

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

June 12, 2020

Digital Fuel Monitor

Specialist's Factual Report

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1. EVENT SUMMARY

Location: Chebanse, Illinois
Date: July 5, 2019
Aircraft: Beechcraft A36
Registration: N1809S
Operator: Private
NTSB Number: CEN19FA210

On July 5, 2019, at 1341 central daylight time, a Beech A36 airplane, N1809S, was substantially damaged during a forced landing following an in-flight loss of engine power near Chebanse, Illinois. The pilot sustained serious injuries, one passenger sustained minor injuries, and one passenger was fatally injured. The airplane was registered to and operated by private individuals as a Title 14 *Code of Federal Regulations* Part 91 as a personal flight. Visual meteorological conditions prevailed at the time of the accident, and the flight was not operated on a flight plan. The flight originated from Smyrna Airport (MQY), Smyrna, Tennessee, at 1134 and was destined for Bolingbrook's Clow International Airport (1C5), Bolingbrook, Illinois.

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following device:

Device Manufacturer/Model:	Shadin Microflo-L
Serial Number:	1057

3.1. Device Description

Microflo-L is a Digital Fuel Management System designed to provide complete fuel management information under real flight conditions after entry of the initial fuel on board. It is connected to the engine fuel flow transducer for fuel flow information and to the GPS

receiver serial port for navigation data (ground speed, distance and estimated time en route). The system includes a non-volatile memory that retains fuel remaining and fuel used information when the power to the unit is shut down. This system is also capable of transmitting the fuel information to navigation receivers for additional calculations and display of fuel management data.

3.2. Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit had impact damage on its front panel and metal outer case, as shown in Figure 1.



Figure 1: Shadin Microflo-L as received (front, back and side).

The Shadin Microflo-L was visually inspected internally, and no damage was found. When the unit powered up initially, it was continuously flashing “Low Fuel” warning on its display, as shown on the left side of Figure 2. The warning persisted until it was acknowledged by pressing the ENTER/TEST button¹. According to the manufacturer, this warning indicated that the fuel level on board was below a preset low fuel level before the power to the unit was cut off. After the low fuel warning was acknowledged, the device displayed fuel flow rate of 0.0 GPH on the left and maximum usable fuel of 141 gallons on the right, as shown on the right side of Figure 2. This display configuration was not expected according to the manufacturer.

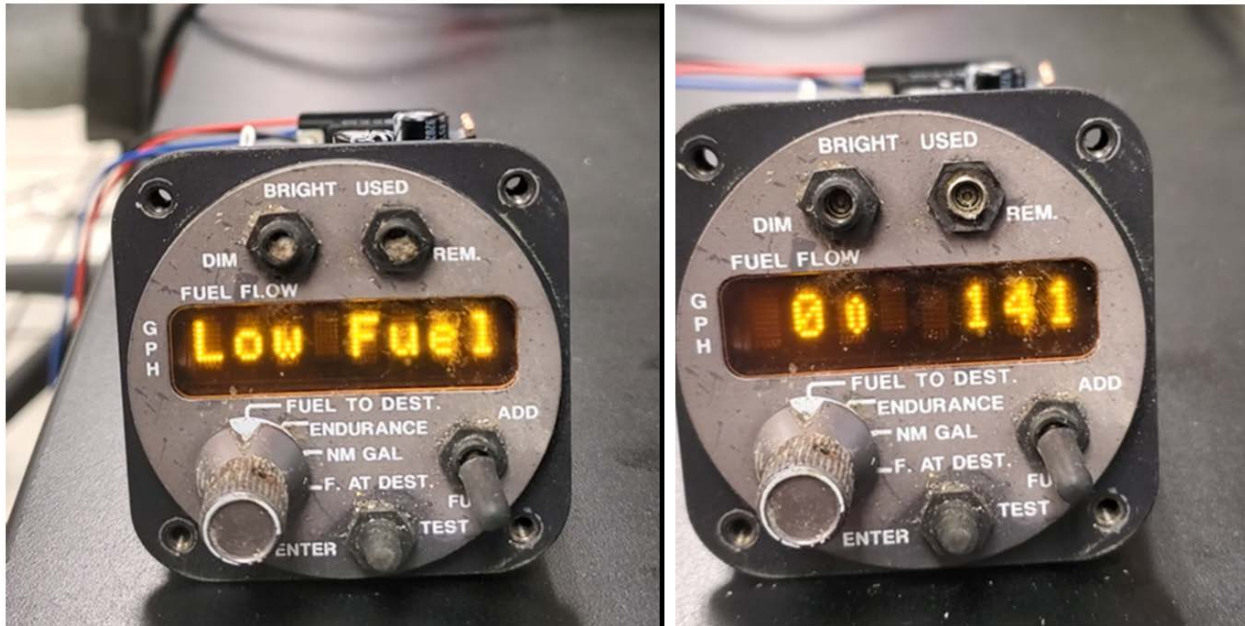


Figure 2: Low Fuel warning when initially powered up (left), fuel flow rate and max usable fuel (right).

Based on the operating manual, the stored fuel remaining and fuel used values can be accessed by toggling the USED/REM switch which was damaged. When the switch was toggled with a laboratory tool, the device did not display the fuel used value and fuel remaining value as expected. Additionally, when trying to read the pre-programmed Low Fuel Level by accessing the Manual Entry Mode, the device entered maximum usable fuel setting mode instead. According to the manufacturer, it is possible that this was the result of an internal issue caused by the impact damage to the device. The manufacturer stated that entering the maximum usable fuel setting mode might have reset the fuel used and fuel remaining values. However, entering this mode would not have changed the initial configuration of the device, including the Low Fuel Level setting. The “Low Fuel”

¹ For further information on unit operations or configuration settings refer to Shadin Avionics Microflo-L™ operating manual for P/N: 91024XT-38-D.

warning shown when the device was powered up is believed to have been valid at the end of the accident flight when power to the unit was cut off according to the manufacturer.

In order to retrieve the initial set-up values, the manufacturer provided a new display. The unit was powered up again with the new display. The stored Low Fuel Level was read to be 20.0 gallons, as shown in Figure 3. This indicates that the fuel remaining on the accident aircraft was lower than 20 gallons before the electrical power to the unit was cut off. All the stored configuration values retrieved from the unit are shown in Tables 1, 2 and 3. The Group 1 configuration is set up by the distributor and contains information defined by the part number of the unit, while the Group 2 configuration can be set up by programing the unit in Manual Entry Mode.



Figure 3: Low Fuel Level setting in device's Entry Mode.

Table 1: Group 1 Configuration Settings.

Display	Value	Description
L	8500	Left K-Factor of 85,000 ²
R	0	Right K-Factor of 0
A	0	Left Fuel Flow Offset Frequency (Hz)
B	0	Right Fuel Flow Offset Frequency (Hz)
U	0	Fuel Units -- Gallons
E	0	Engine Type: Single
C	0	Low Fuel Cutoff: Off

Table 2: Group 2 Configuration Settings.

Display	Value	Description
O	5	GPS Output Type: Generic
I	1	GPS/Loran Input: On
D	0	Endurance Warning Time – 45 Minutes
F	0	Filter Type – Injector
W	0	Ignore Loran Warnings – No Setting Used
S	20.0	Low Fuel Level (gallons)

Table 3: Test Function Readings.

Display	Description
85 GAL	K-Factor setting of 85,000 Pulses Per Gallon
LOF	Without a valid signal from a Loran/GPS
FULL 141	Full Fuel Setting
60.08.838	Unit Software Version

² The K-factor displayed in 10s, so needs to be multiplied by 10 to obtain the correct K-factor.