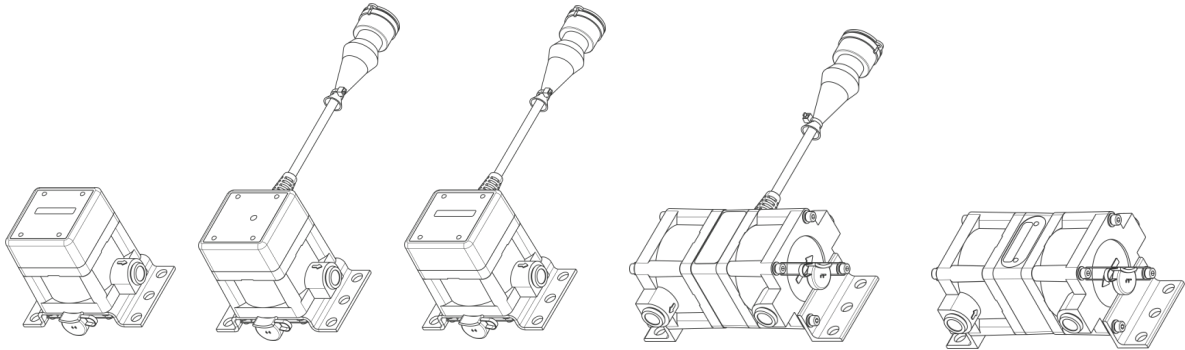




DFM FUEL FLOW METERS



**DFM 50/100/250/500
one-chamber and differential**

**OPERATION MANUAL
(includes Service S6 DFM software manuals)**

Version 6.4

**This document is intended for fuel flow meters
manufactured after 01.01.2016**



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Revision history

Version	Date	Editor	Description of changes
1.0	01.2007		Basic version.
6.2	12.2016	OD	<ul style="list-style-type: none">• Concept of recommended re-calibration interval of DFM is introduced. Re-calibration interval of DFM is defined by volume of fuel went through measuring chamber of DFM (see 1.6.3 and 8).• Description of new version of flow meter available for order is added - DFM 250 HP and DFM 500 HP characterized by higher fuel consumption rate (see Introduction, figure 1).
6.3	01.2017	OD	<ul style="list-style-type: none">• DFM COM data transfer protocol updated (see annex E, table E.5).
6.4	06.2017	OD	<ul style="list-style-type: none">• Clarifications in DFM order identification codes added (see. Introduction, figure 1).• Table of measurement range and accuracy is divided in two separate parts: for one-chamber and for differential flowmeters (see 1.4).• General installation instructions are amended with description of symbols on DFM body for proper installation into fuel lines (see 2.3, figure 20).

Terms and Definitions

ORF 4 — is the Telematics Service by Technoton developed for receiving and processing Onboard Reports via Internet, displaying Operational Data overlapped on area maps, information storage in database and Analytical Reports generation upon user's request.



S6 — is the vehicle onboard data bus developed by **TECHNOTON** to enable integrating the GPS/GLONASS-based vehicle monitoring system into the vehicle electrical equipment. It comprises a set of cables, interfaces and protocols. Physically, it is implemented on the basis of CAN 2.0B (ISO 11898-1:2003) and K-Line (ISO 9141). S6 bus data exchange protocol complies with SAE J1939 International Standard.



To get more details on S6 telematics bus visit <http://s6.jv-technoton.com/en/>

PGN (Parameter Group Number) — is a combined group of S6 parameters, which has common name and number. Functional Modules (FM) of the Unit can have input/output PGNs and setup PGNs.

SPN (Suspect Parameter Number) — informational unit of S6. Each SPN has determined name, number, extension, data type and numerical value. The following types of SPN exist: Parameters, Counters, Events. SPN can have a qualifier which allows qualification of parameter's value (e.g. – Onboard power supply limit/Minimum).

Analytical report — report generated in ORF4 on vehicle or group of vehicles operation for chosen time period (usually a day, week or month). Can be composed of numbers, tables, charts, mapped route of vehicle, diagrams.

Onboard equipment (OE) — Telematics System Elements, directly installed in vehicle.

Onboard Reports (the Reports) — information about vehicle which is returned to a user of Telematics System in accordance with inputted criteria. The Reports are generated by a terminal unit both periodically (Periodic Reports) and on Event occurrence (Event Report).

GNSS (Global Navigation Satellite System) — System for area positioning of an object through satellite signal processing. GNSS is composed of space, ground and user segments. Currently, there are several GNSSs: GPS (USA), GLONASS (Russia), Galileo (EU), Compass (China).

Online monitoring — remote monitoring of location and vehicle operation in real time, the accumulation of information and preparation of Analytical Reports by requests of ORF 4 user.

Parameter — vehicle's characteristics varying over time or in space. E.g. hourly fuel consumption, speed, fuel volume in tank, coordinates. The Parameter is usually depicted as a chart and an average value.

Route — data massive, consisting of coordinates, speed and direction of vehicle's movement. Corresponds to a real route of the vehicle. Depicted as lines on the Map. Direction of vehicle's movement is depicted by arrows.

Server — hardware and software combination of Telematics Service ORF 4, designed for Operation Data processing and storage, also for generation and transfer of Analytical Reports upon User's request.

Event — relatively rare and sudden change in SPN. For example, the attempt to falsify values of "Instant fuel consumption" counter by applying electromagnetic field to fuel flow meter will be recognized as "Interference" Event. An Event can have one or several characteristics. "Interference" Event has the following: date/time and duration of interference. When the Event occurs, a terminal unit registers the time of occurrence, which is later mentioned in a report on the event. Thus, the Event is always attached to exact time and place of occurrence.

Counter — cumulative numerical characteristics of Parameter. Counter is represented by a number, which can only grow in time. Examples of Counters: fuel consumption, engine operation time, total distance and other.

Telematics system — complex solution for real-time and after trip vehicle monitoring and control. Main vehicle parameters monitored: route, fuel consumption, operation time, technical condition of vehicle, safety. Consists of OE, Communication channels, Telematics Service ORF 4.

Vehicle — an object controlled within Telematic system. Usually Vehicle means a truck, tractor or bus, sometimes a locomotive or river boat. From Telematic system point of view, stationary objects are also considered to be vehicles: diesel gensets, stationary tanks, boilers/burners.

Function Module (FM) — unit-embedded component of hardware and software combination, executing a group of special functions. Uses input/output PGNs and settings PGNs.

Unit — an element of Onboard Equipment of Vehicle, which is connected to Telematics Interface S6. Particularly, in this document Unit means DFM fuel flow meter.


Introduction

The Operation Manual contains guidelines and rules which refer to **DFM fuel flow meters** (hereinafter [DFM](#)), developed by JV [Technoton](#), Minsk, Belarus.

The manual contains information on design, operation principle, specifications and instructions on installation, use and maintenance of DFM. The manual provides guidelines on DFM configuration with [Service S6 DFM](#) software (version 1.11 and higher).

 [®] – is a precise tool for fuel consumption measurement. DFM can be as a part of [Telematic System](#) or as stand-alone solution.

DFM features:

- conformity with European and national automotive standards and directives;
- fuel consumption and operation time control – overall and in different engine operation modes;
- protection against unauthorized interference in operation and data “tampering”;
- maximum information richness of output data*;
- high reliability of data transmission over digital interfaces*;
- unique self-diagnostics feature to monitor the stability and accuracy of data*;
- possibility of integration into on-board  [Telematics Interface](#) of vehicles**;
- embedded battery allows data ([Counters](#), [Events](#)) storage in the internal non-volatile memory of flow meter;
- thermal correction function with adjustable coefficient which ensures automatic correction of values to the ambient temperature***;
- easiness of flow meter configuration with S6 SK service kit, which is similar for all Onboard Equipment based on S6 Interface***;
- built-in mud filter;
- minimum fluid flow resistance;
- 100 % of DFM are verified with a certified metrological test rig;
- full set of high-quality elements for installation;
- great operating experience, high-quality technical support, affordable price.

* DFM 232/485/CAN.

** DFM CAN.

*** For DFM with interface cable.

See figure 1 for identification codes for [DFM](#) ordering:

DFM	MAX consumption l/h values of the range: 50, 100, 250, 500		Attribute meaning differential measurement principle: D - differential		Increased accuracy version: Increased measurement accuracy, inaccuracy rate is mentioned	
	X	Y	D	Z**	U***	P***
	Model: A - without display * B - with display C - with display, extended functionality		Electronic interface: K - normalized pulse 232 - digital, interface RS-232 485 - digital, interface RS-485 CAN - digital, interface CAN 2.0B		Version by performance: HP - increased maximum consumption (flow) rate per chamber 350 l/h (for DFM 250D) 600 l/h (for DFM 500D)	

Figure 1 — DFM order identification codes

Example of DFM order identification codes:

“Fuel flow meter DFM 50B”

(max. flow rate 50 l/h, model - autonomous with display)

“Fuel flow meter DFM 250 AK, 0.5 %”

(max. flow rate 250 l/h, model - without display, output interface – normalized pulse, increased measurement accuracy, inaccuracy is $\pm 0.5\%$)

“Fuel flow meter DFM 500DK HP”

(max. flow rate 600 l/h, model - differential without display, output interface – normalized pulse, higher maximum consumption rate)

“Fuel flow meter DFM 500CD”

(max. flow rate 500 l/h, model - differential autonomous with display)

“Fuel flow meter DFM 500CCAN”

(max. flow rate 500 l/h, model - differential with display, output interface – CAN 2.0B)

* **A** symbol is not specified for differential fuel flow meters.

** For autonomous fuel flow meters **Z** version is not used.

*** This version is delivered upon special order. Designation **U** is available only for one-chamber flowmeters, designation **P** – only for differential DFM flowmeters.

For DFM fuel flow meter with output interface configuration a service kit is used (S6 SK or SK DFM), which is ordered additionally, and software [Service S6 DFM](#). You can download and/or update your Service DFM software at <http://www.jv-technoton.com/>, in [Software/Firmware](#) category.



ATTENTION: It is strongly recommended to follow strictly the instructions of the present Manual when using, mounting or maintaining DFM.

The Manufacturer guarantees DFM compliance with the requirements of technical regulations subject to the conditions of storage, transportation and operation set out in this Manual.



ATTENTION: Manufacturer reserves the right to modify DFM specifications that do not lead to a deterioration of the consumer qualities without prior customer notice.

1 DFM general information and technical specifications

1.1 Purpose of use and application area

DFM[®] flow meters are designed for fuel consumption measurement directly in fuel line of vehicles and stationary engines.

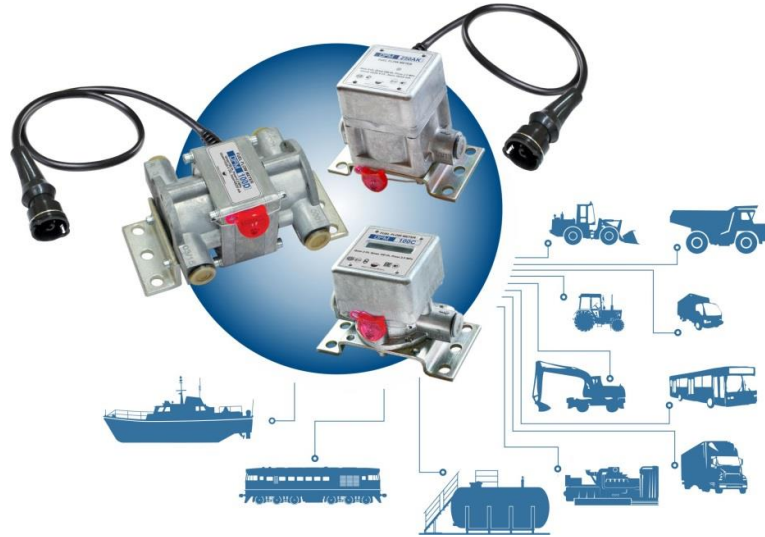
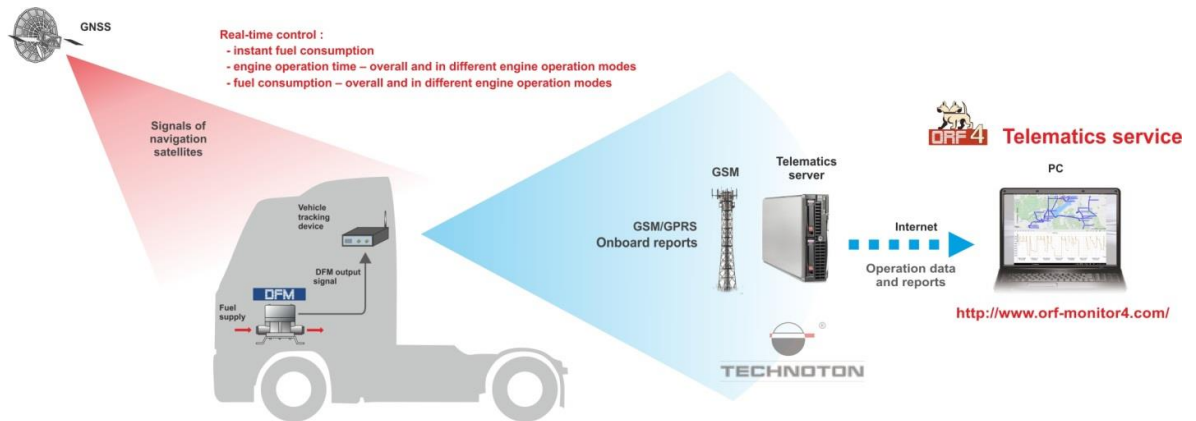
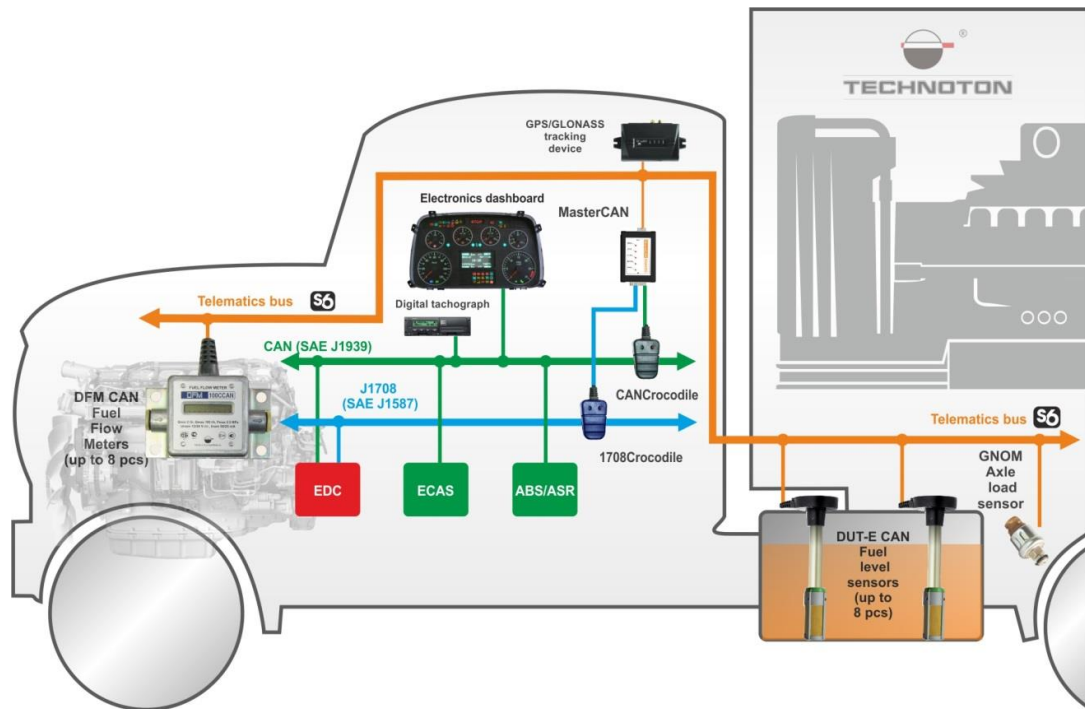


Figure 2 – DFM purpose of application

Application area — DFM fuel flow meters are used both as a part of [Telematics System](#) and as a stand-alone solution (see figure 3).



a) within GPS/GLONASS vehicle telematics system



b) within S6 Telematics Interface *

Figure 3 – DFM examples of application

[DFM](#) are mounted into fuel supply line of the vehicle engine. DFM measure actual (instant) fuel consumption rate and generates an output signal to forward it to a vehicle tracking device (see figure 3 a).

Terminal unit gathers, registers, stores received signals and transfers them to telematic Server. Software installed on the [Server](#) generates [Analytical reports](#), which allow time-related [Route](#) control and [Vehicle](#) fuel consumption monitoring via web-browser (see Figure 4).

DFM with pulse output interface provide data on actual fuel consumption of engine (overall fuel consumption and average instant fuel consumption)

DFM with digital output interface provide real-time control over extended set of information:

- instant fuel consumption;
- engine operation time – overall and in different engine operation modes;
- fuel consumption – overall and in different engine operation modes;
- voltage in on-board power network;
- total operation time of flow meter and duration of power-supply from embedded battery;
- flow meter's malfunctions;
- evidence of interference to flow meter's operation.

* Only for DFM CAN.

Using J1939 output protocol makes possible [DFM_CAN](#) operation as a part of **S6** [telematics bus](#) together with [DUT-E CAN](#) fuel level sensors and other factory-built or additional equipment (see figure 3 b). Tracking device with a single CAN interface port can receive data from up to 8 DUT-E CAN sensors and up to 8 DFM CAN meters. This possibility is especially useful while Vehicles with several engines (river boats, locomotives, technological vehicles, diesel genset stations) are equipped.

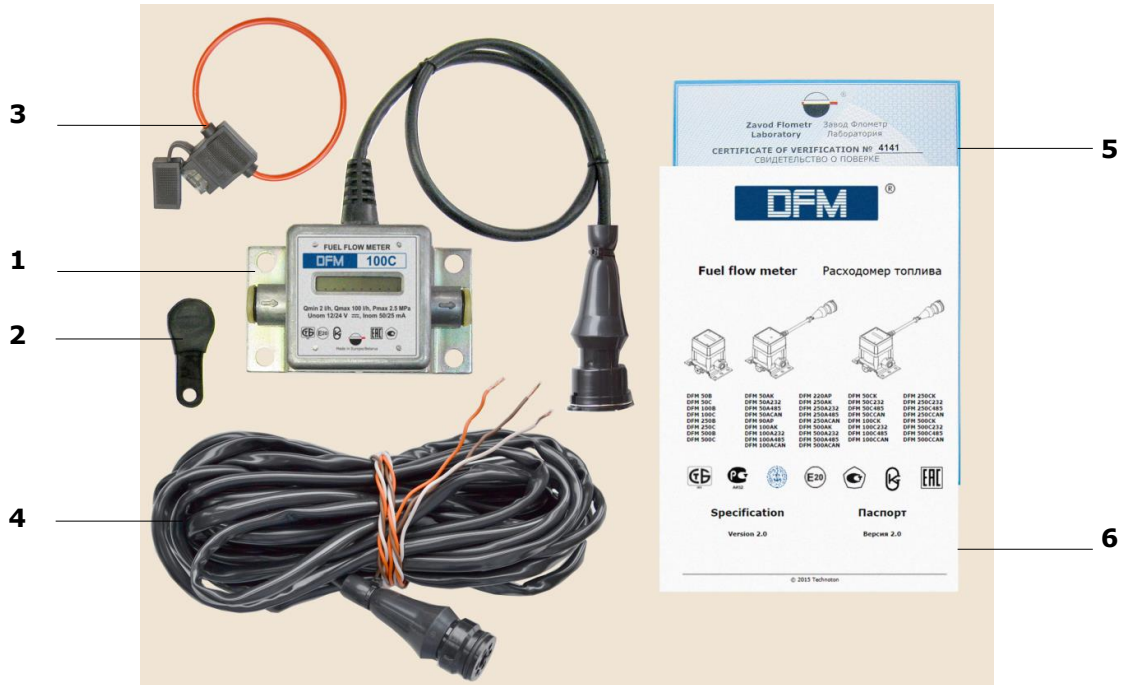


Figure 4 — Example of Analytical Report generated in ORF 4 software, based on the DFM CAN data

Use of [DFM](#) provides vehicle owners with the following:

- actual fuel consumption records;
- registration of machinery working time;
- normalizing of fuel consumption quotas;
- fuel theft detection and prevention;
- real-time monitoring and fuel consumption optimization;
- fuel consumption tests for engines.

1.2 Exterior view and delivery set



- | | | |
|---|---|---------|
| 1 | DFM fuel flow meter | - 1 pc; |
| 2 | iButton key * | - 1 pc; |
| 3 | fuse with holder (2 A) ** | - 1 pc; |
| 4 | 7.5m connection cable CABLE DFM 98.20.003 (7.5 m) *** | - 1 pc; |
| 5 | Verification certificate | - 1 pc; |
| 6 | Specification | - 1 pc. |

Figure 5 — DFM delivery set

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<http://docs.jv-technoton.com/>

-
- * For DFM meters with built-in display.
 - ** Not applicable for autonomous DFM fuel flow meters.
 - *** Only for DFM meters with pulse interface output.