VRX system for the Walter M601

Operational and Installation Manual

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VR Avionics
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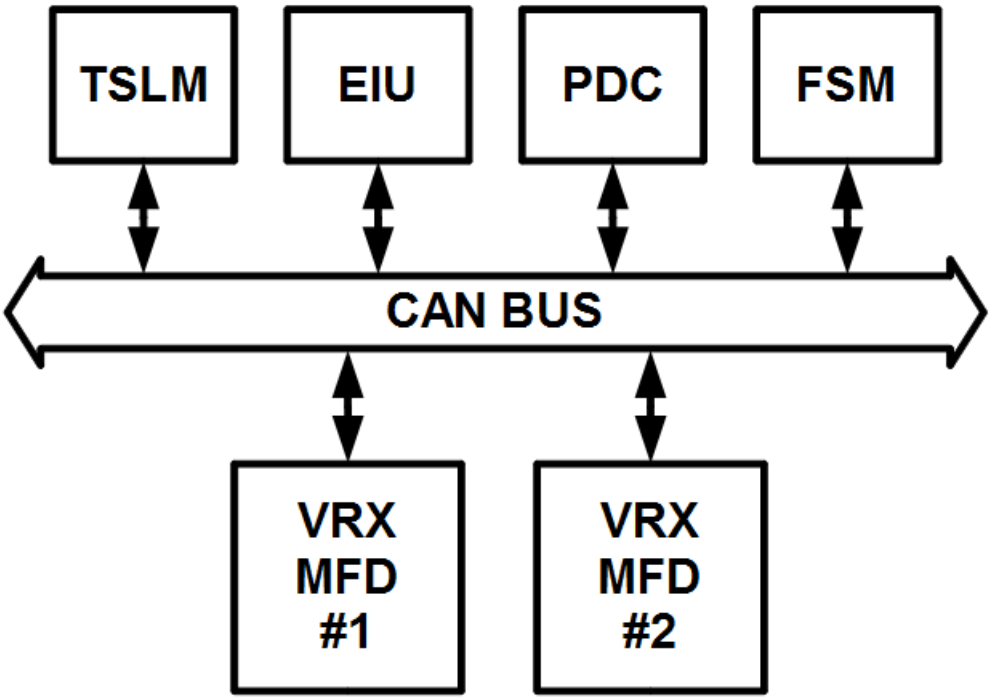
Introduction

System Options

This manual describes the installation and operation of the VRX multifunction display (or MFD) from VR Avionics when used in a Walter/GE M601 application in either single or dual configuration. There are two models of VRX MFD's, the VRD-10 and the DX1, both running the same firmware. This manual describes version 1.8 operation. These VRX MFD's work with various combinations of VR Avionics line-replaceable units (LRU's) communicating via CAN bus as shown below.



The different LRU's operate independently, though when combined as illustrated the user gains new capabilities and closer interaction. The standalone LRU's have separate manuals describing their installation and operation, and should be used in conjunction with this manual. They may be downloaded from the VR Avionics website.

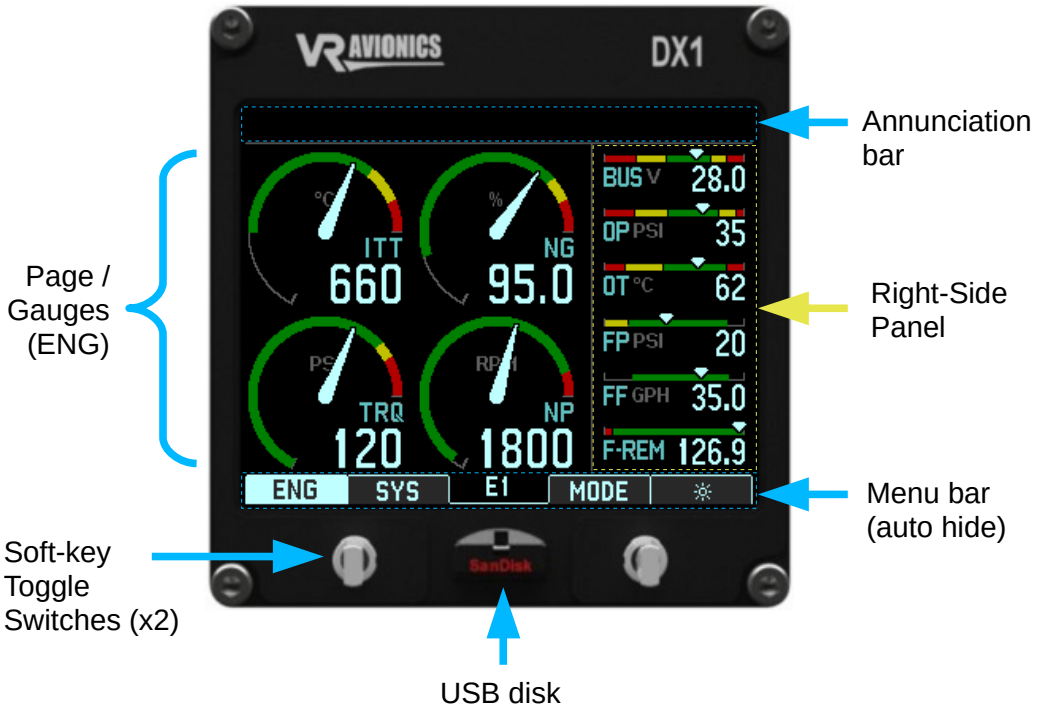
A second VRX MFD realizes a dual VRX system. This not only provides convenience, but adds redundancy – should one MFD go down, the remaining one can keep on going.

One limitation to the system diagram above does however exists. Should you have both a FSM and EIU in your system, a VRX MFD will only show the system page for one of them. A second VRX MFD in a dual VRX system can however be configured to show the system page left out on the first. See the discussion of system pages later.

Third-party devices and systems may use information acquired via your VRX system. The VRX MFD streams real-time data out on it's serial port. The protocol is the same as that of the EIU-M601 and is described in Serial protocol definition.

Operation

VRX MFD basics



The VRX display (DX1 model shown here) has:

- ➔ Four menu bar soft-key selections via 4 buttons (VRD-10) or 2 toggle switches (DX1),
- ➔ one USB slot to allow the utility of removable memory / USB disk,
- ➔ an Annunciation bar for caution, advisory and warning annunciation, and
- ➔ a Page / Gauges area to present graphical instruments and information.

Basic soft-keys

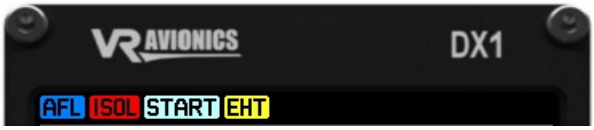
ENG	**"ENG"** high-lights when an engine page is shown. Selecting this soft-key alters the right-side panel to show other readings. Available are up to four panels (marked E1 through E4), each with a set of up to six readings. The four primary engine gauges remain persistently visible. See Engine pages.
SYS	**"SYS"** high-lights when a system page is shown. Selecting this button lets you view other system pages. The VRX-MFD Configuration determines which of up to four system pages gets shown.
MODE	Toggles Scan mode on and off. In scan mode the display switches the right-side panel (E1 … E4) automatically every 10 seconds.
☼	Toggles the screen brightness, either day (bright) of night (dim).

Removable USB Disk

The VRX MFD comes with a removable USB disk. It is used for flight data recording, TSLM history retrieval, and updating of firmware. Should you need a replacement or an additional one, we recommend the low profile *Cruzer-Fit* flash drive from *SanDisk* shown here to the right. It supports USB 2.0 and is available in 8, 16, 32 and 64 GB memory sizes.

Annunciation Bar

The Annunciation bar is present at the top of every page to indicate cautions, advisories and warnings.



These lights fill the Annunciation bar from left to right in the order they become active. They come in various colors – red for warnings, yellow for cautions, and blue and white for advisories.

Annunciation list

The availability of listed annunciation indicators may depend on the presence of a certain LRU.

EXCEED	red	One or more primary engine parameter (ITT, N1, NP, Torque) is in the red (exceeding). Make sure the Walter engine type configuration property is set to the correct M601 engine type.
FUEL	red	Shows when fuel-remaining and/or time-remaining drops too low. Both warning levels are set in the VRX-MFD configuration.
ISOL	red	Emergency Fuel Control Isolating valve is engaged.
FP	red	Fuel pressure is in the red.
OP	red	Oil-pressure is in the red or the oil-pressure switch signals via the EIU.
OT	red	Oil-temperature is in the red.
BUS	red	Bus voltage is in the red.
AMPS	red	Bus current is in the red.
TSLM	red	TSLM unit is offline and no data is being received from it.
EIU	red	EIU unit is offline and no data is being received from it.
FSM	red	FSM unit is offline and no data is being received from it.
PDC	red	PDC unit is offline and no data is being received from it.
F-CHIP	red	The forward chip-detector is detecting something.
A-CHIP	red	The aft chip-detector is detecting something.
GEN	red	The generator is off-line.
PH	red	A fault is being detected with propeller heating.
LFL	red	If one or more of the four possible fuel tank levels drop below their respective red-lines, a relevant annunciation will appear. Each tank's Annunciation text, red-line and capacity can be changed in the VRX-MFD configuration.
CFL	red	
RFL	red	
HFL	red	

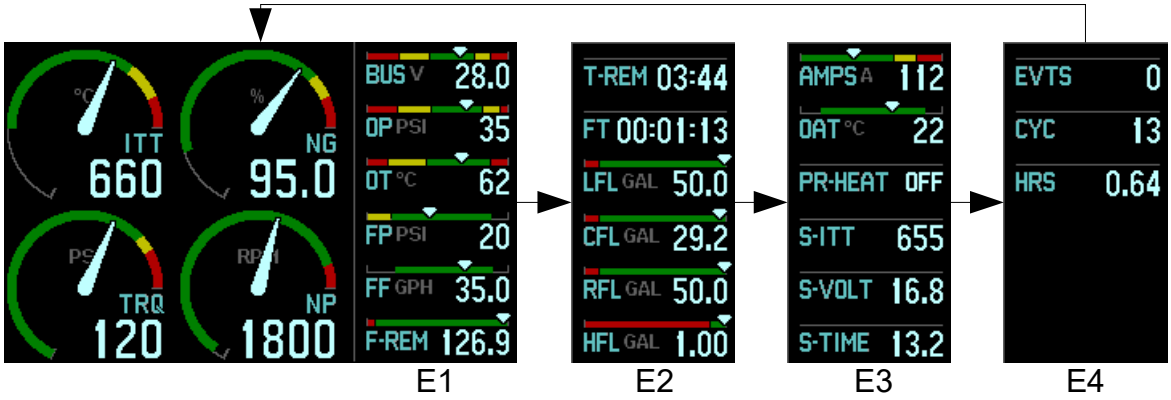
H-PUMP	yellow	Hydraulic pump signals active via the EIU.
BETA	yellow	Propeller is in beta mode.
EHT	yellow	Engine is being limited through the EHT valve.
ITT	yellow	Problem with the ITT thermocouples and/or wiring to the TSLM.
START	white	TSLM is busy performing an engine start-up sequence.
PURGE	yellow	Combustion chamber purging is required. Urges the pilot to move the condition lever to cut-off. Happen if during the start-up sequence the engine failed to light-up in the allotted time.
RUN	white	Engine run / motor sequence is being performed by the TSLM.
AFO	white	Anti-Flameout Operation is being performed by the TSLM.
PH	blue	Propeller Heating is being performed by the PDC.
AFL	blue	Auto Fuel Leveling is being performed by the FSM.

Alerting operation

With Alerting if primary enabled red indicators (warnings) will begin flashing to draw more attention Alert delay in seconds after becoming active. The pilot can either address the warning by taking corrective action or acknowledge those such as *low fuel* that have no corrective action. Warnings are acknowledged by selecting the flashing red WARN soft-key. Once acknowledged, the WARN soft-key disappears and the blinking of red indicators halt. If an acknowledged warning disappears such as after successful corrective action, this warning will only Alert again (blinking plus red WARN soft-key) if Repeat acknowledged alerts is enabled and the same warning become active at some later stage.

Engine page(s)

The ENG page is the primary page. It shows four circular engine gauges – ITT, N1, TRQ and NP as well as on the right a panel of 6 horizontal slide-gauges. Other right-side panels are available showing further readings and can be accessed via the ENG soft-key:



The readings in E1 through E4 depends on the information the installed LRU's provide. Some measurements have redundancy with two or more LRU's providing the same parameter (eg. N1). In such cases there is a preferred source, but should this source become unavailable the display will automatically switch to the next alternative in line, and so forth.

SCAN mode

Scan mode automatically toggles the right-side panel every 10 seconds. This mode is activated by selecting the MODE soft-key. The soft-key text changes to SCAN if the mode is engaged. Selecting this SCAN soft-key (again) exits back to the normal mode.

Changing Arcs

The VRX has two sets of red, yellow and greens arcs automatically applied to ITT, N1, BUS voltage and Oil-pressure. One set is for engine start-up, the other for normal in-flight operations.

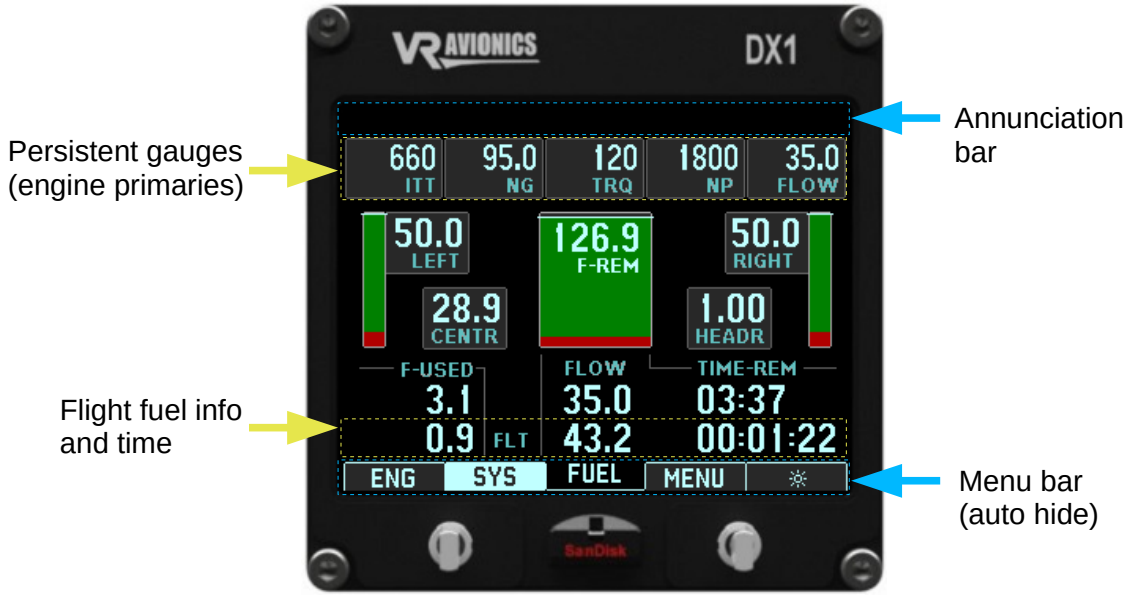
Dual display operation

The VRX caters for dual display installations whether sharing an instrument panel or mounted on separate panels. The latter typically covers tandem two seat cockpits such as the Turbine Legend.

When sharing an instrument panel one display can be configured to play a secondary role. When powered it starts up with the first system page (typically the FUEL page), while the primary starts up with the first engine page. The secondary will become the primary only if the primary goes offline.

FUEL system page

The following FUEL system page is available if your VRX system have access to fuel data from either the fuel interface on a VRX display or an EIU or FSM:



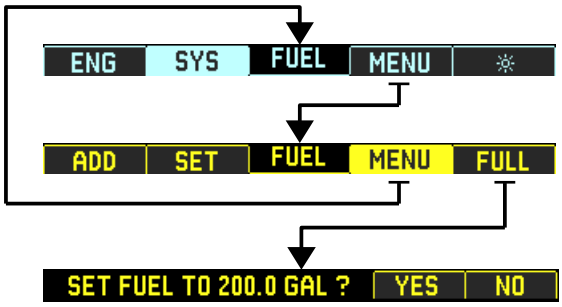
It shows the Annunciation bar at the top and the Menu bar at the bottom. A stack of gauges persistent to all system pages lies just below the Annunciation bar. The rest is filled with the following info:

LEFT RIGHT CENTR HEADR	Shows the left, right, center and header fuel tank level(s) measured by level probe(s) in the units for volume (eg. US gallons). Each tank's name, visibility, red-line and capacity can be configured in the VRX-MFD configuration.
F-REM	Shows the fuel-remaining value that decreases as fuel flows through the sensor before being consumed inside the engine. This value is set by the pilot to closely resemble the fuel on-board. Also see Fuel adjustment.
F-USED (top row)	Shows the amount of fuel-used since the last fill-up or addition of fuel (fuel adjustment) as metered through the fuel flow sensor.
FLOW (top row)	Shows the flow rate used to calculate time-remaining (next entry in this table). It slightly lags the current fuel flow rate.
TIME-REM (top row)	Shows the time-remaining in hours and minutes until fuel-remaining runs out based on the current fuel flow rate (previous entry in this table).
F-USED (bottom row)	Shows the amount of fuel-used during this flight. A flight begins when N1 reaches the value set by the flight timer start N1 configuration property.
FLOW (bottom row)	Shows the average fuel flow rate during this flight. A flight begins when N1 reaches the value set by the flight timer start N1 configuration property.
TIME-REM (bottom row)	Shows the flight-time in hours, minutes and seconds. A flight begins when N1 reaches the value set by the flight timer start N1 configuration property.

Note: An VRX display must be configured to show this page. See VRX-MFD configuration.

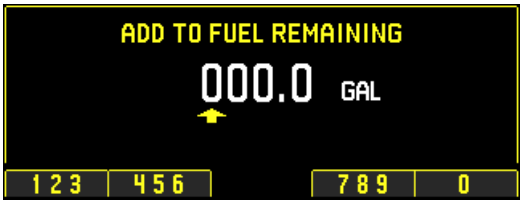
Fuel adjustment

To adjust the fuel-remaining and fuel-used parameters after you have filled-up or added to your fuel on-board, press the MENU soft-key from the FUEL system page as shown below, then select one of three options. Selecting MENU again will exit the menu.

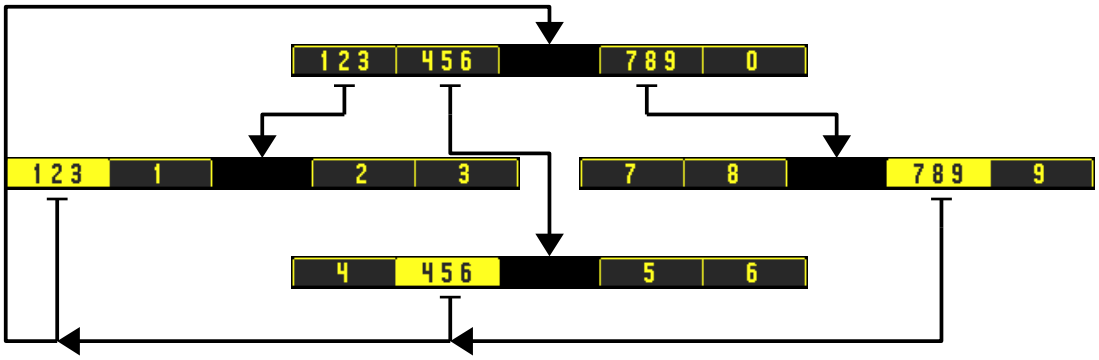


ADD	Adds fuel to the fuel-remaining value (gallons/liters). You'll be prompted to enter a gallon/liter value, and to confirm it. This value will be added to the existing fuel-remaining value and the fuel-used value will be reset to zero.
SET	Sets the fuel-remaining value (gallons/liters). You'll be prompted to enter a gallon/liter value, and to confirm it. The existing fuel-remaining value will be overwritten by this value and the fuel-used value will be reset to zero.
FULL	Sets fuel-remaining value to the full (total on-board) fuel value, which is the value set by the fuel full value configuration property.

ADD and SET will prompt you to enter a value as shown below.



Enter the digit pointed to one-at-a-time using the number entry menu bar shown below until done.

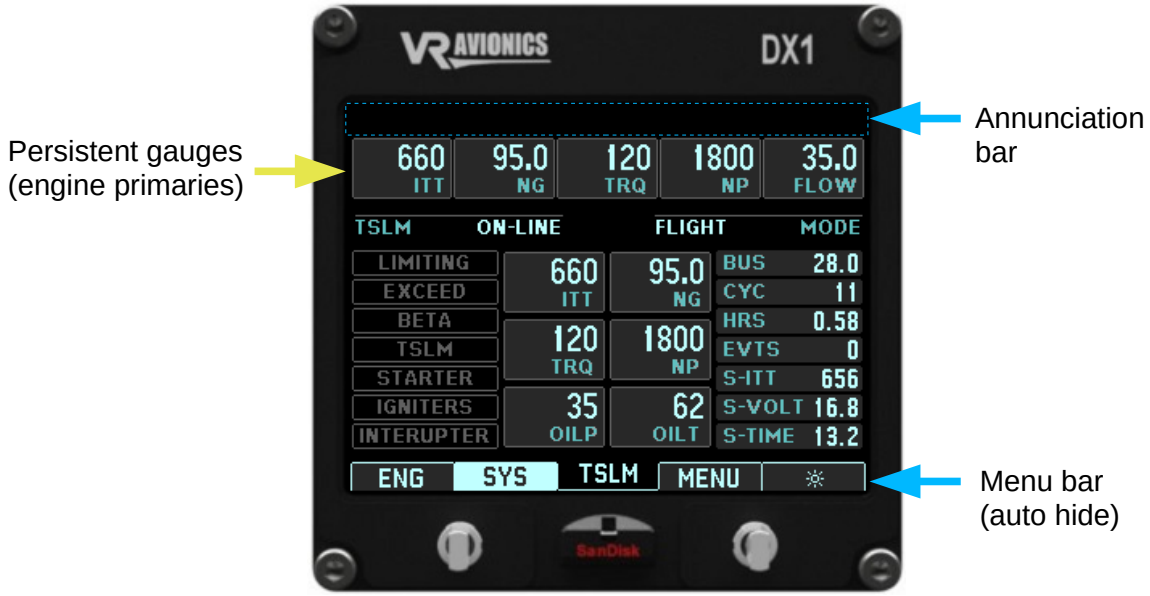


When the last digit have been entered, you'll be prompted to confirm the amount:

If you have made a mistake, simply select NO to repeat the process, or YES to complete it.

TSLM system page

The following system page is available if the VRX-MFD configuration includes the TSLM unit:

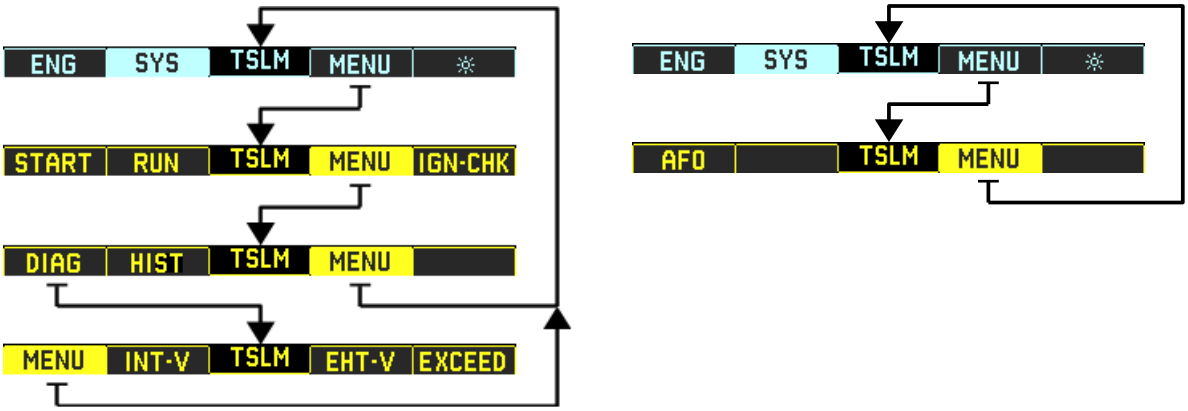


Except for the Annunciation bar and persistent gauge stack at the top and the Menu bar at bottom, this page shows information relating to the TSLM system:

TSLM	Status of the TSLM unit linked via CAN bus, either on-line of offline.
MODE	Mode that the TSLM is currently in.
LIMITING EXCEED BETA TSLM STARTER IGNITERS INTERUPTER	Engine limiting (EHT) activation Engine parameter exceeding warning Propeller in beta mode TSLM status light Starter activation Igniters activation Interrupter valve activation
ITT N1 TRQ NP OILP OILT	Inter-turbine temperature in °C Gas-generator speed (N1) in % Torque in psi Propeller speed (N2) in rpm Oil-pressure in psi Oil-temperature in °C
BUS CYC HRS EVNTS S-ITT S-VOLT S-TIME	Bus voltage Start cycle count Engine hours Engine events Maximum ITT reached during last start Minimum bus voltage during last start Time took to reach idle point during last start

TSLM actions and diagnostics

The VRX system is able to initiate and perform certain actions from the TSLM system page. Press the MENU soft-key to access the options available as shown below.



The menu structure on the left will show if the engine is **not** running, and the one on the right if it is running. The menu allows the following TSLM operations:

IGN-CHK	Makes the TSLM perform an ignition check by powering the exciter unit(s). A 5000 series TSLM will activate ignition A and B simultaneously as you hold this button. A 6000 series TSLM will activate only ignition A or B, alternating between them on successive presses.
START	Commands the TSLM to initiate a start sequence.
RUN	Commands the TSLM to initiate a run / motor sequence.
HIST	Allows you to retrieve and clear the history log of the TSLM. Retrieval will save the history in a file on your inserted USB disk. After successful retrieval you can choose to clear the history log on the TSLM. The file written on the USB disk can be viewed on any PC via our System Link program.
AFO	This toggles engagement or disengagement of Anti-Flameout Operation (AFO) on the TSLM.

Diagnostic tests as follows can be executed:

INT-V	Commands the TSLM to toggle the interrupter valve while you confirm it's proper operation via sound and/or visually.
EHT-V	Commands the TSLM to toggle the EHT valve while you confirm it's proper operation via sound and/or visually.
EXCEED	Commands the TSLM to toggle the EXCEED light while you confirm it's proper operation visually.

Press the OK soft-key when done testing a particular diagnostic.

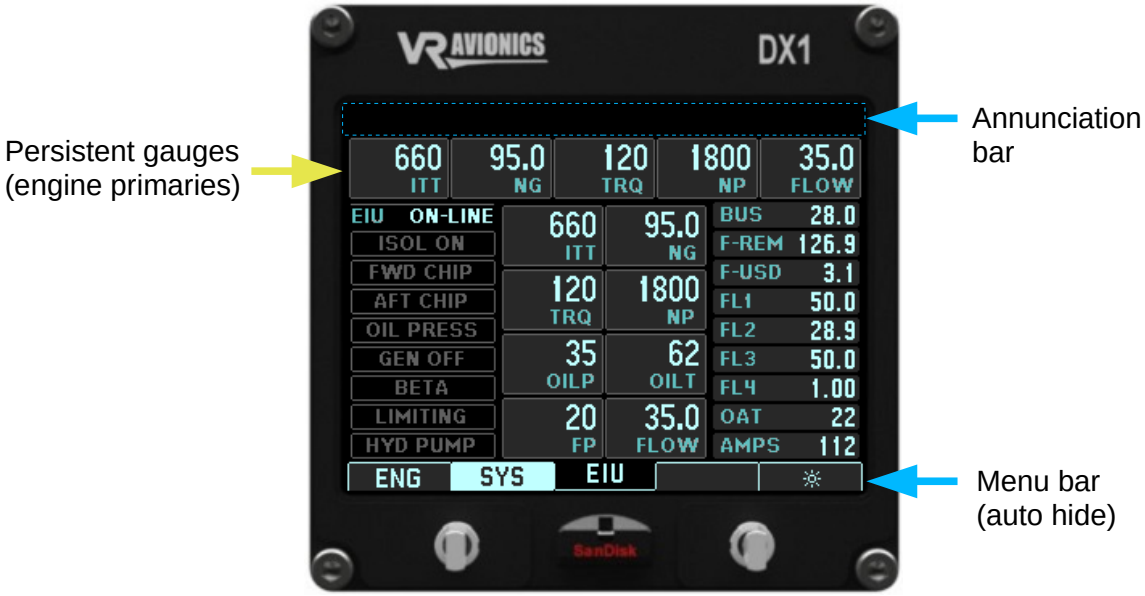
TSLM history retrieval and erasure

To show how to use the VRX menu we will now describe the steps to for example retrieve the history log from a TSLM:

1. Press **SYS** (2nd button) until you get to the TSLM page.
2. Press **MENU** (3rd button) to access the TSLM page menu.
3. Since **HIST** (history retrieve) does not show, press **MENU** again.
4. Now **HIST** (history retrieve) shows. Make sure a USB disk is in the slot and press **HIST**.
5. When the retrieval is complete you'll be asked if you want to erase (clear) the history still in the TSLM unit. Select **YES** or **NO** to continue.
6. If you selected **YES** you will be prompted to enter the configuration password. If correct the history on the TSLM unit will be erased.
7. All done. You may remove the USB disk after you have switched off power to the MFD. You can now insert it into a PC and view the history via our **System Link** program. The TSLM history file is stored in the TSLMXXXX folder on the USB disk, where XXXX is the serial number of the TSLM unit. The name of the file will be HL_XXXXR.VRH where XXXX will be a unique upload number from 0 to 9999 stored in the TSLM unit which increments after every history erase. The R in the file name after this number will also change to an E when a history erase was done.

EIU system page

The following system page is available if the VRX-MFD configuration includes the EIU unit:

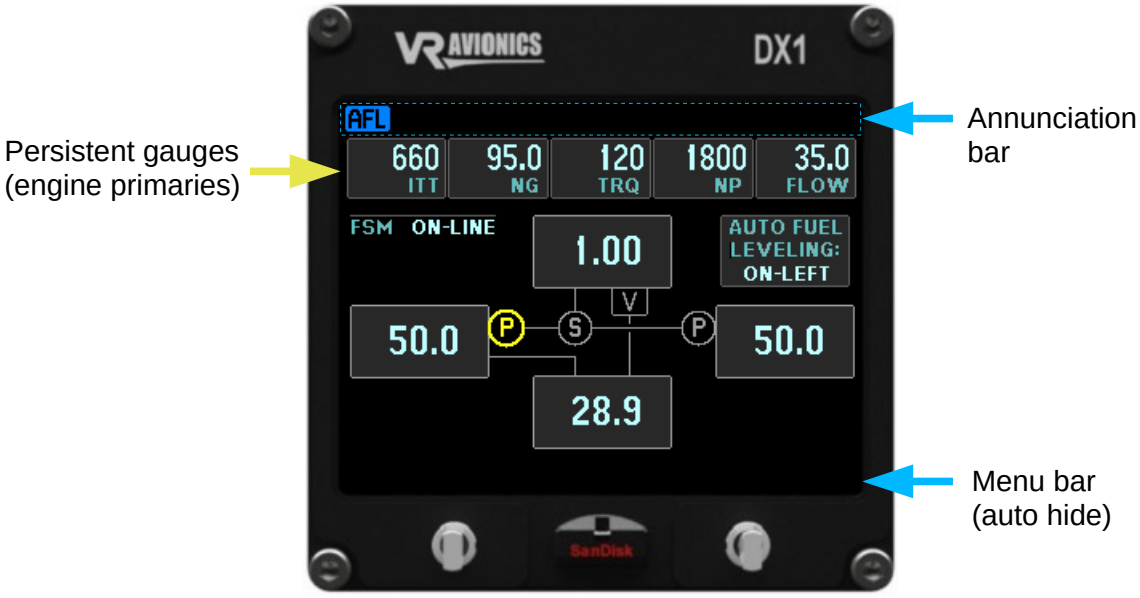


Except for the Annunciation bar and persistent gauge stack at the top and the Menu bar at bottom, this page shows information relating to the EIU monitoring system:

EIU	Status of the EIU unit (linked via CAN bus): either on-line of offline.
ISOL ON FWD CHIP AFT CHIP OIL PRESS GEN OFF BETA LIMITING HYD PUMP	FCU emergency isolating circuit activation Forward chip detection Aft chip detection Oil-pressure switch Generator offline Propeller in beta mode Engine limiting valve (EHT) activation Hydraulic pump activation
ITT N1 TRQ NP OILP OILT FP FLOW	Inter-turbine temperature in °C Gas-generator speed in % Torque in psi Propeller speed (N2) in rpm Oil-pressure in psi Oil-temperature in °C Fuel pressure in psi Fuel flow in GPH
BUS F-REM F-USD FL1 FL2 FL3 FL4 OAT AMPS	Bus voltage Fuel remaining Fuel used Fuel level #1 (name, red-line and capacity set in VRX-MFD configuration) Fuel level #2 (name, red-line and capacity set in VRX-MFD configuration) Fuel level #3 (name, red-line and capacity set in VRX-MFD configuration) Fuel level #4 (name, red-line and capacity set in VRX-MFD configuration) Outside air-temperature in °C Bus current in Amps

FSM system page

The following system page is available if the VRX-MFD configuration includes the FSM unit:



Except for the Annunciation bar and persistent gauge stack at the top and the Menu bar at bottom, this page shows information relating to the FSM system.

FSM	Status of the FSM unit (linked via CAN bus): ON-LINE or OFFLINE
AUTO FUEL LEVELING	Status of Auto Fuel Leveling: OFF, ON-LEFT or ON-RIGHT

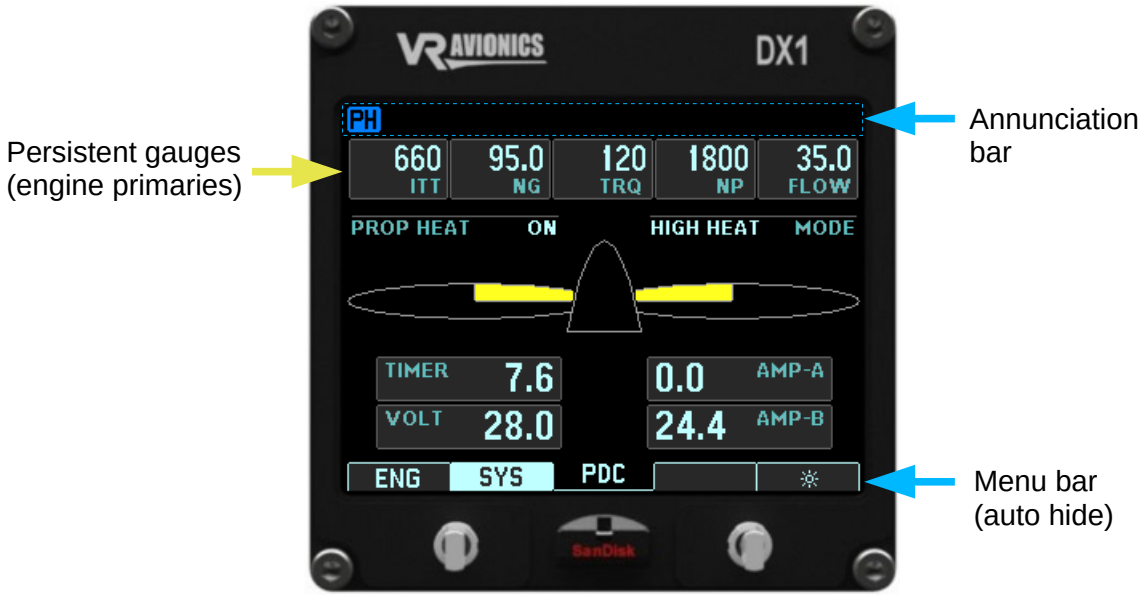
The fuel supply system graphic depends on the fuel layout configuration property selected. It can be adapted to depict other fuel tank arrangements.

The example FSM page shows a four fuel tank system – a center tank supplying the left tank, the left and right tanks supplying the header tank through two pumps and a selector, and the header able to vent back to the center tank through a valve (should air get into the header). Each tank shows a (gallons or liters) value.

The graphic further shows which pumps are active by drawing them yellow.

PDC system page

The following system page is available if the VRX-MFD configuration includes the PDC unit:



Except for the Annunciation bar and persistent gauge stack at the top and the Menu bar at bottom, this page shows information relating to the PDC (propeller heating) system.

The propeller de-icing system graphic shows a propeller and spinner as from above. The heating elements (boots) are also depicted. Other readings show the following:

PROP HEAT	Status of propeller heating – OFF, ON, FAIL or NA (not available).
MODE	PDC unit's mode – standby, low heat, high heat, or offline.
TIMER	Count-down timer to the next phase transition.
VOLT	Voltage measured at the input of the PDC unit.
AMP-A	Electrical current flowing through the phase A boot circuit (in Amps).
AMP-B	Electrical current flowing through the phase B boot circuit (in Amps).

Fuel Level Calibrations

The fuel levels measured by either the EIU or FSM can be calibrated / mapped via a VRD MFD, but only if the engine is not running. To begin the user must:

1. Navigate to either the EIU or FSM system page and select MENU.
2. From the menu select FL-CAL.
3. Prompted by CALIBRATE FUEL LEVEL 1 ? YES / NO select NO until you get to the one you wish to calibrate and then select YES. For the FSM fuel level 1=FL-L, 2=FL-C, 3=FL-R, and 4=FL-H.
4. You'll now be prompted to SET FUEL LEVEL SENSOR TYPE by entering in a value and then confirm it. Set it to the corresponding value below:

Fuel level sensor type	**EIU**	**FSM**
Not used / disabled	0	0
5 volt excitation frequency probe	1	1
5 volt excitation 0 – 5 volt analog voltage probe	2	2
Resistance probe (0 – 270 ohm)	3	-
12 volt excitation frequency probe	4	1
12 volt excitation 0 – 5 volt analog voltage probe	5	2

5. The fuel level mapping screen will appear showing 3 values. On the left is the LITER or GALLON value, on the right the SENSOR value / reading, and below in the middle the total points count value.
6. Starting with an empty tank fill it to the lowest amount you want displayed. This can be an empty tank if you wish. Using INC and DEC buttons (for increment and decrement) set the LITER of GALLON value to the amount you have poured in.
7. Press the ADD button to add this point. You'll see the points count increment to indicate that the point was added to the internal mapping table.
8. Repeat by pouring another amount of fuel into the tank, setting the LITER or GALLON value, and then adding that point to the internal mapping table. Note that there is 50 points available in the table so make sure you don't make the fuel increments too small and exhaust the 50 spots before you reach a full tank.
9. When the fuel tank reaches it's full value, enter and add this last point to the table, then select the DONE button.
10. You'll be prompted on whether you want to proceed and write the calibration table, YES or NO. Select YES to complete the process or no to cancel out back to the main menu.

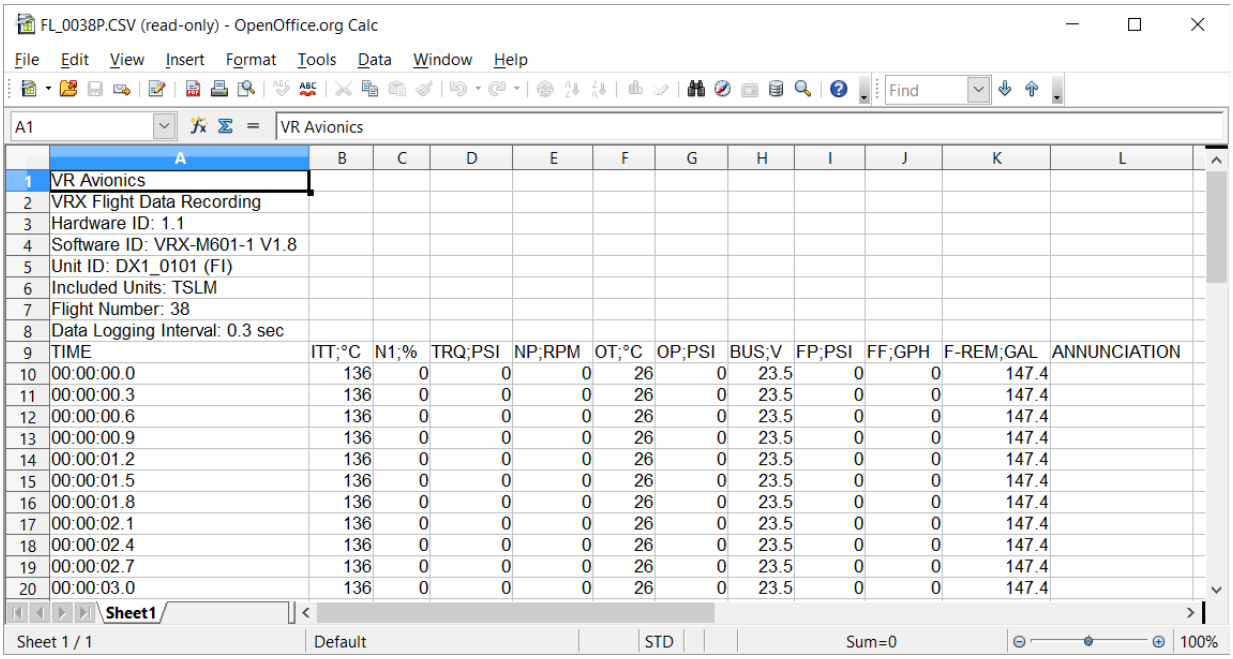
Note: To have this all properly displayed on the VRX, you still need to set the relevant name, red-line and capacity properties in the VRX-MFD configuration of each VRD-MFD you use.

Flight Data Recording

The flight data logging feature automatically stores engine data to a USB disk. Data is recorded to the USB disk every 0.3 to 10.0 seconds. A data file is created each time the system is powered on with a USB disk inserted. A 8 GB USB disk will conservatively store over 8,000 hours of engine data at the highest recording interval of 0.3 seconds. The data files stored on the USB disk have an extension of .CSV. This file format can be opened using a spread sheet application on a personal computer.

USB disk insertion and removal must be done while the MFD is not powered. At power-up a FL_XXXXP.CSV file is created where XXXX represents the flight number. The flight number increments each time the MFD is powered (even if no disk is inserted in the USB slot). This number will run from 0 to 9999 and roll over to zero again. The user can reset it via the Flight number configuration setting. The P in the example file name after the XXXX flight number signifies power-up. It will change to R to indicate that the engine was run (N1 > 10%) and thereafter change to F to signify that the Flight timer was started (N1 > Flight timer start N1).

The interval at which the MFD stores parameters is adjustable from 0.3 seconds to 10 seconds, which is adjustable via the Flight log interval configuration setting. Below is a sample flight log file opened in a spread sheet application.



	A	B	C	D	E	F	G	H	I	J	K	L
1	VR Avionics											
2	VRX Flight Data Recording											
3	Hardware ID: 1.1											
4	Software ID: VRX-M601-1 V1.8											
5	Unit ID: DX1_0101 (FI)											
6	Included Units: TSLM											
7	Flight Number: 38											
8	Data Logging Interval: 0.3 sec											
9	TIME	ITT;°C	N1;%	TRQ;PSI	NP;RPM	OT;°C	OP;PSI	BUS;V	FP;PSI	FF;GPH	F-REM;GAL	ANNUNCIATION
10	00:00:00.0	136	0	0	0	26	0	23.5	0	0	147.4	
11	00:00:00.3	136	0	0	0	26	0	23.5	0	0	147.4	
12	00:00:00.6	136	0	0	0	26	0	23.5	0	0	147.4	
13	00:00:00.9	136	0	0	0	26	0	23.5	0	0	147.4	
14	00:00:01.2	136	0	0	0	26	0	23.5	0	0	147.4	
15	00:00:01.5	136	0	0	0	26	0	23.5	0	0	147.4	
16	00:00:01.8	136	0	0	0	26	0	23.5	0	0	147.4	
17	00:00:02.1	136	0	0	0	26	0	23.5	0	0	147.4	
18	00:00:02.4	136	0	0	0	26	0	23.5	0	0	147.4	
19	00:00:02.7	136	0	0	0	26	0	23.5	0	0	147.4	
20	00:00:03.0	136	0	0	0	26	0	23.5	0	0	147.4	

In the ANNUNCIATION column of the spread sheet all activations are indicated with a “+” preceding the name of the annunciation light as listed in the Annunciation list. Similarly deactivation of any active annunciation light(s) are indicated by a “-” (minus) preceding the annunciation light name. For example “+EXCEED” in the annunciation column indicates the exceed light became active at that moment. Later in the flight “-EXCEED” will be written in the annunciation column at the moment the exceed light is deactivated.

Serial Output Data

RS-232 settings:

Baud Rate: 9600
Data bits: 8
Stop bits: 1
Parity: None
Stream Repeat Rate: 10 Hz

Data stream description:

Byte Number	Description	Bits Used	Format	Min	Max	Resolution	Units
1-2	MSG Header (ID)	16	0xAB55	N/A	N/A		N/A
3-4	Oil Temperature	16	Signed	-60	1100	1	°C
5-6	Oil Pressure	16	*Unsigned	0	100	0.1	PSI
7-8	Fuel Pressure	16	*Unsigned	0	100	0.1	PSI
9-10	Fuel Flow	16	*Unsigned	0	300	0.1	GPH
11-12	Fuel Used	16	Unsigned	0	N/A	0.01	Gal
13-14	Fuel Level 1	16	*Unsigned	0	N/A	0.1	Gal
15-16	Fuel Level 2	16	*Unsigned	0	N/A	0.1	Gal
17-18	Fuel Level 3	16	*Unsigned	0	N/A	0.1	Gal
19-20	Fuel Level 4	16	*Unsigned	0	N/A	0.1	Gal
21-22	OAT	16	Signed	-60	1100	1	°C
23-24	Voltage	16	Unsigned	0	50	0.1	Volt
25-26	Current	16	Signed	-1500	1500	0.1	Ampere
27-28	N1/gas-gen speed	16	Unsigned	0	150	0.1	%
29-30	N2/prop speed	16	Unsigned	0	3000	1	RPM
31-32	Torque	16	*Unsigned	0	300	0.1	PSI
33-34	ITT	16	Signed	-60	1100	1	°C
35	Switches	8	See Table Below				
36	Mode	8	See Table Below				
37	Check-sum	8	See Section Below				

Multiple byte values are serialized into single bytes from “high” to “low”, also known as big-endian byte order. Unsigned formats marked with (*) have the following reserved values:

Hex Value	Description	Explanation
0xFFFF	N/CON (not connected)	Sensor is not connected / installed. The EIU can detect the presence of certain sensors (eg pressures).
0xFFFE	N/CAL (not calibrated)	Sensor is not calibrated / mapped (eg. fuel quantities). Also when a fuel quantity (eg. 4th fuel tank) is not in use.
0xFFFD	FAULT (sensor fault)	A fault is detected with this sensor or with the sensors wiring.

Switches (Annunciation Lights):

Bit Number	Description	Explanation
0	ISOL	Fuel Control Unit is Isolated (emergency valve)
1	EHT	Fuel Limiting active (EHT valve)
2	H-PUMP	Hydraulic Pump active
3	BETA	Propeller is in Beta mode
4	GEN	Generator offline
5	FWD CHIP	Forward Chip Detect
6	AFT CHIP	Aft Chip Detect
7	OIL PRESS	Oil Pressure Low switch

Mode:

Value	Description	Explanation
0	System Initialization	Data is not valid while initializing
1	System Calibration	System in calibration mode
2	System OK	System data valid
3	System Invalid	System data is not valid

Check-sum:

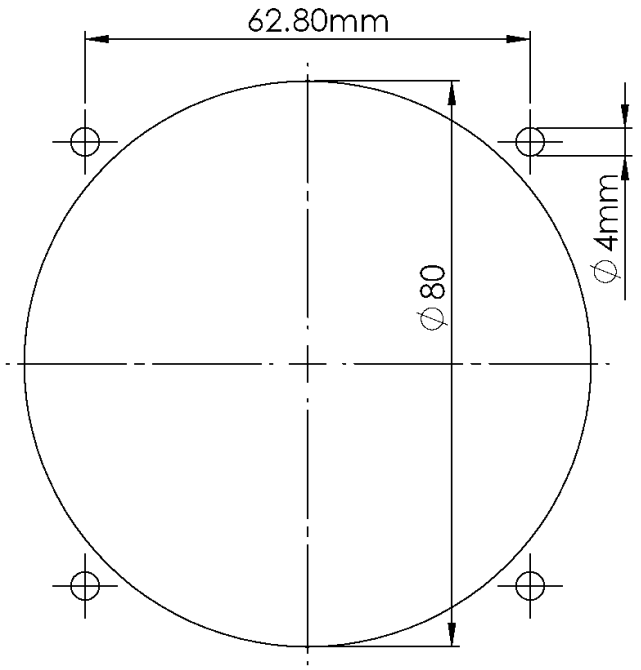
The check-sum is sum of all packet bytes excluding the header and check-sum.

Installation

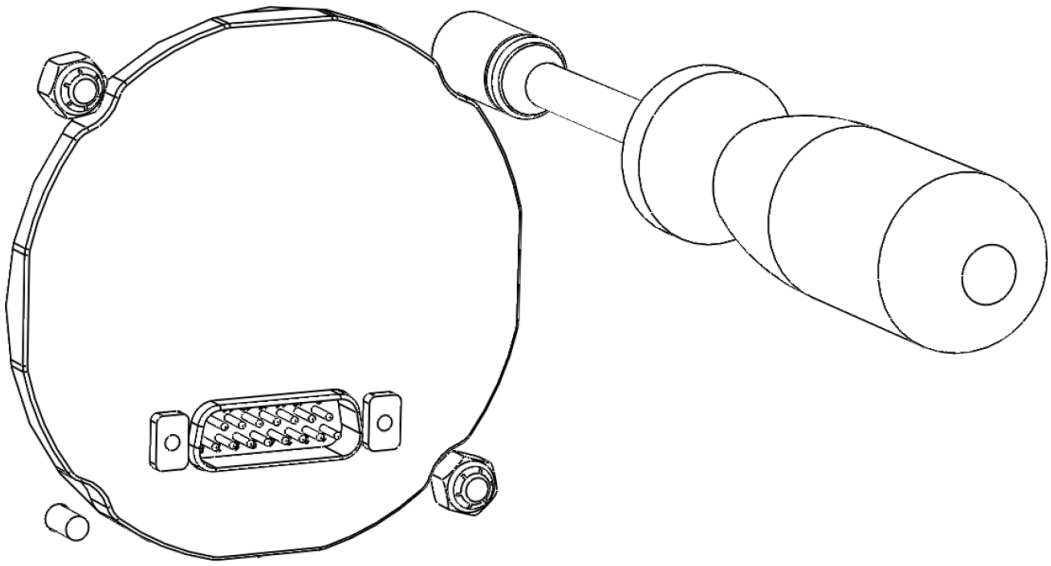
Mounting the VRD-10

Panel cutout

The drawing below provides details on the cut-out hole to be made in a panel to accommodate the VRD-10 MFD. It is consistent with a standard 3.125” instrument hole. The display fits from the front and is secured using four 6-32 self-locking nuts such as the MS20365-632.



The unit will accommodate a socket driver or wrench to secure the nuts from the back of the panel as shown below.

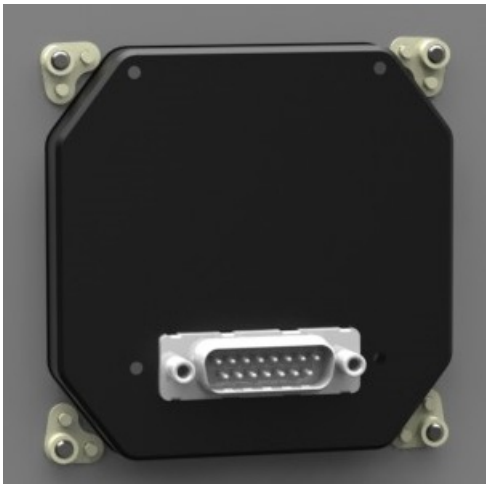


Mounting the DX1

The DX1 multifunction display can be mounted either from the front or from the rear of the instrument panel. Four anchor nuts (MK3400-06) supplied with the DX1 are used in both instances together with 6-32 screws for each anchor nut. The VR Avionics website provide the DXF files for both cutouts as well as the 3D CAD models of the DX1 unit in both Solidworks and IGES formats.

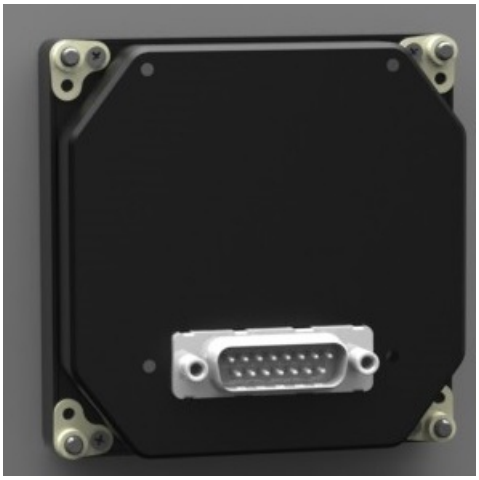
Front-of-panel mount

Shown below we have the DX1 mounted on the front of the panel. It shows the four anchor nuts fixed to the back of the panel plate with eight rivets. After inserting the DX1 through the panel cutout from the front the unit is then secured to the panel with four 6-32 screws.



Rear-of-panel mount

Rear-of-panel mount is accomplished by fixing the four anchor nuts to the DX1 unit using supplied screws before inserting the unit through the panel cutout from the rear and securing the unit to the panel plate using four 6-32 screws from the front. This option realizes a flush-with-panel fit.



Electrical wiring

The following section describes the wiring requirements. Please follow these instructions closely as improper wiring can result in permanent damage to your unit.

Parts and tools

The tools and equipment required are:

- ✔ Wire cutters
- ✔ Wire strippers
- ✔ Teflon insulated wire – 20 to 24 AWG
- ✔ Connector components (15-pin standard D-sub receptacle):

Description	Qty	Part Numbers	
Crimp Connector Shell	1	DAA15SA197FO	
Crimp Contacts 20-24 AWG	15	M24308/10-1	M39029/63-368

- ✔ Tools for working with M24308/10-1 crimp contacts (20-24 AWG):

Description	Part Numbers		
Crimp tool	M22520/2-01	AFM8 (DMC)	
Crimp tool positioner	M22520/2-08	K13-1 (DMC)	
Extraction tool	MS1969/1-02	DAK 145	

Electrical wiring practices

NOTE: For all electrical connections, use correct splicing techniques, taking care to properly insulate any exposed wire. A short circuit between any of the wires may cause damage to the VRX-MFD and/or your airplane.

VR Avionics does not supply connectors or wire for wiring up your VRX MFD. We recommend that standard aircraft grade wiring and connectors be used. 20 gauge wire is sufficient for most lines to the unit. Make sure you protect the power lines with either a circuit breaker or fuse sized appropriate to the wire you select. We recommend you use wire meeting Mil Standard MIL-W-22759/16 (Tefzel insulation) which is available from various suppliers. Another option is to use Teflon insulated wire which is available in various colors.

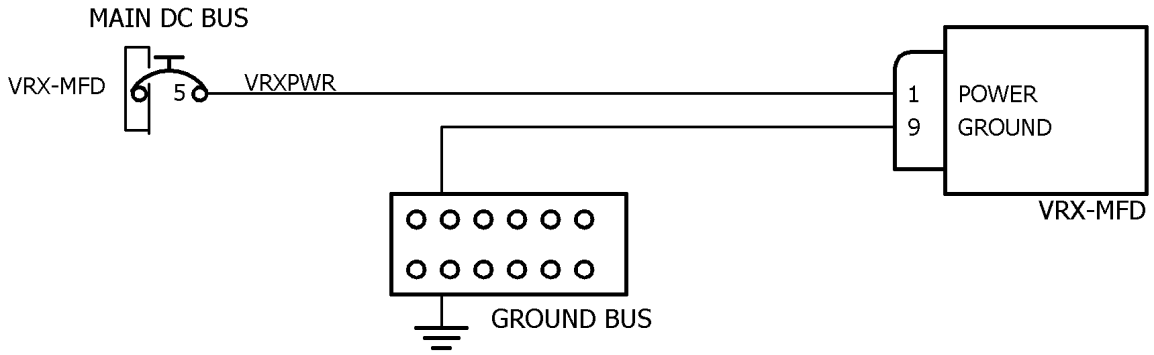
We strongly recommend you use machined pin connectors to mate with the VRX MFD connector. Crimp connections have proven to be the most reliable in aircraft installations. D-Sub shells to hold the pins are available from various sources. Buying high quality connectors is a very wise investment in your aircraft. Make sure all connections are secure and all wires are routed and strain relieved to ensure the wires will not chafe against any other object in the aircraft.

Electrical installation of the VRX display unit is divided into the following sections:

- Power and ground
- Fuel flow circuit (optional)
- Fuel pressure circuit (optional)
- Emergency ISOL circuit (optional)
- CAN bus connection

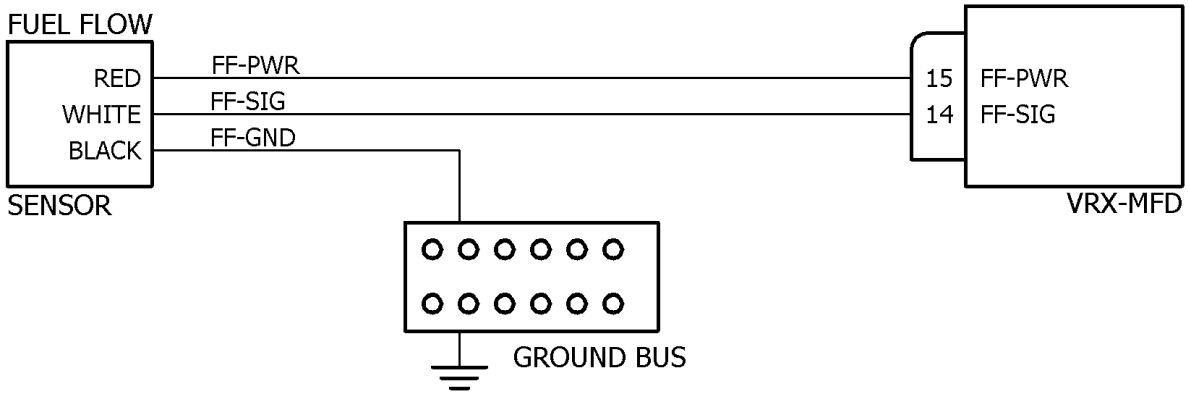
Power and ground

The diagram below shows how power and ground should be wired to the VRX MFD. A 5 amp circuit-breaker runs from the Main DC bus to the unit's pin 1 and another wire runs from pin 9 to ground. A lower rated circuit-breaker (or fuse) will also work since the unit draws little current (less than 0.2 amp). Wire gauges of 22 or 20 AWG is preferred.



Fuel flow circuit

If a VRX MFD have it's Fuel interface configuration property enabled, it will allow fuel flow sensing to drive the fuel computer. The diagram below shows how the fuel flow sensor should be connected.

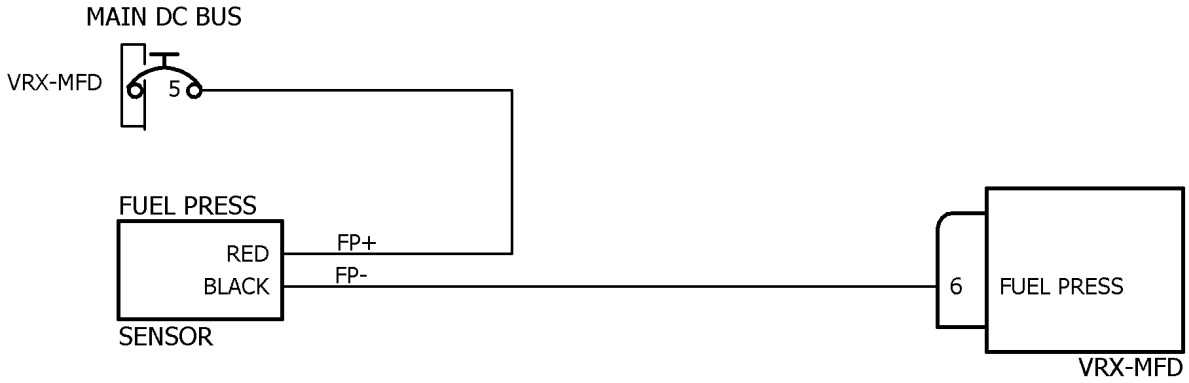


Any pulse based fuel flow sensor, where the output frequency linearly represents the rate of flow, may be used. For the Walter M601 we usually recommend the FT-180 (black cube) from Electronics International (www.buy-ei.com).

Fuel pressure circuit

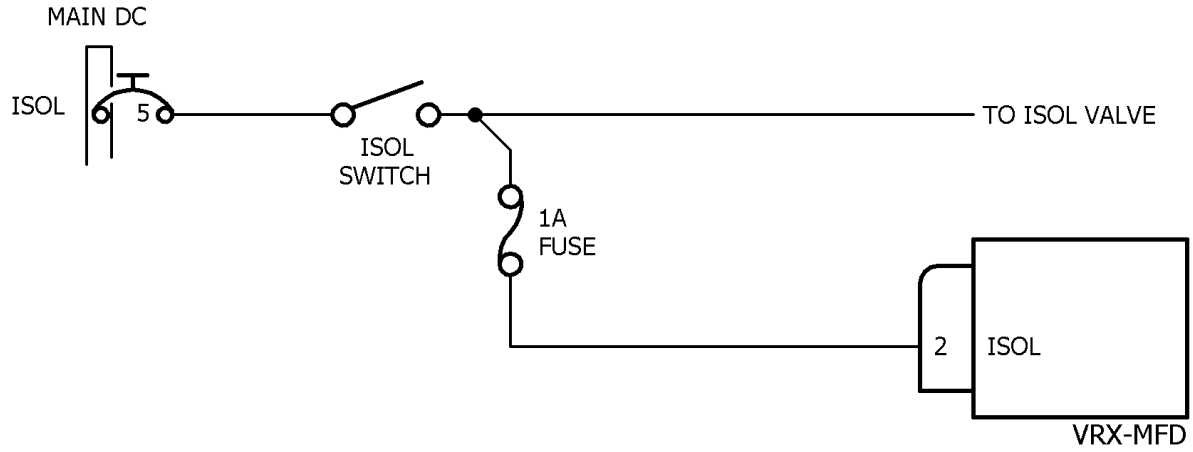
With the Fuel interface configuration property enabled on the VRX MFD unit it will measure and display fuel pressure. The diagram above shows how to wire the fuel pressure sensor. It shows how the sensor may be powered from the same circuit-breaker that the VRX display unit uses.

The fuel pressure sensor should be of the 4-20mA standard current output type and able to measure a pressure range of 0 - 50 psi such as the **M5151-000005-050PG**.



Emergency ISOL circuit

With the Fuel interface configuration property enabled the VRX MFD can sense ISOL activation. Connecting it is useful because if ISOL is active when the pilot issues a start sequence, the display will prompt the pilot to confirm the ISOL start operation. This is to prevent doing so unknowingly which may cause serious damage to the engine. The display will indicate an **ISOL** warning in the Annunciation bar when it is active.

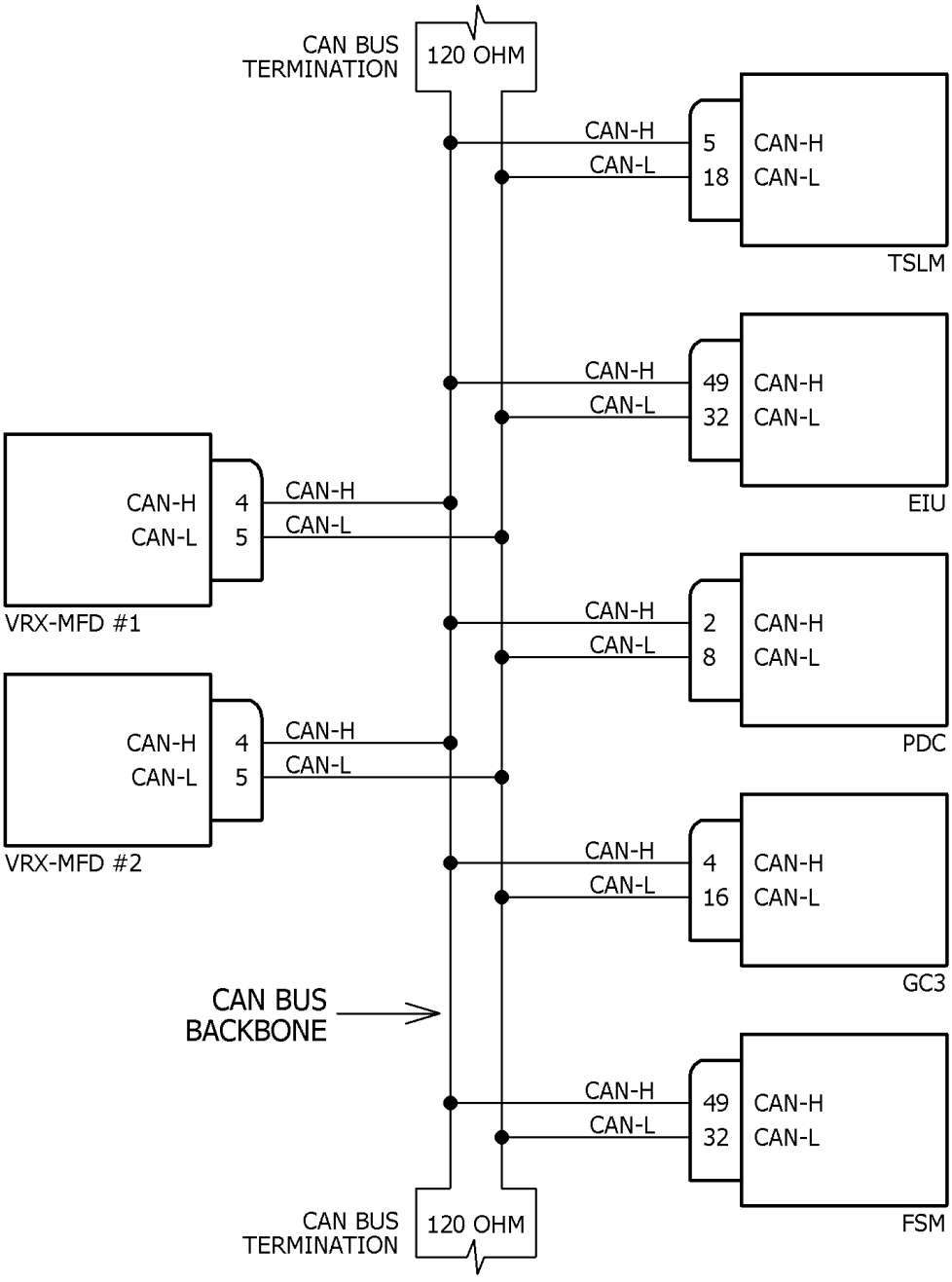


To include this feature the circuit above must be wired-in. A small fuse (or ½ watt 10KΩ resistor) should be installed as indicated very close to the ISOL switch. This ensures no short in the line from the fuse to pin 2 on the MFD can hamper activation of the ISOL circuit.

Note: The ISOL signal (or for that matter fuel pressure, fuel flow, etc.) can alternatively be obtained via an EIU unit. Consult the EIU-M601 manual for more specifics and connection details.

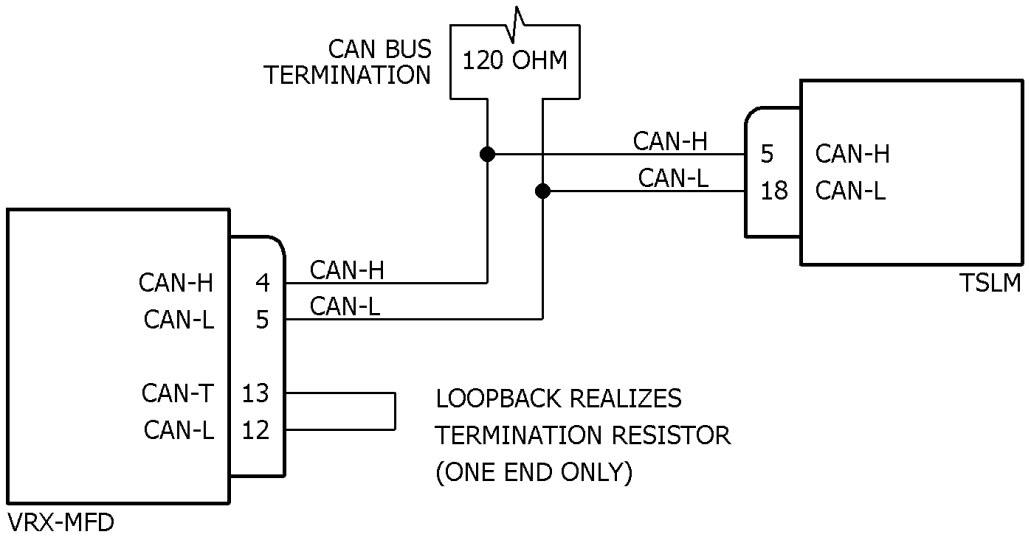
CAN bus connection

Various units share their information with the VRX multifunction display unit(s) via CAN bus. Shown below in blue is the backbone of the CAN bus consisting of 2-core twisted-pair shielded cable with 120 ohm termination resistors at each end. Here we show the largest possible system, but you only connect those units you have installed in yours.



Splicing of the CAN-H (high) and CAN-L (low) wires should preferably be done inside the connector back-shell of each unit.

Though not the preferred method, some VR Avionics units such as the VRD-10, DX1, EIU and FSM can realize the required termination resistor at one end by incorporating a simple loop-back wire at its connector. The following diagram show how a simple VRX MFD with TSLM system can be realized by connecting the CAN-T pin to the second CAN-L pin on the VRX MFD.



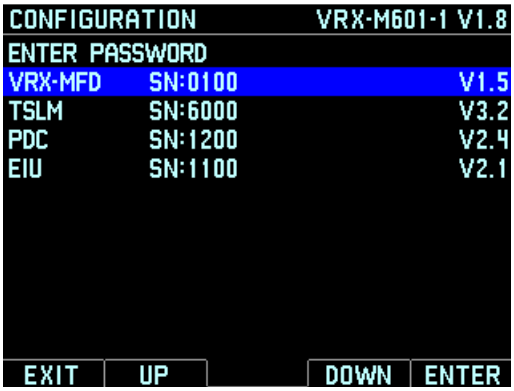
If the total length of the CAN bus cable that connects everything is short enough (under 2 meters) as the case may be in the above example the remaining 120 ohm termination resistor may be omitted.

Configuration

This chapter describes how the VRX MFD's settings can be adjusted to not only represent the installed system, but also suit the operator's preferences. Also covered here are the updating of firmware, not only of the VRX MFD, but of all the CAN bus connected VR Avionics units.

Adjusting the configuration

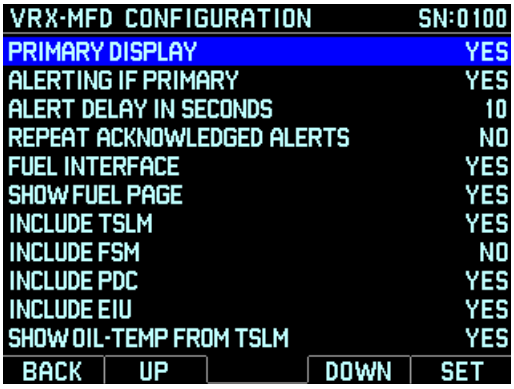
To access the system configuration the #4 (right most) button on the VRX MFD must be held in when power is applied to the unit. Power is typically applied through the aircraft's battery master switch. Afterward a screen similar to the one on the right will appear. It takes a second to load.



Here the VRX MFD and the units connected to it are listed, with each unit's serial number and firmware version next to it. The Menu bar at the bottom lists the actions available for each soft-key.

EXIT terminates configuration mode, UP and DOWN scrolls the cursor to highlight a particular unit, and ENTER lets you view a particular unit's configuration. To make adjustments a password must be entered.

If VRX-MFD is selected a screen similar to the one below will appear.



It lists the configuration properties and settings for the particular unit (the VRX-MFD with serial number 0100 in this case).

Once you have entered the password on the first configuration page you can adjust settings.

Select from the Menu bar BACK to return to the previous configuration list, UP and DOWN to scroll to a specific configuration property, and SET to adjust that property's setting.

Some settings are YES or NO and others require the entry of a value. Some configuration properties are for viewing only.

Configuration Password

The configuration password must be entered to adjust settings in the configuration and also to allow erasure of TSLM history on the TSLM unit. The password is initially set to 0100, but the user may change this at any time. After entering the password on the first configuration page shown above a CHANGE PASSWORD item will appear with the current password. The user may now change it. Please make sure to keep this password in a safe place to remember.

VRX-MFD configuration properties

Property	Setting range	Description / Notes
Primary display	Yes / No	Set to “Yes” if this is the primary display, which is the setting for a single VRX MFD installation. For dual MFD's one can be set “No” to make it a secondary display. See Dual display operation.
Alerting if primary	Yes / No	Enables Annunciation alerting (blinking until acknowledgment).
Alert delay in seconds	0 – 60	Delay in seconds before blinking begins and acknowledgment can be made.
Repeat acknowledged alerts	Yes / No	Set this to “No” to disable further alerting (blinking until acknowledgment) of those warnings that have been acknowledged by the pilot.
Fuel interface	Yes / No	Enables the fuel interface of this display.
Show FUEL page	Yes / No	Enables the FUEL system page to be shown.
Include TSLM	Yes / No	Makes the display expect a TSLM on the CAN bus.
Include FSM	Yes / No	Makes the display expect a FSM on the CAN bus.
Include PDC	Yes / No	Makes the display expect a PDC on the CAN bus.
Include EIU	Yes / No	Makes the display expect a EIU on the CAN bus.
Show oil-temp from TSLM	Yes / No	Makes the display use (prefer) the oil-temperature reading from the TSLM.
Fuel in liters	Yes / No	YES if fuel quantity should be in liter units instead of US gallons.
Fuel full value	0 – 9999	Set this to the total (maximum) amount of fuel on-board. One count equates to 0.1 gallons (or liters). This is the full fuel value used for fuel adjustment.
Fuel flow k-factor	0 – 99999	Set this to the k-factor that comes with your fuel flow sensor. It defines the sensor's unique **pulses per US gallon** value.
Fuel pressure calibration	650 – 700	This value is set at the factory. Adjust this only if the fuel pressure reading is confirmed wrong using another calibrated meter.
Fuel remaining warn level	0 – 9999	Fuel remaining where FUEL warning triggers. One count equates to 0.1 gallons (or liters).
Time remaining warn level	0 – 999	Time remaining where FUEL warning triggers. One count equates to 1 minute.
Flight timer start N1	0 – 999	N1 value where flight timer starts – take-off power application. One count equates to 0.1%
Flight timer stop N1	0 – 999	N1 value where the flight timer is stopped – engine shutdown. One count equates to 0.1%
Walter engine type	0 – 2	0 – M601D 1 – M601E-11 2 – M601E-11A

Property	Setting range	Description / Notes
Ident of fuel tank 1	0 – 10	See Fuel tank identifiers below.
Red line of fuel tank 1	0 – 4000	Fuel level where it's low fuel warning triggers. One count equates to 0.1 gallons (or liters).
Max value of fuel tank 1	0 – 4000	Capacity / maximum fuel level for this tank. One count equates to 0.1 gallons (or liters).
Ident of fuel tank 2	0 – 10	See Fuel tank identifiers below.
Red line of fuel tank 2	0 – 5000	Fuel level where it's low fuel warning triggers. One count equates to 0.1 gallons (or liters).
Max value of fuel tank 2	0 – 5000	Capacity / maximum fuel level for this tank. One count equates to 0.1 gallons (or liters).
Ident of fuel tank 3	0 – 10	See Fuel tank identifiers below.
Red line of fuel tank 3	0 – 5000	Fuel level where it's low fuel warning triggers. One count equates to 0.1 gallons (or liters).
Max value of fuel tank 3	0 – 5000	Capacity / maximum fuel level for this tank. One count equates to 0.1 gallons (or liters).
Ident of fuel tank 4	0 – 10	See Fuel tank identifiers below.
Red line of fuel tank 4	0 – 5000	Fuel level where it's low fuel warning triggers. One count equates to 0.1 gallons (or liters).
Max value of fuel tank 4	0 – 5000	Capacity / maximum fuel level for this tank. One count equates to 0.1 gallons (or liters).
Small header tank 4	Yes / No	If fuel tank 4 reading should multiplied by 10. Used for sub 2 gallon header tanks.
Fuel layout	0 – 4	The number that identifies the FSM fuel layout. This number should match the number for the same property in the FSM configuration.
Flight number	0 – 9999	A number that increments each power-up. It is used for Flight Data Recording to track flight numbers.
Flight log interval	3 – 100	The time interval at which Flight Data Recording is conducted. One count equates to 0.1 seconds.

Fuel tank identifiers

The following table provides the value to set the “IDENT OF FUEL TANK” for each of the four fuel tanks available. Each one that is not used must be set it to 0 (zero).

VALUE	IDENT	NAME	Notes
0	-	-	Fuel tank disabled – it will not appear on the display and not be recorded in the Flight Log
1	1FL	TANK1	Fuel tank enabled – will appear on the display. The IDENT text will be used in the E1 – E4 right-side panel gauges and by the Annunciation bar. The NAME text is used on the FUEL system page.
2	2FL	TANK2	
3	3FL	TANK3	
4	4FL	TANK4	

VALUE	IDENT	NAME	Notes
5	LFL	LEFT	
6	RFL	RIGHT	
7	AFL	AUX	
8	BFL	BELLY	
9	CFL	CENTR	
10	HFL	HEADR	

TSLM-M601 configuration properties

Property	Setting range	Description / Notes
Start cycles		See TSLM-M601 manual
Engine Hours		
Lower ITT events		
Upper ITT events		
N1 events		
N2 events		
Torque events		
*EHT resistance		
ITT calibration		
Voltage calibration		
Torque span calibration		
Torque offset calibration		
Oil pressure span calibration		
Oil pressure offset calibration		
Oil temp. span calibration		
Oil temp. offset calibration		
Alternative int-valve enable		
Double-click start override		
Oil temp. measurement enable		
Walter engine type	0 – 2	
Start ITT control setting		

* configuration properties marked with an asterisk are not user adjustable (for information only).

EIU-M601 configuration properties

Property	Setting range	Description / Notes
Temp. offset calibration		See EIU-M601 manual
Temp. span calibration		
Voltage calibration		
Shunt rating type		
Shunt pos. calibration		
Shunt neg. calibration		
Torque span type		
Torque span calibration		
Oil pressure span type		
Oil pressure calibration		
Fuel pressure type		
Fuel pressure calibration		
N1 calibration		
N2 calibration		
Fuel flow k-factor		
Fuel flow filter		
Fuel tank designation		

PDC configuration properties

Property	Setting range	Description / Notes
Operation		See PDC manual
Combine outputs		
Blink phase states		
Low cycle phase A on time		
Low cycle phase B on time		
Low cycle phases off time		
High cycle phase A on time		
High cycle phase B on time		
High cycle phases off time		
Operating current maximum		
Operating current minimum		
Current calibration		
Voltage calibration		

FSM configuration properties

Property	Setting range	Description / Notes
Fuel pressure warn level		See FSM Manual
Header quantity warn level		
Fuel pump flow warn level		
Fuel flow filter		
Auto fuel level diff. wait enable		
Use level readings for AFL		
Auto fuel level diff.		
Fuel pressure type		
Fuel pressure calibration		
Fuel flow k-factor left		
Fuel flow k-factor center		
Fuel flow k-factor right		
Fuel full value left		
Fuel full value center		
Fuel full value right		
Fuel layout		

Updating firmware

To update the system firmware a FAT32 formatted removable USB disk must be used like the one supplied with the MFD unit.

Confirming USB disk format

To confirm a disk is formatted FAT32 you can insert it into a Windows PC, right click on the disk (listed under “Computer”) and select “Properties”. It should state FAT32 next to “File system”.

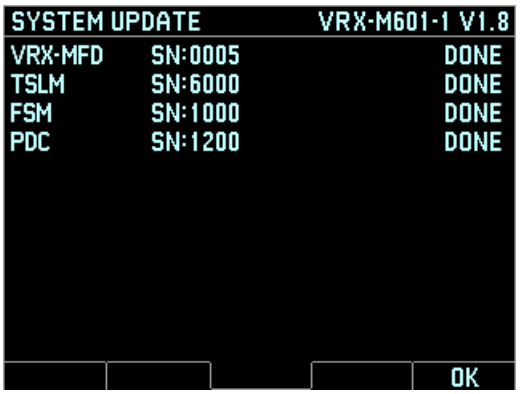
If you want to format a USB removable disk to FAT32 you can right click on the disk again and select “Format...”.

Copying files to USB disk

Open a new folder named “VRX” in the root of the disk (if not already there). Copy the firmware files to this folder (directory). Firmware files have an .VRB extension and the latest versions are available on our website.

Executing the update

Eject the removable disk from your PC and insert it into the VRX MFD's USB slot. Press the #3 (second from right) button and hold it in while applying power (through the battery master switch). After turning on the power you may release the button. The VRX-MFD will begin updating it's own firmware and thereafter update any other VR unit connected to it according to the files in the VRX folder of the USB disk. Afterward a screen similar to the following will appear:



It lists every unit in the system starting with the current VRX-MFD. Each unit is listed with it's serial number and update status next to it. The following explains various update statuses:

DONE	Unit's firmware have been successfully updated.
NO USB DISK	No USB disk was detected in the VRX-MFD's slot.
NOT FAT32	The USB disk is not formatted with the FAT32 file system.
NO VRX FOLDER	No VRX folder (directory) was found on the USB disk.
FILE MISSING	The particular unit's firmware file was not found in the VRX folder and thus the unit was not updated.
FILE ERROR	The firmware file for this unit was found to have an error and thus the update was not performed.
NO DETECT	The particular unit could not be detected on the CAN bus and thus the update could not be done.