
3. Take the cable from the DFM-8D and pass it through one of the glands of the DFM-BC. Tighten the gland-nut very well by hand, until the cable is fixed.
4. Now connect the wires from the DFM-8D according to the table below to the terminal block on the DFM-BC print:

DFM-8D - cable colors		DFM-BC - positions on the terminal block
White	to	1
Brown	to	2
Green	to	3
Yellow	to	5

To ensure a proper function, the cable, described in the procedure below, **must be** connected directly to the vehicle's battery. Do not connect it over the start-key of the vehicle. That means, also with the vehicle key in your pocket the DFM-BC must be electrically powered. The power consumption is far below 1mA.

5. Connect a two wire cable (0.75 mm^2) from the vehicle battery, through one of the gland of the DFM-BC, to the connector position 13 (batt. plus) and position 14 (batt. minus). Tighten the gland-nut very well by hand, until the cable is fixed.
6. After all cables are connected and well in place, put the upper part of the DFM-BC back to the base part and screw it down.
7. Look at the type plate of the DFM-8D flow meter. Read the value for the SL-KF and the RL-KF (it must be a value like **SL KF +0.12 or SL KF -0.13)**. Keep this value in mind or write it down to paper.
   These values are needed to reach optimal performance.
8. Take the DFM-BC. If it is off, press one of the 4 Keys on the front to reactivate it.
   Go to the menu point <Service>.
   Press <OK> and enter the Service-Code. Standard service code is: 1111.
9. Input Value and Output Value:
   Change the "Input Value" by doing the following:
   a. Press the ▼ down-arrow
   b. On the "Input" line press <OK>
   c. The field "Input xxxx.x ml" will by highlighted.
   d. "Move the cursor to the right with the <OK> key, move the cursor to the left with the <ESC> key.
   e. Press the ▼ down-arrow or the ▲ up-arrow to adjust the "Input Value" to 12.5 ml/pulse.
   f. Press <OK> to confirm the modification.
   g. The "Output Value" can be chosen from the "Flow meter Type" table or set a value of your choice.

Flow meter Type	Input Value
DFM-20S	36 ml
DFM-25S	100 ml

10. Set the Return Line flow meter
    a. Press the ▼ down-arrow to move to the <RL flow meter> line.
    b. The value must be <Yes> (standard). If not, press the <OK> key and change the value with the arrow keys.

11. Set the <SL KF> and the <SL app>.
    a. Starting from the previous position, press many times the ▼ down-arrow, until you reach the menu point "Supply configuration".
    b. Press <OK> at the menu point "SL KF". Enter the value for the <SL KF> using the arrow keys. This value is printed on the type plate of the flow meter. Confirm with <OK>.
    c. Move with <OK> to the menu point <SL app>. Normaly you do not need to change this value. For more information go to the section <Higher Performance Results>
    d. Press many times the ▼ down-arrow key until you reach the menu point "Return configuration".
    e. Press <OK> at the menu point "RL KF". Enter the value for the <RL KF> using the arrow keys. This value is printed on the type plate of the flow meter. Confirm with <OK>.
    f. Move with <OK> to the menu point <SL app>. Normaly you do not need to change this value. For more information go to the section <Higher Performance Results>
12. Set the date
    a. Starting from the previous position, press many times the ▼ down-arrow, until you reach the menu point "Clock".
    b. On the line "Date", press <OK>. Modify the date by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key.
    c. When the date is set, confirm it with the <OK> key.
13. Set the time
    a. Move with the ▼ down-arrow key to the line "Time".
    b. On the line "Time", press <OK>. Modify the time by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key
    c. When the time is set, confirm it with the <OK> key.
14. Set the Service code.
    This procedure is optional. We recommend to change it for more security.
    Store the new service code in a save place. Loosing of the service code leads to a "factory reset", which means sending the DFM-BC to the factory with loosing of all setting parameters. So, be careful.
    a. Move with the ▼ down-arrow key to the line "Service code".
    b. On the line "Service code", press <OK>. Modify the service code by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key and from right to left with the <ESC> key.
    c. When the new service code is set, confirm it with the <OK> key.
15. End of installation
    a. Exit with <ESC>.
    b. After the installation is done **and before** you start the engine, go to the section "Startup (commissioning)" for the initial checks and startup.

Single chamber flow meter to the Board Computer (DFM 20S / 25S to the DFM-BC)

This installation consists always in pair installation of two flow meter.
For an easier reading during this section the DFM 20S / 25S are called **DFM flow meter.**

Please read the **Installation Advices** before you start.

1. With the DFM-BC in front of you, open the side-wings of the box and unscrew the 4 screws. Put the upper part of the DFM-System careful a side. The upper part is connected to the base part with a flat cable.
2. Look at the print on the base. You will see a terminal block with 14 positions.
3. Take the cable from the first DFM-flow meter and pass it through one of the gland of the DFM-BC. Do the same with the second one. Tighten the gland-nut very well by hand, until the cable is fixed.
4. Now connect the wires from the DFM-Sensor according to the table below to the terminal block on the DFM-BC print:

Supply-Line flow meter

DFM-flow meter – cable colors		DFM-BC – positions on the terminal block
White	to	1
Brown	to	2
Green	to	3
Yellow	to	Not used

Return-Line Sensor

DFM-flow meter – cable colors		DFM-BC – positions on the terminal block
White	to	7
Brown	to	8
Green	to	9
Yellow	to	Not used

5. To ensure a proper function, the cable, described in the procedure below, **must be** connected directly to the vehicle's battery. That means, also with the vehicle key in your pocket the DFM-BC must be electrically powered. The power consumption is far below 1mA.
   Connect a two wire cable (0.75 mm²) from the vehicle battery, through one of the gland of the DFM-BC, to the connector position 13 (Batt. plus) and position 14 (Batt. minus). Tighten the gland-nut very well by hand, until the cable is fixed.
6. After al cables are connected and well in place, put the upper part of the DFM-BC back on the base part and screw it down.
7. Look at the type plate of the DFM-flow meter. Read the value for the SL-KF and the RL-KF (example: it must be a value like <**SL KF +0.12> or <SL KF -0.13**>). Keep this value in mind or write it down to a paper.
   These values are needed to reach optimal performance.
8. Take the DFM-BC. If it is off, press one of the 4 Keys on the front to reactivate it.
   Go to the menu point <Service>. Press <OK> and enter the Service-Code.
   Standard service code is: 1111.
9. Input Value and Output Value
   Change the "Input Value" by doing the following:
   a. Press the ▼ down-arrow
   b. On the "Input" line press <OK>
   c. The field "Input xxxx.x ml" will by highlighted.
   d. Press the ▼ down-arrow or the ▲ up-arrow to adjust the "Input Value" according to the table "Flow meter Type"
   e. Press <OK> to confirm the modification.
   f. The "Output Value" can be chosen from the "Flow meter Type" table or set a value of your choice.

Flow meter Type	Input Value
DFM-20S	36 ml
DFM-25S	100 ml

10. Set the Return Line flow meter
    a. Press the ▼ down-arrow to move to the <RL flow meter> line.
    b. The value must be <Yes> (standard). If not, press the <OK> key and change the value with the arrow keys.
11. Set the <SL KF> and the <SL app>.
    a. Starting from the previous position, press many times the ▼ down-arrow, until you reach the menu point "Supply configuration".
    b. Press <OK> at the menu point "SL KF". Enter the value for the <SL KF> using the arrow keys. This value is printed on the type plate of the flow meter. Confirm with <OK>.
    c. Move with <OK> to the menu point <SL app>. Normaly you do not need to change this value. For more information go to the section <Higher Performance Results>.
    d. Press many times the ▼ down-arrow key until you reach the menu point "Return configuration".
    e. Press <OK> at the menu point "RL KF". Enter the value for the <RL KF> using the arrow keys. This value is printed on the type plate of the flow meter. Confirm with <OK>.
    f. Move with <OK> to the menu point <SL app>. Normaly you do not need to change this value. For more information go to the section <Higher Performance Results>
12. Set the date
    a. Starting from the previous position, press many times the ▼ down-arrow, until you reach the menu point "Clock".
    b. On the line "Date", press <OK>. Modify the date by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key and from right to left with the <ESC> key.
    c. When the date is set, confirm it with the <OK> key.

13. Set the time
    a. Move with the ▼ down-arrow key to the line “Time”.
    b. On the line “Time”, press <OK>. Modify the time by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key and from right to left with the <ESC> key.
    c. When the time is set, confirm it with the <OK> key.
14. Set the Service code
    This procedure is optional. We recommend changing for more security.
    Store the new service code in a save place. Loosing of the service code leads to a “factory reset”, which means sending the DFM-BC to the factory with loosing of all setting parameters. So, be careful.
    a. Move with the ▼ down-arrow key to the line “Service code”.
    b. On the line “Service code”, press <OK>. Modify the service code by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key and from right to left with the <ESC> key.
    c. When the new service code is set, confirm it with the <OK> key.
15. End of installation
    a. Exit with <ESC>.
    b. After the installation is done **and before** you start the engine, go to the section “Startup (commissioning)” for the initial checks and startup.

Single chamber flow meter to the Board Computer for direct fuel consumption (DFM 20S / 25S to the DFM-BC)

This installation is done with a single installation of a flow meter. For an easier reading during this section the DFM 20S / 25S are called **DFM flow meter**.

Please read the **Installation Advices** before you start.

1. With the DFM-BC in front of you, open the side-wings of the box and unscrew the 4 screws. Put the upper part of the DFM-System gently a side. Be CAREFULL. The upper part is connected to the base part with a flat cable.
2. Look at the print on the base. You will see a terminal block with 14 positions.
3. Take the cable from the DFM-flow meter and pass it through one of the gland of the DFM-BC. Tighten the gland-nut very well by hand, until the cable is fixed.
4. Now connect the wires from the DFM-flow meter according to the table below to the terminal block on the DFM-BC print:

DFM-flow meter – cable colors		DFM-BC – positions on the terminal block
White	to	1
Brown	to	2
Green	to	3
Yellow	to	Not used

5. To ensure a proper function, the cable, described in the procedure below, **must be** connected directly to the vehicle’s battery. That means, also with the vehicle key in your pocket the DFM-BC must be electrically powered. The power consumption is far below 1mA.
   Connect a two wire cable (0.75 mm2) from the vehicle battery, through one of the gland of the DFM-BC, to the connector position 13 (Batt. plus) and position 14 (Batt. minus). Tighten the gland-nut very well by hand, until the cable is fixed.
6. After all cables are connected and well in place, put the upper part of the DFM-BC back on the base part and screw it down.
7. Look at the type plate of the DFM-flow meter. Read the value for the SL-KF (example: it must be a value like <**SL KF +0.12**> or <**SL KF -0.13**>). Keep this value in mind or write it down to a paper.
   These values are needed to reach optimal performance.
8. Take the DFM-BC. If it is off, press one of the 4 Keys on the front to reactivate it.
   Go to the menu point <Service>. Press <OK> and enter the Service-Code.
   Standard service code is: 1111.

9. Input Value and Output Value
   Change the “Input Value” by doing the following:
   a. Press the ▼ down-arrow
   b. On the “Input” line press <OK>
   c. The field “Input xxxx.x ml” will by highlighted.
   d. Press the ▼ down-arrow or the ▲ up-arrow to adjust the “Input Value” according to the table “Flow meter Type”
   e. Press <OK> to confirm the modification.
   f. The “Output Value” can be chosen from the “Flow meter Type” table or set a value of your choice.

Flow meter Type	Input Value
DFM-20S	36 ml
DFM-25S	100 ml

10. Set the Return Line flow meter
    a. Press the ▼ down-arrow to move to the <RL flow meter> line.
    b. **This value must be <No>**. If it is not, press the <OK> key and change the value with the arrow keys.
11. Set the <SL KF> and the <SL app>.
    a. Starting from the previous position, press many times the ▼ down-arrow, until you reach the menu point “Supply configuration”.
    b. Press <OK> at the menu point “SL KF”. Enter the value for the <SL KF> using the arrow keys. This value is printed on the type plate of the flow meter. Confirm with <OK>.
    c. Move with <OK> to the menu point <SL app>. Normaly you do not need to change this value. For more information go to the section <Higher Performance Results>
    d. Press many times the ▼ down-arrow key until you reach the menu point “Return configuration”.
    e. Press <OK> at the menu point “RL KF”. Enter the value for the <RL KF> using the arrow keys. This value is printed on the type plate of the flow meter. Confirm with <OK>.
    f. Move with <OK> to the menu point <SL app>. Normaly you do not need to change this value. For more information go to the section <Higher Performance Results>
12. Set the date
    a. Starting from the previous position, press many times the ▼ down-arrow, until you reach the menu point “Clock”.
    b. On the line “Date”, press <OK>. Modify the date by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key and from right to left with the <ESC> key.
    c. When the date is set, confirm it with the <OK> key.
13. Set the time
    a. Move with the ▼ down-arrow key to the line “Time”.
    b. On the line “Time”, press <OK>. Modify the time by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key and from right to left with the <ESC> key.
    c. When the time is set, confirm it with the <OK> key.
14. Set the Service code
    This procedure is optional. We recommend changing for more security.
    Store the new service code in a save place. Loosing of the service code leads to a “factory reset”, which means sending the DFM-BC to the factory with loosing of all setting parameters. So, be careful.
    a. Move with the ▼ down-arrow key to the line “Service code”.
    b. On the line “Service code”, press <OK>. Modify the service code by using the ▼ down-arrow or the ▲ up-arrow. Move from left to right with the <OK> key and from right to left with the <ESC> key.
    c. When the new service code is set, confirm it with the <OK> key.
15. End of installation
    a. Exit with <ESC>.
    b. After the installation is done **and before** you start the engine, go to the section “Startup (commissioning)” for the initial checks and startup.

Board Computer (DFM-BC) to a Fleet Manager or GPS Tracking System

For an easier reading during this section the Fleet Manager or the GPS Tracking-System are called Auxiliary.

This configuration allows you to send the exactly calculated consumption amount to an external device (e.g., Fleet Manager or GPS Tracking System). In order to work, a flow meter with the correct “Output Value” must be installed to the DFM-BC.

1. With the DFM-BC in front of you, open the side-wings of the box and unscrew the 4 screws. Put the upper part of the DFM-System gently a side. Be CAREFULL. The upper part is connected to the base part with a flat cable.
2. Look at the print on the base. You will see a connector with 14 positions.
   To ensure a proper function, this cable **must be** connected directly to the vehicle's battery. Do not connect it over the start-key of the vehicle. That means, also with the vehicle's key in your pocket the DFM-BC must be electrical powered. The consumption of the electrical power is far below 1mA.

3. Connect a two wire cable (0.75 mm2) from the vehicle battery, through one of the gland, to the position 13 (Batt. plus) and position 14 (Batt. minus). Tighten the gland-nut very well by hand, until the cable is fixed.
   To ensure a proper function, this cable must have a direct connection to the battery. Do not connect it over the start-key of the vehicle.
4. Take the cable from the Auxiliary and pass it through one of the gland of the DFM-BC. Tighten the gland-nut very well by hand, until the cable is fixed.
5. Connect the cable according to the table below:

DFM-BC positions on the connector		**Fleet-Manager or GPS Tracking-System**
11 (Signal Output)	to	Signal or Digital/Analog Input
12 (Ground)	to	Ground

For more information see section "Electrical connections and Specifications"

6. After all cables are connected and well in place, put the upper part of the DFM-BC back on the base part and screw it down.

7. Take the DFM-BC. If it is off, press one of the 4 Keys on the front to reactivate it. Go to the menu point <Service>. Press <OK> and enter the Service-Code. Standard service code is: 1111.
8. Set the Auxiliary (AUX) active.
   a. Press the ▼ down-arrow to move to the <AUX> line.
   b. On the line "AUX", press <OK>. Modify the value by using the ▼ down-arrow or the ▲ up-arrow.
   c. Change the value to <Yes>
   d. Press <OK> to confirm the modification.
   e. Exit with <ESC>.
9. From this point the signal will be send to the auxiliary port of the DFM-BC and the word AUX will be displayed on the DFM-BC Display in big letters. No more information on the DFM-BC screen will be available until you deactivate the <AUX>.
10. Set the Fleet-Manager or the GPS-System input according to the "Output Value" set during the installation of the flow meters.

Flow meters to Fuel Counter other than the DFM Board Computer (DFM 8D / 20S / 25S)

1. Go to section <Electrical Connections and Specifications> and install the DFM flow meters according to the specification of the used Fuel Counter.
2. Go to the section "Startup (commissioning)"

DFM-BC connection to other flow meter(s) other than the DFM flow meter(s).

For differential measurement

Supply Line flow meter

1. Connect the "Signal" cable from the flow meter 1 to the pin 3 of the DFM-BC
2. Connect the "Ground" cable from the flow meter 1 to the pin 2 of the DFM-BC

Return Line flow meter

3. Connect the "Signal" cable from the flow meter 2 to the pin 9 of the DFM-BC
4. Connect the "Ground" cable from the flow meter 2 to the pin 8 of the DFM-BC

For direct measurement

1. Connect the "Signal" cable from the flow meter to the pin 3 of the DFM-BC
2. Connect the "Ground" cable from the flow meter 1 to the pin 2 of the DFM-BC

Setting of the DFM-BC

Start with the settings of the DFM-BC by doing the following:

1. Take the DFM-BC. If it is off, press one of the 4 Keys on the front to reactivate it.
   Go to the menu point <Service>. Press <OK> and enter the Service-Code
   Standard service code is: 1111
2. On the "Input Value" line press <OK>
3. The field "xxx ml/p" will by highlighted.
4. Move the curse to the right with the <OK> key, move the cursor to the left with the <ESC> key
5. Press the ▼ down-arrow or the ▲ up-arrow to adjust the "Input Value" according to the flow meter signal value.
6. Press <OK> to confirm the modification.
7. Repeat the above procedure for the "Output Value" (set the "Output Value" requested by your external device (GPS or Fleet Manager)
8. Set the Return Line flow meter
   a. Press the ▼ down-arrow to move to the <RL flow meter> line.
   b. **Differential measurement:** this value must be set to <Yes>. If it is not, press the <OK> key and change the value with the arrow keys.
   c. **Direct measurement:** this value must be set to <No>. If it is not, press the <OK> key and change the value with the arrow keys
9. Go to the section "Startup (Commissioning)".

Startup (commissioning)

In this section we assume that the installation of all needed instruments has been done in a correct and professional way, that means,

The fuel system is purged according to engine manufacturer advice, leak and bubble free

If this is not the case, please set the system in proper operating condition.

1. Start the engine and let it run at min. load until it reached its operating conditions (heat exchange water between 70 °C - 90 °C)
2. Check all connections for leakages.

The next steps are only for users which have a DFM Board Computer (DFM-BC). If you do not have a DFM Board Computer you may skip this section

3. Switch on the **Board Computer** (DFM-BC) by pressing a key.
4. Go to the **Info** mode, by using the ▼ down-arrow or the ▲ up-arrow, and press <OK>.
5. Check on the <Configuration> display for the correct values.
   a. Check the <Input / Output Value> > and the <RL flow meter>. Are these settings correct?
   b. If not, got back to the section <How to connect …> and take the appropriate corrections.
6. Go to the <Supply Line>
   a. The values for **Total, TRIP and Current** must show values higher than zero.
7. Go to the <Return Line> (**ONLY** for differential measurement)
   a. The values for **Total, TRIP and Current** must show values higher than zero.
8. Go to the <Consumption Overview>
   a. The values for **Total and TRIP** must show values higher than zero and must change during the run, which means, the values have to rise up.
   b. The value for Consumption depends on the engine size and its fuel consumption, but must still be higher than zero. As long as the engine runs at idle mode, this value must always show the same amount (small variations behind the comma are normal).

9. Go to the <Supply Configuration>
   a. Check the <SL KF>. Is it the right one?
   b. If not, go back to the section <How to connect …> and take the appropriate corrections.
10. Go to the <Return Configuration>
   a. Check the <RL KF>. Is it the right one?
   b. If not, go back to the section <How to connect …> and take the appropriate corrections.

Operating Instruction for the Board Computer (DFM-BC)

The Board Computer (DFM-BC) has no ON/OFF switch. It has a sleep mode.

What does it mean?
When no activities are recognized on the connected lines (Supply line and Return Line) the Board Computer (DFM-BC) will switch itself OFF. It will be woken up when more than 2 pulses are coming in over the connected lines.
The consumed power is very low (less than 1 mA), so that no discharge of the vehicle battery should occur during a very long period.

The Menu structure has 3 branches:

- **User-Mode**
  Is intended for the daily user. It informs him about the daily needed information.
- **Info-Mode**
  Is intended for the advanced user. It shows you deeper information about the DFM-System. No parameter changes are possible.
- **Service-Mode.**
  Service-Mode is only for the Service-Engineer and is password protected. Because you have complete access to all parameters, it is absolutely important to be a trained and qualified person. Inaccurate changes in this section can result in fault calculations and mistakes.

For User ... daily information (User Mode)

Total Consumption

This picture shows the total consumption of the Engine since commissioning.

▲Last screen ▼Next screen

TRIP

This picture shows the consumption of the Engine since the last reset.

▲Previous screen ▼Next screen

Reset the TRIP

This function is activated in dependence of the setting in the section **Service Mode**.

Press OK to enter the reset mode

Press OK again to reset the TRIP

After this, the TRIP will show 0 l/h

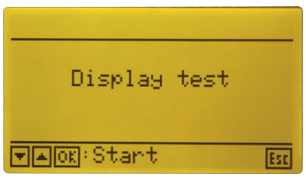
Consumption

This picture shows the current consumption of the Engine in l/h.

▲Previous screen ▼Next screen

The next two screens (Info Mode and Service Mode) are explained in the section **for Managers** and **for Service People.**

Display Test



Press OK to start the Display test.

▲Previous screen ▼Next screen

This will start the Display test. The screen will switch from a black screen to a blank screen and back. At the end of the test it will go to the "Total screen".
During the switching from black to blank, have a look at the surface for missing pixels (points). If you saw missing pixel, then the display must be changed (use the Repair Form). If you do not have one, contact your local dealer.

For Managers ... more and deeper information (Info Mode)

Take a few minutes to read first the section **User Mode**. It is the base for the next section.
In the "Info Mode" you have all the relevant DFM-System information at a glance.

1. From the **User Mode** go with the ▲ up arrow or ▼ down arrow to the Info screen and press OK.
   After you entered the "Info Mode", the
2. **ESC** key has always the same function: it brings you back one step (to the Info Mode).
3. ▲**up arrow** brings you to the previous screen or to the line above
4. ▼**down arrow** brings you to the next screen or to the next line

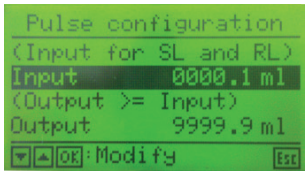
In the following sections, the **ESC** key, ▲**up arrow** and the ▼**down arrow** will no further be described.

Entering the Info Mode

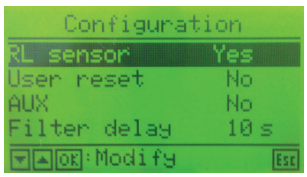
Press OK to enter the Info mode

Be aware: NO changes are possible in the Info Mode. This is just intended for Information.

Configuration (Information about Input / Output Value, RL flow meter, User Reset)



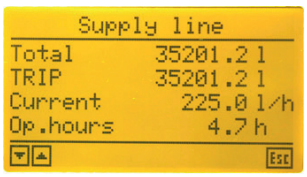
Input: value of the incoming signal in ml/pulse
Output: value of the outgoing signal. This value shall be higher than the "Input Value"



RL sensor (flow meter): is a Return Line flow meter installed? (Yes / No)
User reset: it is allowed for the user to do a reset? (Yes / No)
Aux: communication line to an external device (e.g, Fleet Manager, GPS-Tracking system)
Filter delay: shows the Filter delay value used to stabilize the current consumption (value between 1 and 99).
Be aware: the Return Line flow meter **must** be the same like the Supply Line flow meter

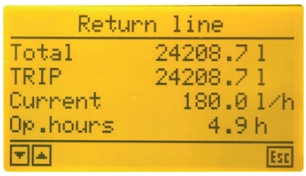
Is the Display inverted? (Yes or No)
(Standard: bright display and dark text)

Supply Line (information about Total, TRIP, Current l/h, Op. Hours)



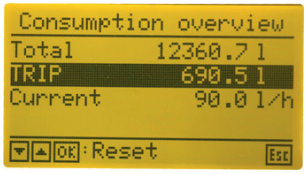
Total: amount of liter that has flow through this flow meter since commissioning
TRIP: amount of liter since the last reset (it functions like a daily counter)
Current: actually flow rate in l/h
Op. hours: operating hours of the flow meter since commissioning

Return Line (information about Total, TRIP, Current l/h, Op. Hours)



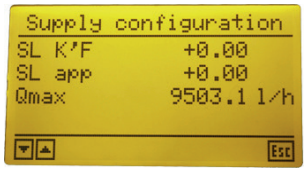
Total: amount of liter that has flow through this flow meter since commissioning
TRIP: amount of liter since the last reset (it functions like a daily counter)
Current: actually flow rate in l/h
Op. hours: operating hours of the flow meter since commissioning

Consumption Overview (results from Supply Line minus Return Line)



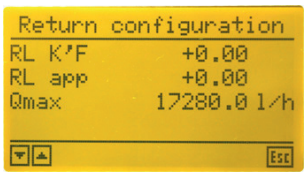
Total: Engine consumption since the commission.
TRIP: Engine consumption since the last reset.
Current: Current engine consumption.

Supply Configuration



SL K'F: Optimization value for best flow meter performance.
SL app: Optimization value for best application performance.
Qmax: : This value shows the peak flow rate ever measured in the supply line.

Return Configuration



RL K'F: Optimization value for best flow meter performance.
RL app: Optimization value for best application performance (typical: fuel temp, etc.)
Qmax: This value shows the peak flow rate ever measured in the supply line.

Error Log Entry
The DFM-BC is able to catch different flow meters conditions, to compare it with stored values and to decide if an error occurred or not. If an error occurred, it will be showed on the display and stored in an Error Log for later reviewing. This information will help you resolving complex situation. If the Error Log is full, the oldest entry will be deleted.

This screen shows you, when the last error messages was recorded.

Press OK to enter the Error Log

Error Log
This screen shows you, with data and time stamp, the last stored Error Messages in a readable form.

Press the ▲ ▼ arrows to go through the messages.

Config Log Entry
The DFM-BC has the ability to store all configuration changes. If the Error Log is full, the oldest entry will be deleted.

This screen shows you, when the last configuration change was recorded.

Press OK to enter the Config Log.

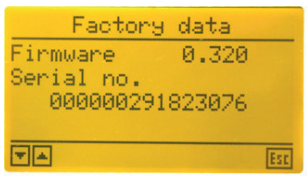
Config Log
This screen shows you, with data and time stamp, the last stored configuration change in a readable way.

Press the ▲ ▼ arrows to go through the messages.

Clock

This screen shows you the date and time.

Factory Data



This screen shows you the firmware version and the serial number of the DFM-BC, which can/will change over the time.

For Service People ... parameter setting (Service Mode)

In this section we assume that the service engineer is familiar with the differential measurement technique and also knows the previous sections. In the Service Mode mode you have unrestricted access to all vital parameter. Please be careful in changing parameter. Inadequate parameter settings can lead to incorrect function and calculations.

A good way to avoid mistakes is to write down the parameters before you change it.

1. From the User Mode go with the ▲ arrow or ▼arrow to the Service screen and press OK. After you entered the Service mode, the
2. ESC key
   a. brings you back one step or
   b. brings you back one digit (one position).

3. OK key
   a. Means Modify, Show, Store, Reset, Yes, Next. All this are described on the display of the Board Computer (DFM-BC)
4. ▲arrow key
   a. brings you to the previews screen or to the line above or
   b. it is used to change values (increment).
5. ▼arrow key
   a. brings you to the next screen or to the line below or
   b. it is used to change values (decrement).

In the following sections, the OK key, ESC key, ▲arrow and the ▼arrow will no more be described.

Entering the Service Mode

Press OK to enter the Service mode

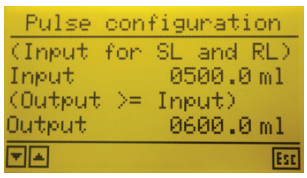
Entry Code
After entering the Service Mode, a code is requested

Enter the 4 digit code and press OK

Use the arrow key to change values.

- The standard service code is: 1111.
- If you enter the wrong code, you will be redirected back to the first digit.
- If you change the Entry Code store it in a safe place. Without Entry Code you have no access to the service mode.
- If you loose your Entry Code you MUST send the DFM-BC to the factory for resetting it to its default value (see Return of Instruments).

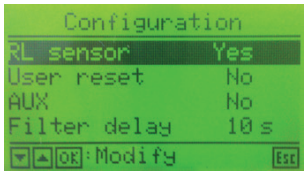
Configuration (Flow meter Type, Return Line Flow meter, User Reset, AUX)
Move the bar over the line you would like to change parameters. Press OK. The changeable field will be highlighted for changing. Make your changes and press OK to accept. If there are security questions, answer it with YES or NO.



Input value: enter the value of the signal (ml/pulse) which is coming from the flow meter used (see table). This value is used also for the second flow meter (if installed).

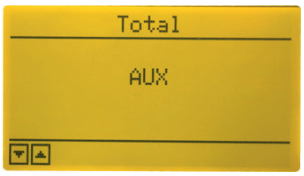
Flow meter Type	Input Value
DFM-20S	36 ml
DFM-25S	100 ml

Output Value: enter the value of the outgoing pulse (value between 1-9'999 ml/pulse.
Remember: the "Output Value" shall not be lower than the "Input Value".



RL flow meter: Is a Return flow meter installed? Answer this question according to the measurement you use (differential measurement or direct measurement) Attention: incorrect setting of this parameter will result in wrong consumption calculation.
User Reset: Is the user allowed to reset the TRIP? Choose between YES or NO.
AUX: If you answer with YES, the calculating consumption will be send to the auxiliary port according to the value set by "Output" on the window "Pulse configuration". This is needed for Fleet Manager or GPS Tracking Systems. The outgoin signal is a passive pulse

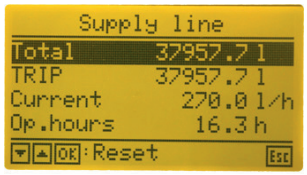
and the screen of the DFM-BC will only show the word AUX



Filter delay: enter a value from 1 to 99. This allows you to decide how strong the stabilizing of the current consumption should be. Use this feature if the current consumption is jumping from low to high values.

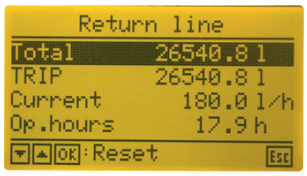
Switch between 2 modes:
- dark background and bright text (Yes)
- bright background und dark text (No)

Supply Line (Total, TRIP, Current)
Move the bar over the line you would like to change parameters. Press OK. The changeable field will be highlighted for changing. Make your changes and press OK to accept. If there are security questions, answer it with YES or NO.



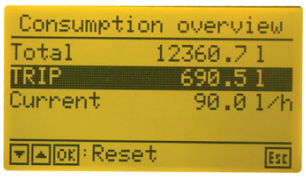
Total: Reset of the total amount of the fuel which has passed through the supply line since commissioning. This value should only be reset in case the flow meter was changed.
TRIP: Reset of the total amount of the fuel which has passed through the supply line since the last reset.
Current: No function will be activated.
Op. hours: Reset of the total amount of working hours of the supply line flow meter since commissioning. This value must be reset in case the flow meter was changed..

Return Line (Total, TRIP, Current)
Move the bar over the line you would like to change parameters. Press OK. The changeable field will be highlighted for changing. Make your changes and press OK to accept. If there are security questions, answer it with YES or NO.



Total: Reset the total amount of the fuel which has passed through the return line since commissioning. This value must be reset in case the flow meter was changed.
TRIP: Reset the total amount of the fuel which has passed through the return line since the last reset.
Current: No function will be activated.
Op. hours: Reset of the total amount of working hours of the return line flow meter since commissioning. This value must be reset in case the flow meter was changed.

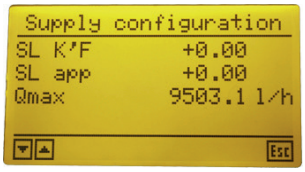
Consumption Overview (Total, TRIP, Consumption)



The only thing you can change is the TRIP. Press OK to reset this value. This action will be followed by security questions. Answer the question with YES or NO until the value will be changed.

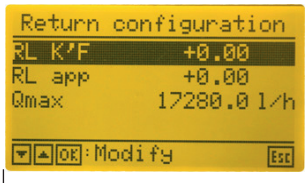
The Current shows you the calculated difference between the supply line and the return line, the Total shows you the total consumption.

Supply Configuration (SL KF, SL app, Qmax)
Move the bar over the line you would like to change parameters. Press OK. The changeable field will be highlighted for changing. Make your changes and press OK to accept. If there are security questions, answer it with YES or NO.



SL KF: Enter the SL K'F-value which you will find on the type plate of the flow meter. This value is to optimize the flow meter performance.
SL app: Put in a % value for a possible application correction. For more information go to the section "High Performance Results"
Qmax: This value shows the peak flow rate ever measured in the return line.

Return Configuration (RL KF, RL app, Qmax)
Move the bar over the line you would like to change parameters. Press OK. The changeable field will be highlighted for changing. Make your changes and press OK to accept. If there are security questions, answer it with YES or NO.

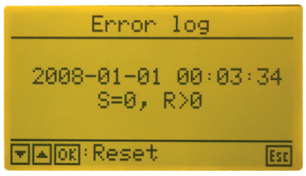


RL cal: Enter the RL K'F-value which you will find on the type plate of the flow meter. This value is to optimize the flow meter performance.
RL app: Put in a % value for a possible application correction. For more information go to the section "High Performance Results"
Qmax: This value shows the peak flow rate ever measured in the return line.

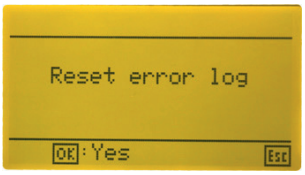
Error Log Entry

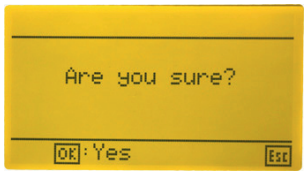
Press OK to enter the error log

Read the stored Error Messages (Error Log)



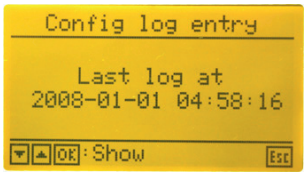
With the ▲arrow and the ▼arrow you can scroll through the messages
Each message has a date and time stamp. After the last message is reached the first message will be shown.
The message consist in a short word-explanation about what error has happened.
For more information about Error Messages see section “Description of the Error Messages”
Reset: To reset the Error Log press the OK key. This will lead you to the next 2 security questions.





Those two security questions avoid an accidentally deleting of the log
Be aware: after the reset action is done, the error log is empty. No recovery is possible

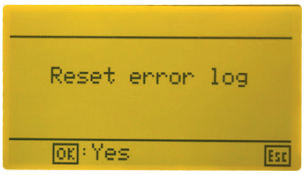
Config Log Entry

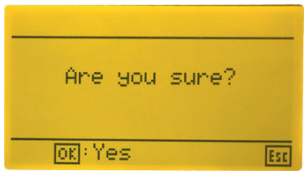


Press OK to enter the Config log

Read the stored Config Messages (Config Log)

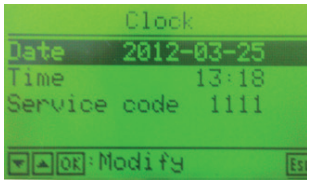
With the ▲arrow and the ▼arrow you can scroll through the messages
Each message has a date and time stamp. After the last message is reached the first message will be shown.
The message consist in a short word-explanation about what error has happened.
Reset: To reset the Config Log press the OK key. This will lead you to the next 2 security questions.





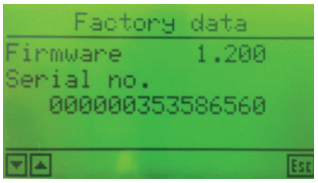
Those two security questions avoid an accidental deleting of the log
Be aware: after the reset action is done, the error log is empty. No recovery is possible

Clock



Move the bar over the line you would like to change parameters and press OK. The changeable field will be highlighted for changing.
With the▲arrow and the ▼arrow you can change the selected value
With the <OK> key and the <ESC> key you can move from right to left to right.

Factory data



No changes are possible. The displayed information is needed for updates or internal use.

Error condition

Error Messages

If an error has occurred and it has consequence for the following digital readouts

Total or TRIP or the Consumption

than the Board Computer (DFM-BC) will show the following on the display:

...and after 5 seconds...

The DFM-BC will show an empty display until the correct results are available. There is no need for actions.

Description of the Error Messages

In any case, if an error occured look at the Error Log to define what exactly happened and at what time.
To check the installation is also a recommended approach for finding faults.
The following messages will be displayed if an error occurs:

S>0 &R=0
Supply line flow meter has a flow rate. Return line flow meter has no flow rate.
Possible causes:
- Leak on the return line before it enters the flow meter.
- Was the connection on the return line unscrewed? Why? Set it tight.
- Check for loose connections of wires.
- Return Line flow meter blocked.

S=0 & R>0
Supply line flow meter has no flow rate. Return line flow meter has a flow rate.
Possible causes:
- Leak on the supply line before it enters the flow meter.
- Was the connection on the return line unscrewed? Why? Set it tight.
- Check for loose connections of wires.
- Supply Line flow meter blocked.

S>0 & R>0 & S<R
Supply line flow meter has a flow rate. Return line flow meter has a flow rate. But the Supply line flow meter flow rate is smaller than Return Line flow meter flow rate.
Possible causes:
- Leak on the supply line before it enter the flow meter.
- Was the connection on the supply line unscrewed? Why? Set it tight.
- Check the temperature difference between the 2 lines. Remember: 10 °C of temperature difference mean an volume increase of 0.8 %.
- Check for loose connections of wires.
- Supply Line flow meter blocked.

S<0
Supply line flow meter has no flow rate.
Possible causes:
- Leak on the supply line before it enters the flow meter.
- Was the connection on the supply line unscrewed? Why? Set it tight.
- Check for loose connections of wires.
- Supply Line flow meter blocked.

R<0
Return line flow meter has no flow rate.
Possible causes:
- Leak on the return line before it enters the flow meter.
- Was the connection on the return line unscrewed? Why? Set it tight.
- Check for loose connections of wires.
- Return Line flow meter blocked.

If you have no success in finding out the reason of the fault, please call your local supplier.

High Performance Results
(with application optimization)

High Performance Results means, to adapt the system to the different condition you can face during your daily work. This can be:

1. High ambient temperatures.
2. Low ambient temperatures.
3. Different temperatures between supply line and return line of the fuel system.
4. Something else...?

To avoid the influence of all the mentioned conditions listed above, the Board Computer allows you the unique possibility to optimize your application. It is an application optimization because the CONTOIL® DFM System it-self works perfect but the condition around it changes. To take care of this situation you can adjust the calculation according to your experience on the field.

Let's look at an example:

The temperature of the return line fuel is 10 °C higher than the temperature of the supply line fuel. This temperature difference cause a volume increase of about 0.8 % on the return line.

Note: all 10 °C the volume of the fuel will increase for approximately 0.8 %. This statement is based on a large experience of the developer of the CONTOIL® DFM.

To compensate this fact, enter on the RL app parameter the value -0.8 %. From now on the calculated flow on the return line will be -0.8 % reduced. This reduced flow will be used for the consumption calculation. The same you can do with the SL app.

How to enter this parameter?

Go to the section "For Service People … parameter settings" enter the sub-section "Return Configuration" and change the "RL app" or the "SL app".

What to do if there is a malfunction?

No Display on the Board Computer (DFM-BC)

1. The Board Computer (DFM-BC) has a sleep mode. Press any key the wake it up. It is ok? If not go to the check list below.
2. Check the following:
   a. Has the vehicle battery min. 12 VDC?
   b. Power connections from the vehicle battery to the Board Computer (DFM-BC). Do you have min.12 VDC? If not the check the connection for wire interrupts.
   c. Are the wires from the vehicle battery connected to the Board Computer (DFM-BC) (pin 13 (battery plus) and pin 14 (battery minus) of the connector inside the case)?
   d. If the display is still not working, disconnect all wires except the ones from pin 13 (battery plus) and pin 14 (battery minus).
      i. It works!
      The problem may be by an incorrect connection of the wires from the flow meter or from the auxiliary device.
      ii. It still does not work!
      Contact your local dealer for more information.

The Board Computer (DFM-BC) is running, but no value from the flow meters

1. Check the following:
   a. Are the flow meters connected to the Board Computer?
   b. Check the voltage on the Board Computer for the flow meters (pin 1 and/or 7). It must be at least 12 VDC. See also section "Electrical connections and specifications".

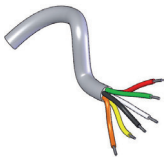
After Installation, an <Error> is displayed.

1. Check the following:
   a. Are the DFM flow meter mounted the right way (look for the direction arrows on the flow meters).
   b. Look at the Error Log and try to find out the solution with the description of the Error Messages.

Electrical Connections and Specifications

For the DFM-8D

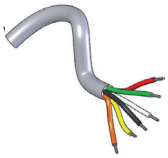
Explanation of the wires:



White	Input voltage 12-24 VDC from the DFM-BC or from another source. If you use another source, make sure the and filtered (that means,always between 12VDC and max. 28VDC, noise free)
Brown	Ground (take the same ground like the 12-24 VDC source).
Green	“Supply Line ” (SL). On this line a signal is send only if the rotary piston is rotated the correct way.
Yellow	“ReturnLine” (RL). On this line a signal is send only if the rotary piston is rotated the correct way.

For the DFM 20S / 25S

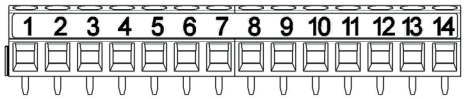
Explanation of the wires:



White	Input voltage 12-24 VDC from the DFM-BC or from another source. If you use another source, make sure the and filtered (that means, always between 12VDC and max. 28VDC, noise free)
Brown	Ground (take the same ground like the 12-24 VDC source).
Green	“Supply Line ” (SL). On this line a signal is send only if the rotary piston is rotated the correct way.
Yellow	Not used for this flow meter

Attention:
the signal is a pull down transistor, that means, whenever a signal should be generated, this line will go to ground (Open Drain).

For the DFM-BC



Explanation of the wires:

Pin 1:	Power supply for the flow meter. This connection is used to feed the following flow meters: DFM-8D, DFM-20S, DFM-25S or others.
Pin 2:	Ground for the flow meter. This connection is used as ground for the following flow meters: DFM-8D, DFM-20S, DFM-25S and others.
Pin 3:	Input for Supply Line (SL). This connection is used for the DFM-8D, DFM-20S, DFM-25S and other.
Pin 4:	Not used
Pin 5:	Input for Return Line (RL). This connection is used exclusively. for the DFM-8D.
Pin 6:	Not used
Pin 7:	Power supply for the second flow meter. This connection is used to feed the following flow meters: DFM-20S, DFM-25S and others. Use this connection for the Return-Line flow meter.
Pin 8:	Ground for the second flow meter. This connection is used as ground for the following flow meters: DFM-20S, DFM-25S and others. Use this connection for the Return-Line flow meter.
Pin 9:	Input for Return Line (RL). This connection is used for the following flow meters: DFM-20S, DFM-25S and others. Use this connection for the Return-Line flow meter.
Pin 10:	Not used
Pin 11:	Signal for the external device Connect the cable from the Fleet-Manager or GPS-Tracking-System. Attention: the signal is a pull down transistor, that means, whenever a signal should be generated, this line will go to ground (Open Drain).
Pin 12:	Ground for the external device. Connect here the ground cable from the Fleet-Manager or GPS-Tracking-System.
Pin 13:	Plus Power Supply connection from the vehicle battery (12-24 VDC)
Pin 14:	Minus Power Supply connection from the vehicle battery

Flow Meter	l/pulse (ml/pulse)	Hz (max)	Pulse interval (min.)	Pulse width	mA (max)	VDC (Nominal)
Double flow meter DFM 8D	0.0125 (12.44)	15	46 ms	20 ms	10	12-24
Single flow meter DFM 20S	0.036 (36)	15	46 ms	20 ms	10	12-24
Single flow meter DFM 25S	0.100 (100)	15	46 ms	20 ms	10	12-24

Explanation of the power on the DFM-BC pins:

Pin number	VDC	mA max
1 (+)	12-24	10
2 (-)	GND	
7 (+)	12-24	10
8 (-)	GND	

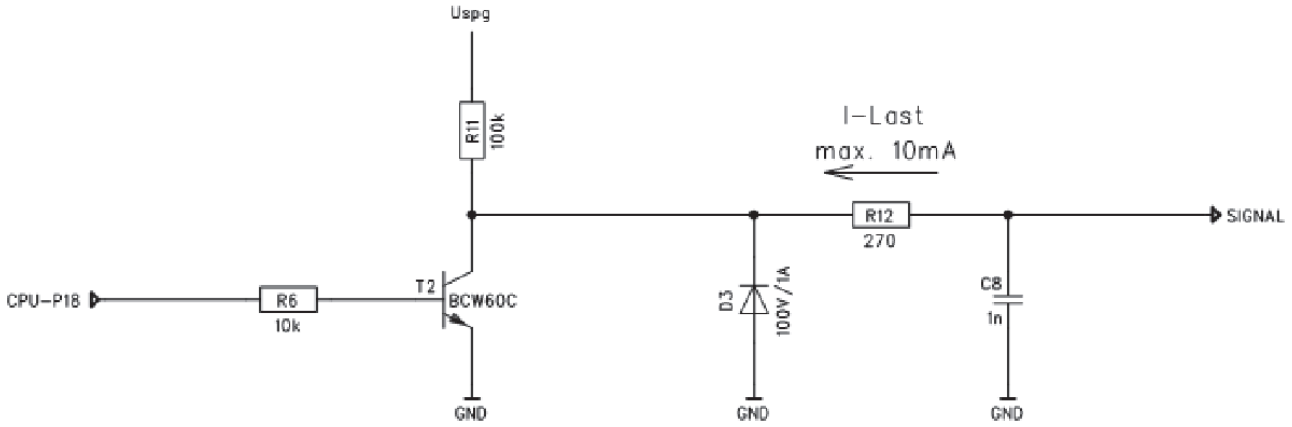
Connection of non Aquametro flow meters

	Pin number		
Flow meter 1	2	GND	Connection for the “supply line” flow meter or for the flow meter for direct consumption measurement
	3	+	
Flow meter 2	8	GND	Connection for the “return line” flow meter only if you have a differential consumption measurement
	9	+	

Connection of the output signal

	Pin number		
External device	11	+	Connection of pulse output to other external device (Fleet Manager oder GPS-Tracking System)
	12	GND	

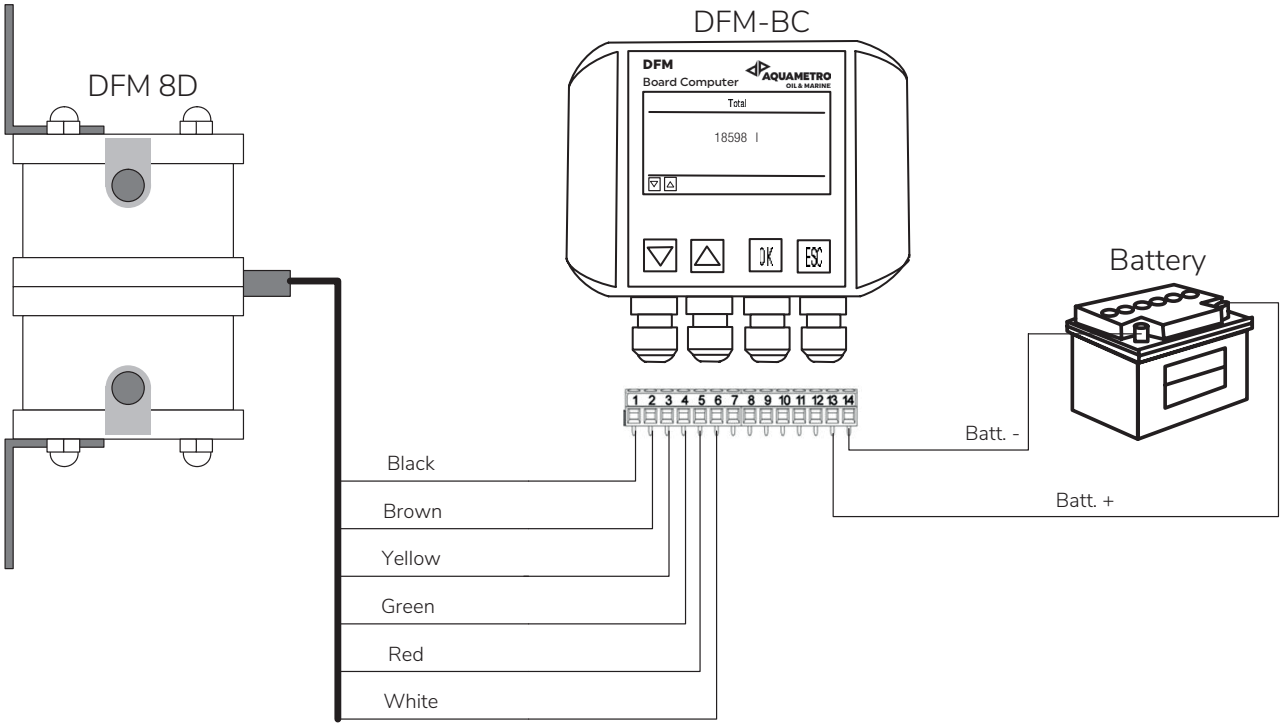
Electrical scheme of the DFM signal



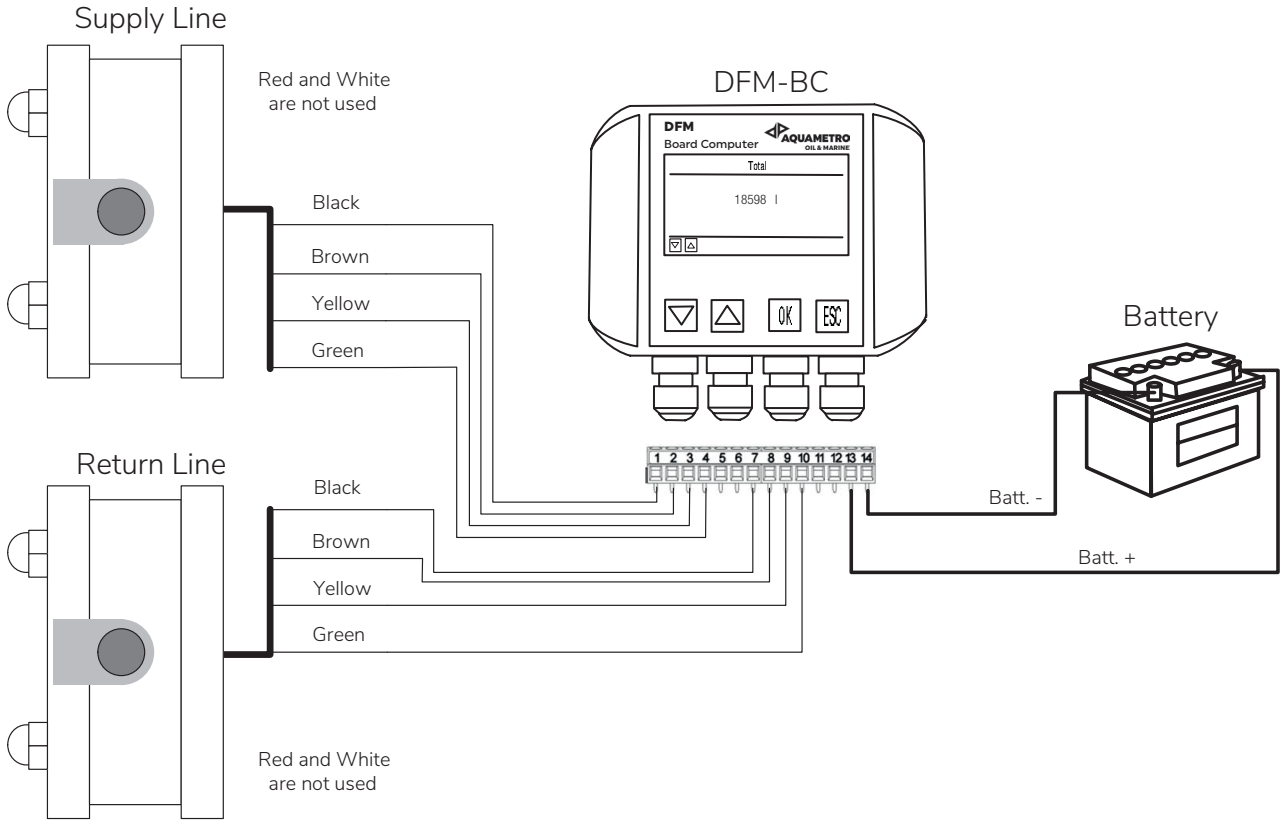
If you do not use the Board Computer (DFM-BC), please look at **your Fuel Counter Manual** you have purchased for a correct connection of the DFM- flow meter wires.

Electrical scheme of the DFM Systems

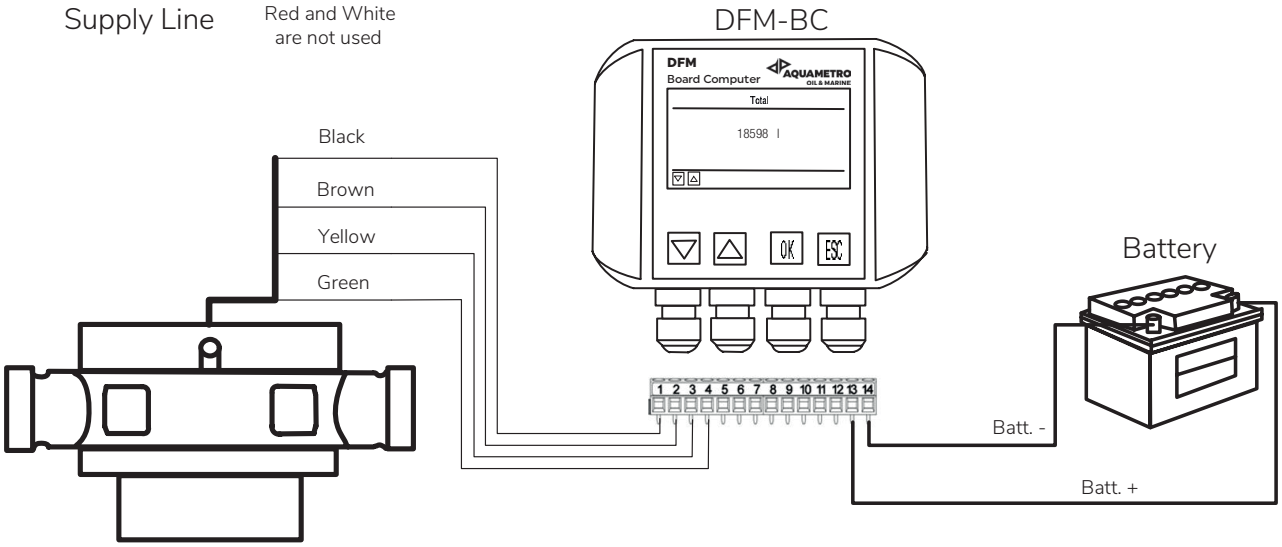
DFM-BC to DFM 8D



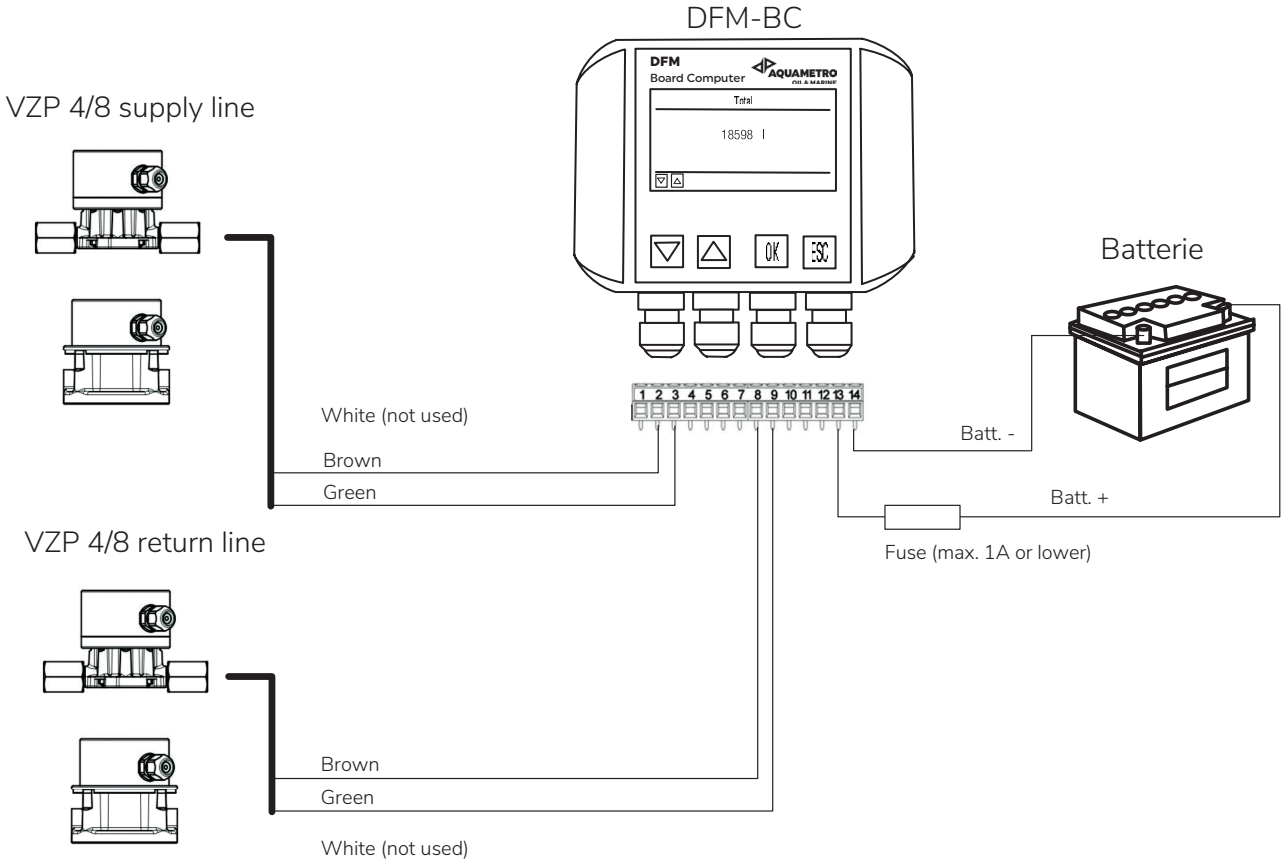
DFM-BC to DFM 20S / 25S for differential consumption



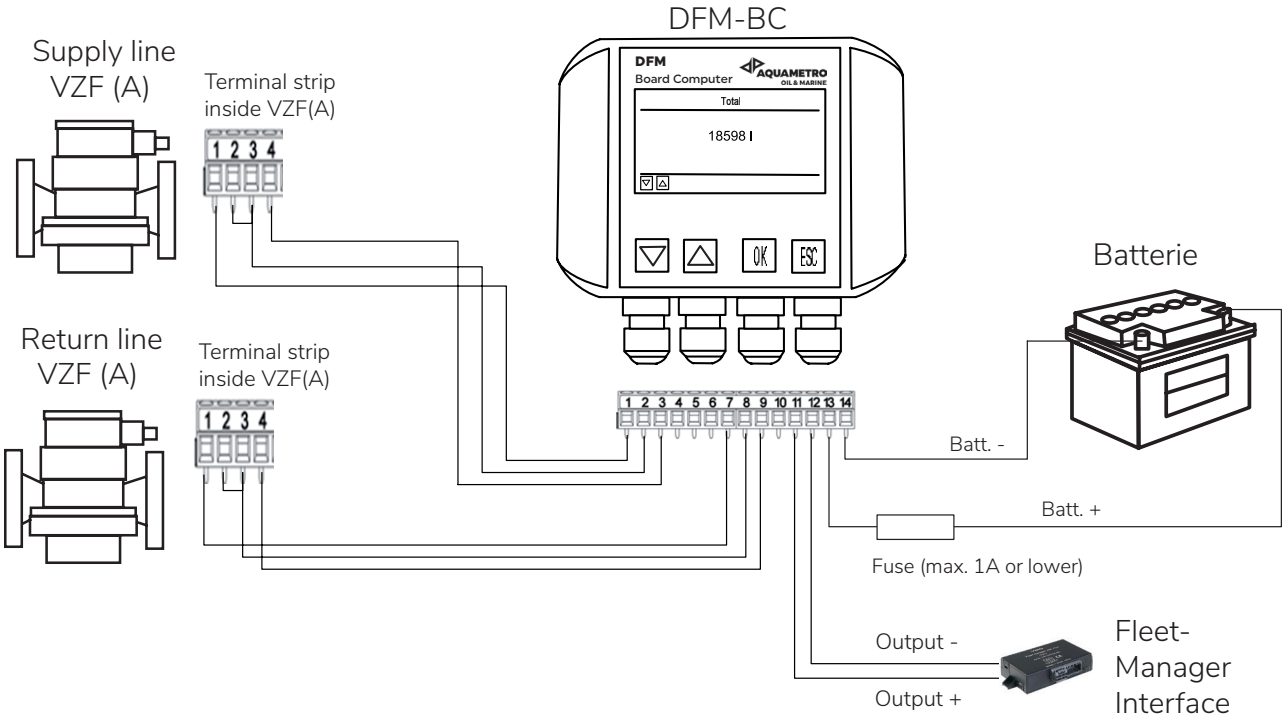
DFM-BC to DFM 20S / 25S for direct consumption



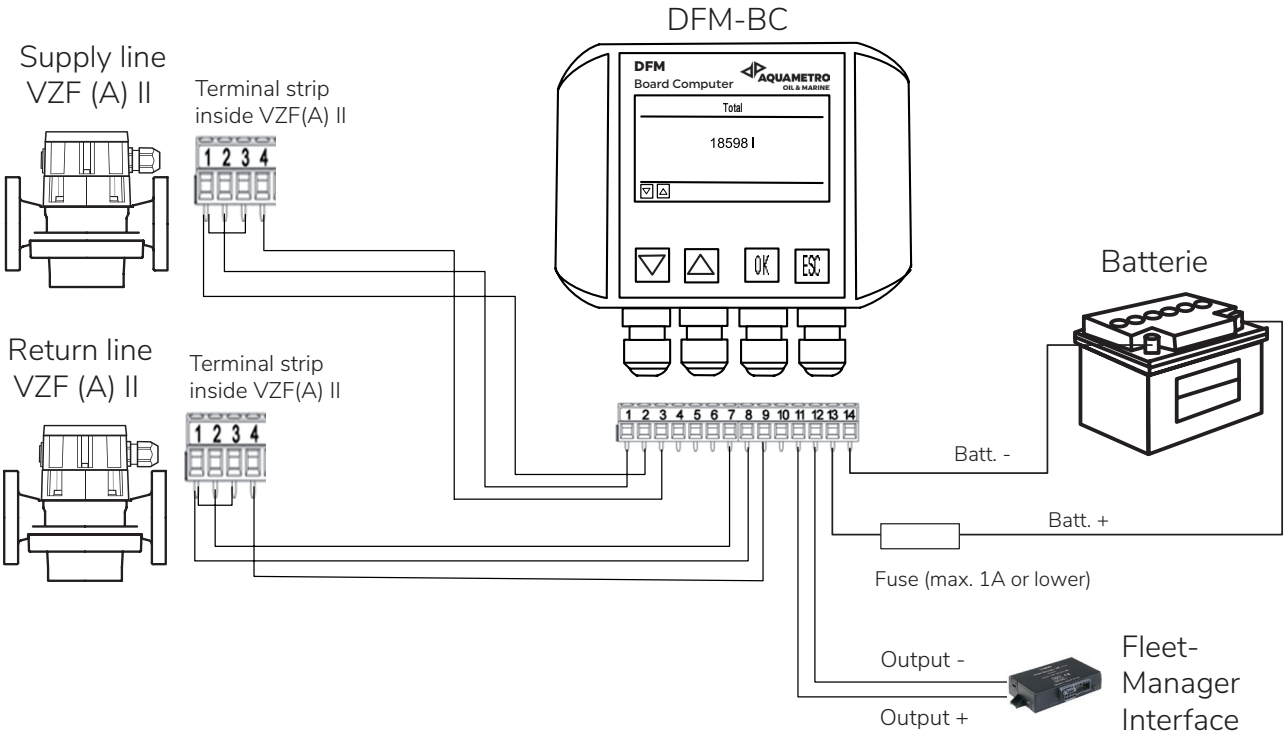
DFM-BC to VZF(A) for differential consumption



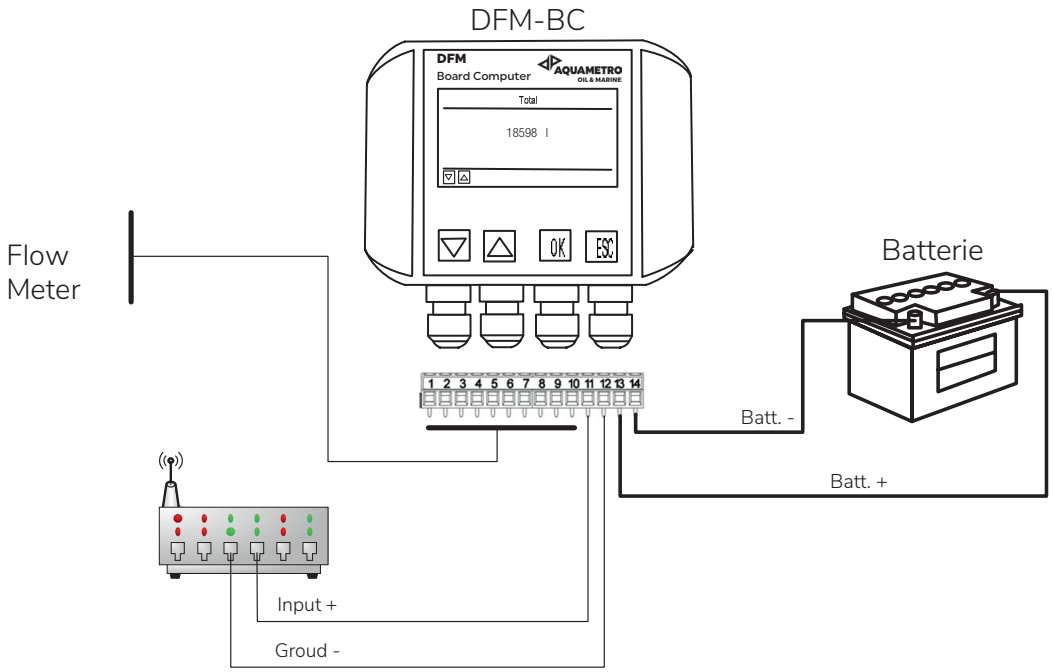
DFM-BC to VZF(A) for differential consumption



DFM-BC to VZF(A) II for differential consumption



DFM-BC to Fleet Manager or GPS-Tracking System



Specification and Technical Data

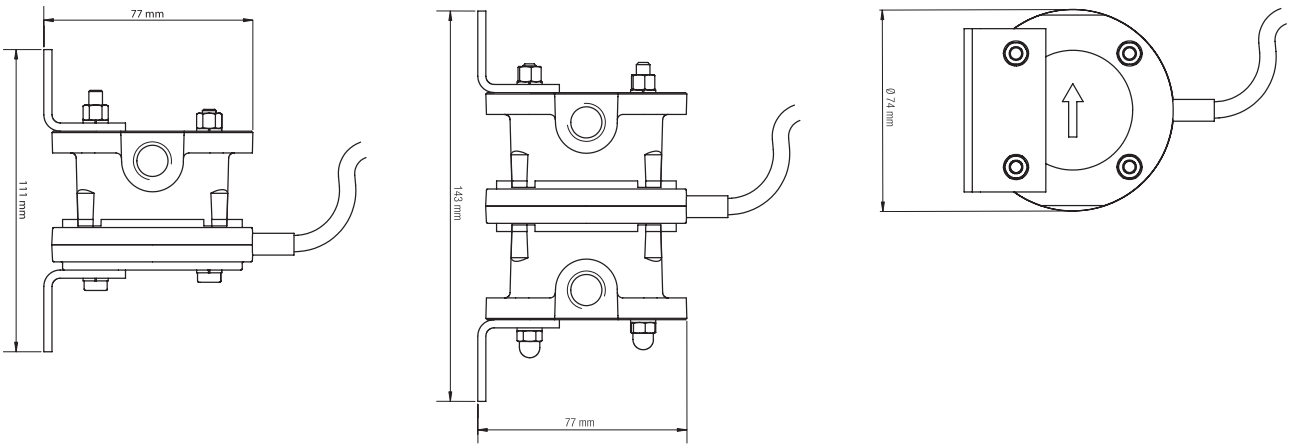
Flow meters		DN 8	DN 20	DN 25
Max supply flow rate Qn	l/h	200	1000	2000
Max. engine consumption approx.	l/h	100	600	1200
Min. flow rate at measuring point approx.	l/h	10	40	75
Max. operating pressure	bar	16	16	16
Approx. pressure drop at Qn	mbar	150	150	150
Max. measuring error per sensor	%	±1	±1	±1
repeatability	%	±0.2	±0.1	±0.1
Operating temperature	° C	-20...+80	-20...+80	-20...+80
Ambient temperature 2)	° C	-40...+125	-40...+125	-40...+125
Max. filter mesh size	mm	0.100	0.100	0.250
Protection class according to IEC 60529		IP 66	IP 66	IP 66
Hydraulic connections		M14x1.5mm	G 1”	G 1 ¼”
Recommended connectors:	size	M14x1.5mm	G 3/4”	G 1”
	part number	80447	81192	81151
Cable 6 x 0.5 mm2, outer dia. 6.2 mm, length 7.5 m		included	included	included
Safety: Vehicle approved for vibration, shock and electrical immision and emission.		yes	yes	yes

2) Within this temperature the sensor will not be damaged, but the proper operation is not guaranteed.

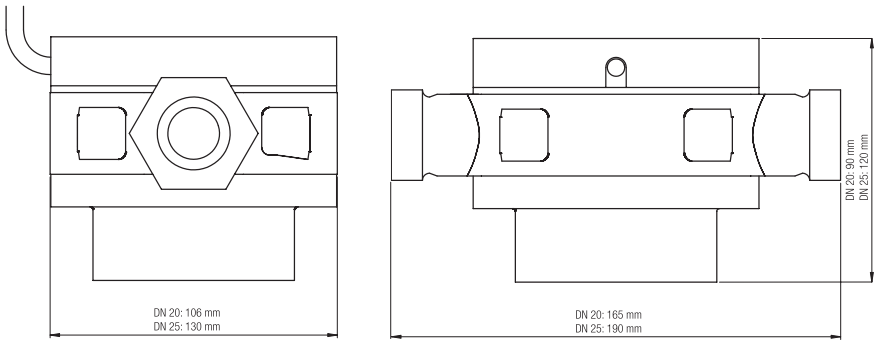
Board Computer	
Power supply	12…24 VDC direct from vehicle battery
Registration	100.000.000 litres
Scale value	Default for DN 8 = 80 pulses per liter
Temperature	Ambient –10 ... +70 °C,
Protection class	IP 54 according to IEC 60529
Electrical connection	Power supply with cable 2 x 0.75 mm², 2 m supplied Cable outer diameter 5.0 mm

Dimensions

Flow meter DFM 8D

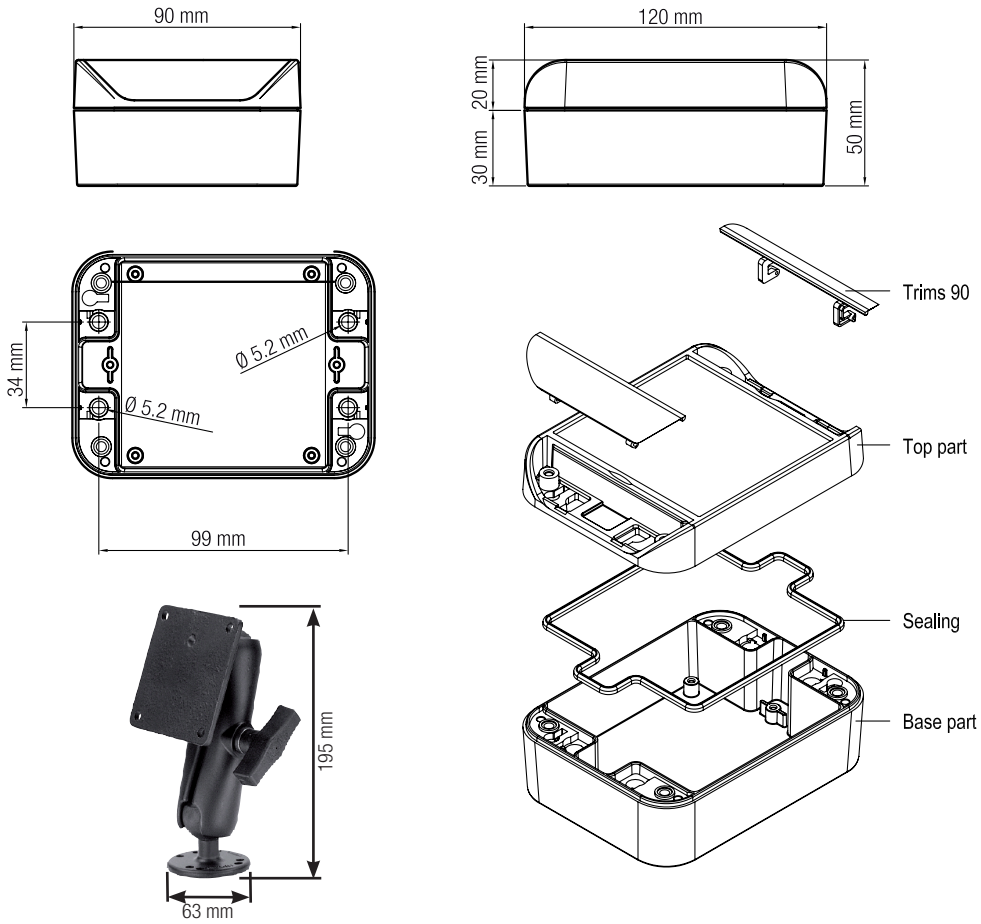


Flow meters DFM 20S and DFM 25S



Type	L	B	a	Ø F	b	h1	p	r
DN20	165	105	260	105	54	74	G 1”	G 3/4”
DN25	190	130	305	115	77	101	G 1 1/4”	G 1”

DFM-BC



Ordering Information

Description	Type	Part. no.
Diesel fuel flow meter DN 8D (double)	DFM8D	94465
Diesel fuel flow meter DN 20S (single)	DFM20S	94466
Diesel fuel flow meter DN 25S (single)	DFM25S	94467
Board Computer	DFMBC	95344
Hose Connector for DN 8 (M14 x 1.5mm)	DFM8D	80447
Pipe Connector for DN 20	VSR 3/4”	81192
Pipe Connector for DN 25	VSR 1”	81151
Mounting Bracket for DFM-BC		80485

Warranty Information

All Aquametro Oil & Marine AG products are produced under high quality levels and ISO 9001 standards. Every single flow meter is submitted to an accuracy test that is documented in a test protocol. The test benches used for this process are under constant control of the Swiss and the German authorities (METAS and PTB). The electronic products have to pass an individual quality test. Therefore Aquametro Oil & Marine AG guarantees for the Product Quality (perfect material, machining and function) of every delivered product. Further details are specified in our terms of business.

As Aquametro Oil & Marine AG does not have a direct influence to the Installation and Application Quality we cannot take any responsibility for this part.

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