DFM fuel flow meters

INSTRUCTION SHEET

Version 1.0

TECHNOTON

ADVANCED VEHICLE TELEMATICS

Contents

1 General

This instruction sheet contains recommendations regarding the efficient and uninterrupted operation of DFM fuel flow meters during their service as components of a fuel monitoring system.

Mounting and initial configuration of DFM flow meters are carried out by the installer personnel which is to draw up the following documents in 2 copies:

- Act of the Vehicle (monitored facility) inspection (see the example in annex A).
- Act of the DFM installation performed (supplemented with the flow meter installation diagram and a description of particularities of the Vehicle (monitored facility) equipped)) (see the example in annex B).
- Protocol of measurement accuracy check (see the example in annex C).

The Acts signed by both Parties are further on kept at the installer company and in the Customer company that employs DFM.

For successful operation of the fuel monitoring system incorporating DFM, the head of the Customer company is to **designate a responsible person** selected from the engineering personnel.

The responsible person must:

- control the correct flow meters use;
- take the flow meters readings;
- carry out the flow meters inspection, configuration, diagnostics and troubleshooting.

In the process of DFM fuel flow meters operation, we recommend to carry out their maintenance regularly, at least, as often as the Vehicle (fuel consumer) seasonal maintenance. More often maintenance of DFM is welcomed.

The flow meters maintenance is to be conducted by the certified personnel which has undergone training at the Manufacturer company including methods of DFM configuration, use and diagnostics.

Before starting to use DFM fuel flow meters, the responsible person of the Customer company that employs DFM is highly recommended to study the document "DFM fuel flow meters. Operation manual" and strictly follow the Manufacturer recommendations contained in it!

2 Taking readings

1) <u>Taking readings in the online mode</u>

The user can take readings of the DFM fuel flow meter with the help of the monitoring system (Telematics system) analytic software in the form of: numeric values, tables, graphs.
The volume of data obtained and the list of monitored parameters depend on the design of a specific Telematics system, on the specific model of DFM flow meter, on the Telematics terminal and the capabilities of the analytic software.

Indications of DFM fuel flow meters can be generated in the form of:

- User reports in which data on the actual fuel consumption and the Vehicle (monitored facility) operation time are presented in the convenient form — summarized and separately for "Idle", "Optimal", "Overload" "Tampering" and "Interference" fuel consumption modes.
- Diagnostics reports in which data on the DFM operability, cases of interference into the flow meter operation and incorrect data due to any Vehicle (monitored facility) or Telematics equipment malfunction are presented.

2) <u>Taking readings in the offline mode</u>

The user can take DFM fuel flow meter readings directly from the DFM display (for models DFM B/ C/CK/C232/C485/CCAN/CD) or from the external display (e.g. DFM i fuel consumption indicator (for models DFM AP/AK/DK) or Master CAN Display 35 CAN j1939/S6 Display (for models DFM CAN)) (see figure 1).

- Readings are taken visually by the responsible person; the readings taken are entered into the fuel consumption worksheet.
- The head of the Customer company establishes the schedule for taking readings, depending on the system of fuel accounting adopted at a particular company. As a rule, DFM readings are taken at the beginning and at the end of the working day (shift, week, month).

a) DFM i fuel consumption indicator *b) Master CAN Display 35 CAN j1939/S6 Display*

Figure 1 — Recommended external displays for DFM fuel flow meters

3 Maintenance

1) Daily (each shift) maintenance of the flow meter

Is exercised by means of the DFM inspection on the equipped Vehicle (monitored facility) itself (e.g. during the Vehicle inspection for operation permit) and includes the following operations:

- Visual DFM examination for any signs of the casing damage, presence of any permanent magnets and other foreign objects close to the flow meter mounting location.
- Checking that the inbuilt display and LED indicators are in order.
- Checking the seals, their presence and integrity.
- Checking the reliability of the flow meter mounting.
- Visual inspection for any signs of unauthorized connection to the fuel system.
- Visual inspection of hermeticity of the fuel lines connection.
- Checking the integrity of the signal cable insulation, as well as the state of joining connectors (outside the cabin).
- Checking the reliability of electrical connection of wires to the terminal and to the power supply terminals; checking the fuse integrity (in the cabin).

2) Seasonal (planned) maintenance of the flow meter

It is conducted for deeper analysis of the DFM performance, for planning its verification or replacement. Planned maintenance is normally conducted together with the Vehicle (monitored facility) seasonal servicing maintenance. Apart from all operations pertaining to the daily (shift) maintenance, planned maintenance includes the following additional operations:

- Checking the state of the fine filter. It should be washed or replaced, if needed.
- Checking the state of the flow meter internal mud filter (see figure 2). If needed, the mud filter should be washed in the diesel fuel or replaced.

Figure 2 — Exterior view of DFM mud filter

- Checking the charge of the inbuilt battery. The battery check can be performed:
  - on the flow meter display for the models DFM B/ C/CK/C232/C485/CCAN/CD (information screen #10);
  - in Service S6 DFM service software or Service S6 DFM (Android) service mobile application for models DFM AK/A232/A485/ACAN/CK/C232/C485/CCAN/DK/D232/ D485/DCAN (window "Battery FM").
- Checking indications of counters (window "Flowmeter FM") and events ("Events" window), recorded into the internal memory of the following models: DFM AK/A232/A485/ACAN/CK/C232/C485/CCAN/DK/D232/D485/DCAN.

In case any increment of the counter of time in the "Interference" mode is detected, you should take measures to identify individuals among the Customer company personnel who might profit by the unauthorized interference into the flow meter operation.

You must control the indication of the counter “Total fuel consumption. High resolution”. The increment of this counter should not exceed the value of the inter-calibration period of the flow meter measuring chamber.

Re-calibration interval since previous calibration equal to:

- for DFM 50/DFM 100 — 100 000 l;
- for DFM 250 — 250 000 l;
- for DFM 500 — 500 000 l.

In case the increment of the total fuel consumption counter has reached the value that is equal to the inter-calibration period indication, we recommend to conduct the flow meter test, in order to check the measurement error. If the error value exceeds the limit established, or in case it is not acceptable for the Customer company, we recommend to send the DFM to undergo the metrological test at the nearest regional service center (RSC).

Note — To ensure the continuity of the monitoring system operation, in cases the DFM is to be removed for maintenance or verification of measurement, we recommend to have and use a few spare flow meters.
In case spare flow meters are not available, it is possible, upon agreement with the Customer company, to fix temporarily a connector fitting, in order to sustain the fuel system serviceability (see figure 3). In case DFM D is removed, two connector fittings are needed.

Figure 3 — Connector fitting for temporary mounting into the fuel system, instead of DFM fuel flow meter

3) Off-schedule flow meter maintenance

Is conducted only in cases of:

- Complaints from the Customer company regarding the flow meter accuracy of indications.
- Signs of the flow meter incorrect operation.
- Signs of unauthorized interference into the flow meter operation.
- Air presence in the fuel system.

Off-schedule maintenance includes all the operations performed in the course of daily and seasonal flow meter maintenance.
If no signs of the flow meter (fuel system) incorrect operation are revealed, after all the maintenance operations are accomplished, we recommend to conduct the flow meter test aimed at unbiased evaluation of the flow meter serviceability.

4 Monitoring the unit correct operation

1) <u>Monitoring the unit correct operation in the online mode</u>

Conclusions regarding the flow meter serviceability can be drawn on the basis of its readings received in user and diagnostics reports.

At the beginning of the monitoring system operation, we recommend to record fuel consumption indications in different modes of the engine operation.

During the DFM service you should pay special attention to all ungrounded cases of exceeding the average hourly fuel consumption in the "Idle" mode, because they can be signs of unauthorized interference into the flow meter operation, cutting into the fuel line or the engine malfunction. To identify the engine malfunction, you must check filters, injectors and other components of the fuel system.

In case of extremely low/high indications of fuel consumption, you need to check the fuel system for possible penetration of air into the feed and reverse fuel lines.

2) <u>Monitoring the unit correct operation in the offline mode</u>

Is exercised during the installer personnel arrival at the Customer company, in accordance with the established schedule, or in case of the Customer claims.

After the troubleshooting of any possible malfunctions, the following operations are obligatory:

- Replacement of a fuse (in case it is faulty), search and elimination of the cause of its burning.
- Re-sealing the fuel system (see figure 4).

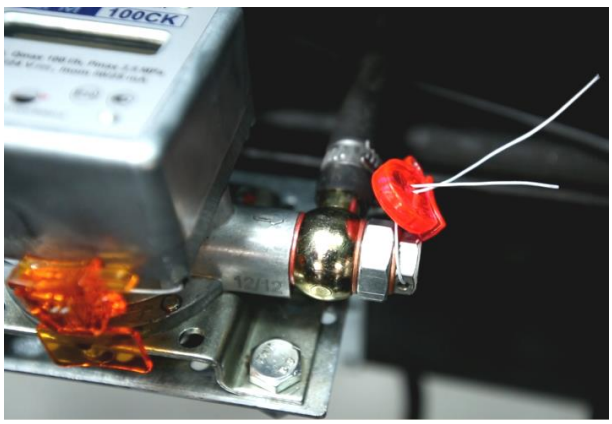

Figure 4 — Example of sealing the location of the fuel line connection to the DFM fuel flow meter

Annex A

Act of the Vehicle (monitored facility) inspection

_____/ _____ /20____
Date Month Year

We, the undersigned representatives of the Customer

_____,

and representatives of the Contractor

_____,

have conducted vehicle (installation) inspection

Machinery unit type _____
Brand, model _____
Registration number _____
for conformity to DFM installation requirements, and have concluded the following:

Requirement	Conforms/ Does not conform	Notes
Leakage resistance of the fuel system		Measurement accuracy and DFM performance is not guaranteed in case of a leakage in the fuel system. Fuel system repair is recommended to eliminate leaks.
Pressure of the fuel supply system		DFM performance is not guaranteed in case of an insufficient pressure in the fuel system. Maintenance of the fuel pump is recommended.
Injectors return flow rate		Injectors return flow being higher than normal can significantly affect measurement accuracy. Injectors maintenance or replacement is recommended.
Onboard voltage		DFM performance is not guaranteed in case of insufficient power supply voltage. Maintenance of the onboard power supply network and/or generator.
Chassis ground switch condition		DFM performance is not guaranteed in case of significant resistance/oxidation ot the switch. Maintenance or replacement is recommended.

Representative of the CUSTOMER:

_____

Name, signature

Representative of the CONTRACTOR:

_____

Name, signature

Annex B

Act of the DFM installation performed

Date of installation		
Customer, company name		
Contact person name		
Telephone, fax, mobile phone		
Contractor, company name		
Installer		
Vehicle	Type	
	Brand, model	
	Registration number	

This Act is to certify that the Contractor has installed the equipment on this vehicle; the following operations have been performed:

Type of Operations	Number	Price	Cost of Work (VAT added)
DFM installation Serial #_____			
Total:			

Additional operations:

Type of Operations	Number	Price	Cost of Work (VAT added)
Down time, hours			
Another visit, hours			
Complicated installation, hours			
Escorting 1, hours			
Total:			

Total sum: _____

Including VAT

_____

The installation operations are performed in due time, no claims regarding the quality of the operations performed, the fuel system is operable, after the installation of DFM is completed.

Representative of the CUSTOMER:

_____

Name, signature

Representative of the CONTRACTOR:

_____

Name, signature

Annex C

Protocol of measurement accuracy check

_____/ _____ /20____
Date Month Year

Vehicle type, model, registration number	
DFM model, serial number	

Fuel consumption	Actual fuel consumption. according to calibrated container V_m, liters	
	Fuel consumption measured According to DFM reading $V_{measured}$, liters	
Relative error of fuel consumption measurement	$\delta = \frac{V_{measured} - V_m}{V_m} \cdot 100\%$	
Actual fuel amount from injectors return line	$V_{inj.return}$, liters	
Proportion of the return flow from the injectors in overall fuel consumption	$\frac{V_{inj.return}}{V_m} \cdot 100\%$	

Resume:

Fuel consumption measurement corresponds /does not correspond to the technical specification.

Comments:

_____

_____

_____

Representative of the CUSTOMER:

_____

Name, signature

Representative of the CONTRACTOR:

_____

Name, signature