Multi-Function Display
User Guide

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Contents

EC declaration of conformity

We declare that this product has been tested to and meet the requirements of:

EC directive 2004/104/EC
"Adapting to technical progress council directive 72/245/EEC relating to the radio interference (electromagnetic compatibility) of vehicles and amending directive 70/156/EEC on the approximation of the laws of the member states relating to the type-approval of motor vehicles and their trailers."

And has also been assessed, via technical construction File, by an independent DTI competent body and found to be in conformance with the essential requirements of:

EC directive 89/336/EEC (and amending directives)
"Council directive of 03 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility."
DTI competent body responsible for issuing certificate of compliance:

3C Test Ltd,
Silverstone Technology Park,
Silverstone,
Northants
NN12 8GX

Introduction

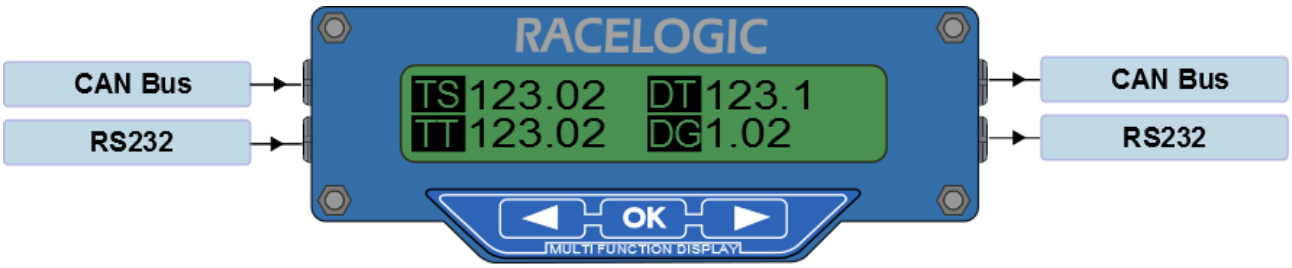
The Multi-Function Display allows simultaneous display of up to 4 VBOX data channels. The channels are user configurable - a list of all selectable channels can be found in table 1 (on page 7). Thirteen screens exist within the display memory. The two main screens contain a total of 8 parameters. Any of the VBOX data channels can be assigned to a parameter. Three other screens include, GPS position as latitude and longitude, lap timing screen and a target graph screen. The lap timing screen has selectable parameters which are listed in table 2 (page 10), and the target graph screen allows a parameter and a target value to be selected, allowing the user to attain consistency during test procedures. The target screen and lap timing screen have individual sub menus, main screen 1 & 2 and Lat/Long all access the main menu. The remaining eight screens display pre-set tests to allow different test profiles to be configured, which can then be quickly swapped between, ideally suited for the quick pace of test environments.

Connection to the VBOX is accomplished via the CAN interface.

Features

- Display multiple data parameters at one time
- Backlit large character display
- User selectable display parameters
- ¼ - 20 Thread mounting

Inputs/outputs



Standard inventory

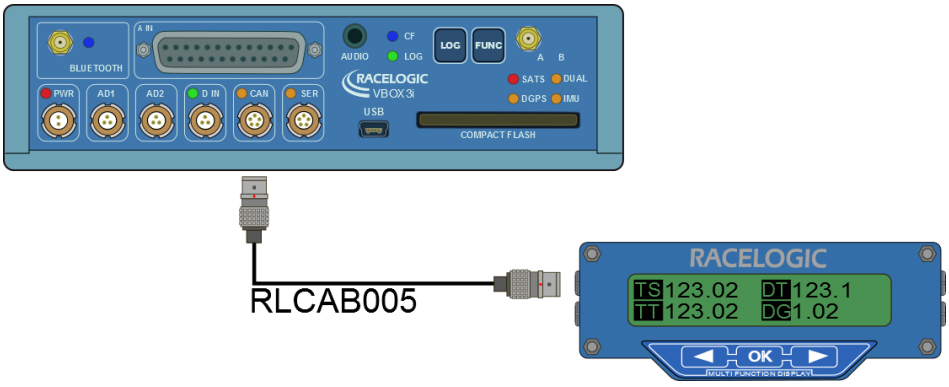
Description	Qty	RL Part #	Description	Qty	RL Part #
MF Display unit	1	VBDSP03	Suction Mount	1	RLVBACS041
VBOX Connection cable	1	RLCAB005	User Guide	1	VBDSP03MAN

Optional accessories

Description	RL Part #	Description	RL Part #
Serial cable for firmware upgrade	RLCAB001	MF Display Thermal Printer	RLVBACS026
Unterminated 5W Lemo cable	RLCAB015		

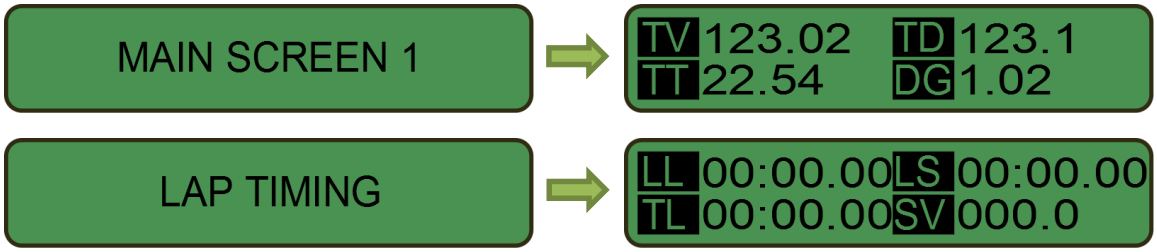
Connection to VBOX

The multifunction display has 2 LEMO connectors at each end. The top left and top right connectors share the same function and are used for connection to the VBOX CAN bus and to supply power to the display. The bottom left and bottom right connectors are serial connections. The function of these connectors is to allow firmware upgrade via a PC and to provide connection to a thermal printer for instant paper record of test results. Also in the serial connectors is a digital output, which will either send a pulse or toggle its state when a split line is crossed.



Data displays

When power is first applied to the display, it will revert to the last screen displayed. Then pressing one of the arrow keys in this mode will cycle through the 13 screen layouts. Some screens will display a title page, which will timeout after approximately one second if no buttons are pressed. The title pages are to inform the user as to which page is displayed, as shown in the examples below.



Mode screens

The different mode screens are as shown below (default setup).

Main screen 1 – showing parameters 1 to 4

Main screen 2 – showing parameters 5 to 8

Latitude and Longitude

Target Screen

Lap Timing Parameters

8 Test Screens

Display parameters

When viewing data Main screen 1 or 2, the user can configure the display to show either four or two parameters simultaneously.

Four parameter view

Two parameter view

If four parameters are displayed at once, a two digit code is shown next to each section of channel data. A list of all the parameter codes used by the MF Display can be found on the page below.

If only two parameters are displayed, then the complete description of the channel will be displayed alongside the value, as shown above.

The setting to change between parameter configurations can be found in **CONFIG DISPLAY > NUM OF PARAMS**.

The parameters are split into 4 groups: General, Brake, Accel and CAN. General parameters are taken from standard Racelogic CAN output from the VBOX. Brake parameters are commonly used in brake testing, the majority of which require the use of a brake trigger switch with the VBOX. Accel parameters are used in acceleration tests, and CAN parameters are from external modules connected to a CAN bus, such as analogue, thermocouple or vehicle CAN data.

Display parameters (table 1)

General | Brake | Accel | CAN

Code	Name	Units
TO	*** TIME UTC	H:M:S
SA	Satellite Count	Sats
VL	Velocity	Km/h or Mph
DT	Heading	Degrees
AL	Altitude. Ref WGS84	Metres or Feet
VV	Vertical velocity	Km/h or Mph
AG	Lateral Acceleration	G
GA	Max. Lateral Acceleration	G
OG	Longitudinal Acceleration	G
AV	Average Velocity	Km/h or Mph
D0	Distance Travelled	Metres or Feet
V0	Vertical Velocity 2	M/sec or Ft/sec
VD	Current Filename	VBOXIII & VB3i
VS	File Status	VBOXIII & VB3i
SS	IMU-INS Status	See table below
TA	Memory Used	VBOXIII & VB3i
VG	Velocity Quality	VBOXIII & VB3i

Code	Name	Units
TV	* Speed at trigger	Km/h or Mph
TD	* Distance from trigger	Metres / Feet
TT	* Time from trigger	Seconds
DG	* Peak deceleration	G
AD	* Average deceleration	G
DO	* Average deceleration 2	G
DD	* MFDD	% MFDD
OD	* Corrected distance	Metres / Feet
ST	** Deceleration time	Seconds
DS	Deceleration distance	Metres / Feet
VT	Maximum speed	Km/h or Mph
AT	** Acceleration time	Seconds
DA	Acceleration distance	Metres / Feet
OV	Velocity at target distance	Km/h or Mph
OT	Time to target distance	Seconds

CAN	The first 32 CAN channels currently being logged by the VBOX are selectable here. If no channels are currently being logged then you will be unable to enter this submenu. Note: - To allow the MFD to read the available CAN channels it must be connected up to a VBOX and VBOX Setup entered. Failure to do so will result in this list being blank or incomplete.

* A brake trigger must be present in order to use these parameters.

**To set up the start and end speed for the acceleration / deceleration tests enter the CONFIG DISPLAY MENU from screens 1,2,or 3, scroll across until the screen displays ACCEL/DECEL SETUP press OK to enter the test set-up menu.

***Display parameters calculated using UTC time, for example; Peak Deceleration must be performed either side of 11.59pm. Tests, which start before 11.59 and end after 12.00 may contain invalid data.

The table below shows the hex and decimal numbers associated with Kalman filter status. The VBOX can have a number of these status flags active at the same time so the resultant number shown in VBOX Tools or a logged file will be a result of adding together the numbers of the active statuses shown below.

Kalman Filter Status	Hex	Decimal
kf_Clear	0x0000	0
kf_NEWIMUVersion	0x0001	1
kf_TestMode	0x0002	2
kf_Use	0x0004	4
kf_Initialised	0x0008	8
kf_IMUDataFound	0x0010	16
kf_GoodLock	0x0020	32
kf_Reset	0x0040	64
kf_CoastingTimeout	0x0080	128
kf_IMUFound	0x0100	256
kf_Initialise	0x0200	512

Example
Kalman Filter Status = 317 (13D Hex)

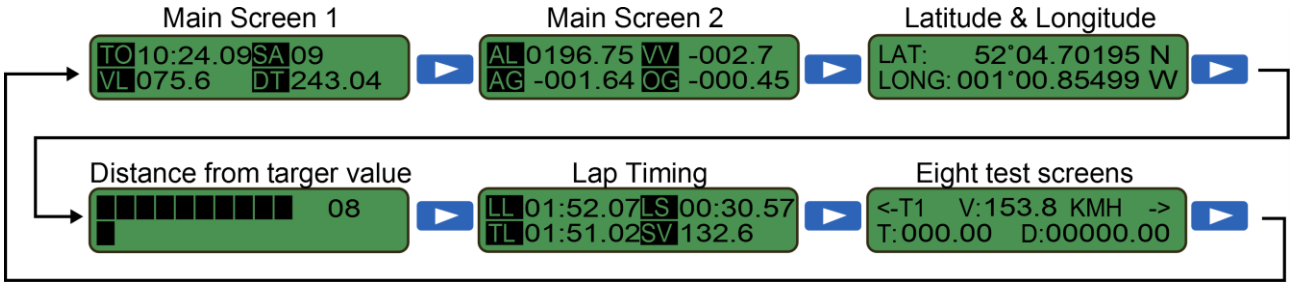
256: kf_IMUFound
32: kf_GoodLock
16: kf_IMUDataFound
8: kf_Initialised.
4: kf_Use.
1: kf_NewIMUVersion.

256+32+15+8+4+1 = 317

Display operation

Three buttons are used to configure the display.

The left and right arrow keys are used for selecting a menu item or cycling through the display screens. When power is applied, the display will revert to the data display mode.



Menus

Enter the main menu by pressing the OK button when in either of the main screen displays. When the desired option to configure is highlighted, press the OK again to move into to the next sub-menu or setup area. Each menu layer will have a BACK option. Pressing OK when this is highlighted will exit the currently

Main menu

SET PARAMETERS	Define the displayed parameters in both main screens.
CONFIG DISPLAY	Settings such as Contrast, Backlight brightness and units of measurement.
VERSION	View the display firmware version and serial number.
VBOX INFORMATION	View the current compact flash file name, memory % used and logging status.
BACK	Press OK to return to the data display mode.

Set parameters menu

TO TIME UTC	Press OK to select a field to edit. Use the right arrow key to choose from General, Brake, Accel or CAN. When the letters are flashing, the arrow keys will cycle through the parameter list. Press OK to store.
SA SATELLITE COUNT	If the parameter indication letters are not flashing, the right arrow key moves to the next parameter on the display.
2: AL ALTITUDE	The 2 indicates that the field being edited is on main screen 2.
BACK	Press OK to return to the main menu.

Version menu

RACELOGIC MFD: 01.001.002	May 18 2011 11:04:05 REVISION: 10.03	SERIAL NUMBER 012345	BACK
Hardware Version	Firmware version.	Unit serial number.	Press OK to return to the main menu.

Config display menu

BRIGHTNESS ▬▬▬▬▬▬▬▬┼▬▬▬▬▬▬	Adjust brightness of the backlight. Adjust the brightness using the arrow keys, press OK to set.
CONTRAST ▬▬▬┼▬▬▬▬▬▬▬▬▬▬	Change the contrast of the LCD. Adjust the contrast using the arrow keys and press OK to set.
VELOCITY MILES PER HOUR	Select measurement units. When units are flashing, the arrow keys switch between Kmh & Mph.
LANGUAGE ENGLISH	Change the display menu language. Select using arrow keys and press OK to set.
CAN BAUD RATE 500 KBit/Sec	Select the CAN BAUD RATE. Options available are 125Kbs, 250Kb/s, 500Kbps and 1Mbps. Note 500Kbps is the default VBOX baud rate.
NUM OF PARAMS FOUR	Change the number of parameters shown in the main screens. Use the arrow keys to select either two or four.
REPROG STATUS DISABLED	Press OK to enable/disable for firmware upgrades. After upgrade is complete, status must be manually disabled. If using a thermal printer, this must be disconnected before firmware upgrade status is enabled.
START SPEED 060	Select accel or decel test and set start & end speeds for each test. Arrow keys increase/decrease the value, OK key moves to next digit. Target distance can also be defined here.
RESET AVERAGE VEL & DISTANCE TRAVELLED	OK will reset Average Velocity and the Distance Travelled. Note, Average Velocity is calculated from VBOX turn on and not from first movement.
BEEP AT VELOCITY 000	Define a velocity at which the MFD will momentarily beep.
SHOW BRAKETRIGGER ENABLED	Enable/disable on screen Brake Trigger message when the Brake Trigger is pressed.
FREEZE RESULTS DISABLED	When enabled, the display will display test results until another test is completed.
DRIVE BY NOISE DISTANCE 1	Define up to four distances for drive by noise testing. When these are crossed the display will beep.

Example of parameter selection

1. Main screen displayed – press OK.

2. Press right arrow so the display shows ‘SET PARAMETERS’. Press OK.

3. Press right arrow until the parameter to be altered is displayed. Press OK.

4. Using right arrow, select either general, brake, accel or CAN parameters. Press OK to select.

5. The code to be changed should now be flashing. Use the arrow key to select the new parameter. Press OK to set. The MF display will beep to indicate setting change has been successful.

6. Press the left arrow button until the display shows BACK. Press OK. Repeat this step once more to return to the main screen.

Target set-up menu

Press OK to change the target parameter. Press the right arrow key to choose parameter group, once selected, arrow keys will cycle through list. Press OK to store the setting for the target parameter.

Here the target buzzer can be turned on or off. The target buzzer sounds when the target screen is shown and the target value is exceeded. The further the value goes over the target the louder the buzzer becomes.

To set, use the arrow keys to set each digit and the OK key to move onto the next digit. To set a negative value the '-'sign must be in the left most digit.

Set using same method as target minimum. The target value will be at 50% of the full scale. I.e. if a minimum value of 0 is entered and a target value of 20, the maximum value will auto set to 40.

Lap timing menu

The setup method is the same as the other screens except from here you can only select lap parameters. (Table 2)

In lap setup, start/finish and split lines can be set. Use the arrow keys to scroll to which line you wish to set, drive over the line position and press OK.

To view lap times, press OK. Use arrow keys to move through the list. When the start / finish line is crossed, a new lap is stored. Lap times are saved when the MFD is turned off. Power up resets the lap counter to lap 1, so any previously stored times will be overwritten when new laps are completed.

Press OK to print out the lap times for the last 20 laps stored in EEPROM.

Clear all saved lap times and reset lap counter to lap 1. On power up the lap index is reset but old lap times are not cleared to allow old lap times to be viewed after the event.

Press OK to clear all start / finish and split lines stored in memory.

Change whether split time is time from start / finish line (ON) or time from previous split point (OFF).

Change whether digital output pulses or toggles when crossing a start / finish split line.

Press OK to reset average lap time and lap count.

Lap timing parameters (table 2)

Code	Name	Units	Code	Name	Units
TL	Best lap time	Seconds	**S2**	Split 2 time	Seconds
LL	Last lap time	Seconds	**V2**	Velocity at split 2	Km/h or Mph
LS	Last Split Time	Seconds	**S3**	Split 3 time	Seconds
SV	Vel @ Last Split	Km/h or Mph	**V3**	Velocity at split 3	Km/h or Mph
LD	Lap Count	NA	**S4**	Split 4 time	Seconds
AL	Average Lap Time	Seconds	**V4**	Velocity at split 4	Km/h or Mph
VL	Velocity	Km/h or Mph	**S5**	Split 5 time	Seconds
LT	Lap Time	Seconds	**V5**	Velocity at split 5	Km/h or Mph
V0	Velocity at start / finish line	Km/h or Mph	**S6**	Split 6 time	Seconds
S1	Split 1 time	Seconds	**V6**	Velocity at split 6	Km/h or Mph
V1	Velocity at split 1	Km/h or Mph			

Pre-set test screens

The eight pre-set test screens allow the user to set up eight individual test profiles that can be accessed directly and quickly when testing a vehicle. The test that is displayed on the screen will be the test that is being conducted. At the end of each test the time and distance for the test is displayed and printed on a thermal printer if connected. The results of the test are also output on the CAN bus.

When you scroll to a new test the test name and start and end conditions are momentarily displayed, then the screen shows three parameters, Velocity, Time and Distance.

Pre test setup

From any one of the eight Pre-set Test screens press OK to enter the Set up screens for the Pre-set test.

CLEAR CURRENT	Press OK to clear the current results of this Pre-set test.
CLEAR ALL	Press OK to clear the results from all of the Pre-set tests.
PRINT RESULTS	Press OK to print all of the results from all of the Pre-set tests on a Thermal Printer connected to the serial port of the MFD.
T1: TEST 1 OK TO EDIT	Press OK to enter the general Pre-set test setup screens.
BACK	Press OK to return to the main menu

Entering the Setup menu from any of the pre-set tests will enter the general setup menu from which each of the pre-set tests can be configured. The Pre-set test numbers are shown on the screen, use the arrow buttons to scroll to the Pre-set screen you wish to edit then press OK to edit the test details.

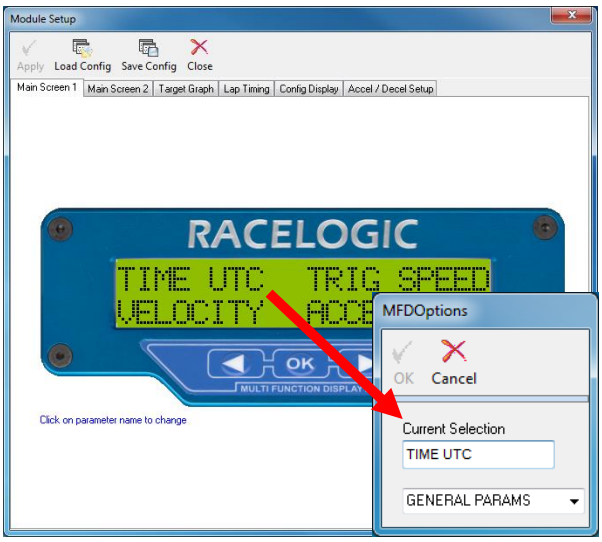
TEST NAME TEST 1	Use the left and right arrow keys to scroll through an alphanumeric list, then press OK to confirm and proceed to the next character, up to 10 characters.
TRIGGER DISABLED	Press OK choose between ENABLED and DISABLED. With ENABLED selected all tests will start with a brake trigger event.
START SPEED 000	Press OK to edit the Start speed for the test
END SPEED 000	Press OK to edit the End speed for the test.
DISTANCE 00000	Press OK to edit the distance over which the test should be timed.
BACK	Press OK to return to the main menu

MFD setup using VBOX Tools software

VBOX Tools software can be used to be setup MF displays remotely. When connected to a VBOX the MFD is recognised by the VBOX and a MFD tab appears in VBOX setup.

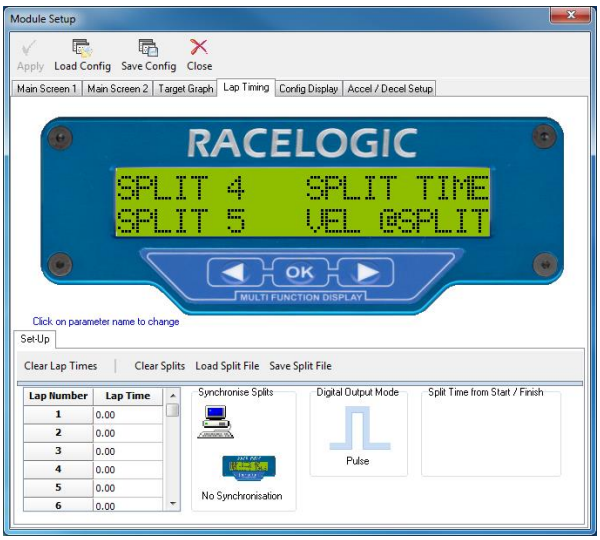
Clicking on the image of the MFD logo in the tab in Multifunction Display tab will bring up a set up window.

From within this window all of the functions and display parameters of the MFD can be set. To change any of the displays parameters, click on a title and a new window appears allowing the selection to be changed.



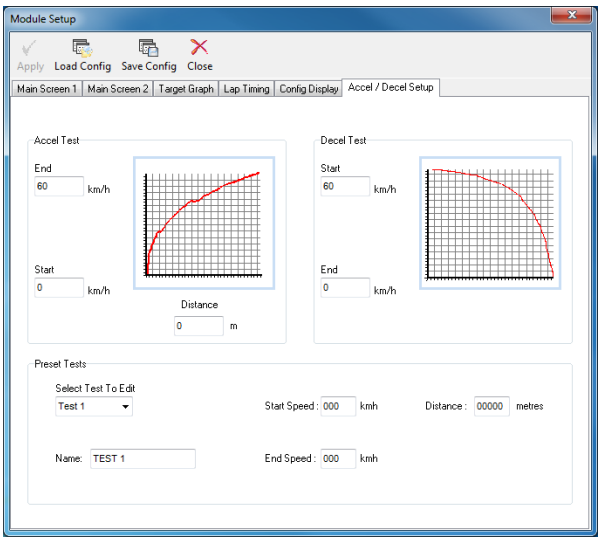
The image on the right shows the setup screen for Lap Timing functions of the MFD.

Note that from the Lap Timing setup page Lap and Split positions can be downloaded from or uploaded to the VBOX.



Accel/decel test setup

From within this page the start and end criteria for the Accel and Decel tests can be set. These Accel and Decel tests run concurrently when either of the Main Screens are displayed.



Thermal printer

The printer contains an integral re-chargeable battery pack. Connect the printer to the serial port of the MFD and ensure that the battery pack is fully charged. Although the battery pack in the printer is trickle-charged while connected to the MFD it is recommended that the battery is fully charged before use using the mains charger supplied. When the MFD is powered up the printer should also automatically power up. If the printer does not power up press the green button above the LED. The printer will print acceleration time results, deceleration time results, time to set distance from stand still, velocity at set distance from stand still, brake test results, time at split/start/finish line, velocity at split/start/finish line and old lap times.

To print old lap times (laps 1 – 20) go into the lap timing menu and find the option 'PRINT LAP TIMES' press OK to print.
On completion of an acceleration / deceleration test the time taken and start/end speeds will be printed automatically.
After travelling the set distance (as set in the ACCEL TEST SETUP option of the CONFIG DISPLAY menu the time taken to travel this distance and the velocity at this point will automatically be printed.

On completion of a brake test using a trigger the following results will be printed

- Speed at Trigger
- Distance from trigger
- Time from trigger
- Peak deceleration
- Average deceleration
- MFDD
- Corrected distance from trigger

Every time you pass over a set point (start/finish/split line) the time and velocity will be printed automatically.

Note: - when doing lap timing set the end speed for the acceleration test and start speed of deceleration test to a value you will attain (i.e. 900) otherwise every time you have a valid test the results will be printed out along with the lap timing results which can be confusing.

Loading paper

Paper rolls must be 57.5 ± 0.5mm wide, 36mm maximum diameter and have the thermally sensitive coating on the outside.

Discard a few turns in case they have been damaged or have glue on. Slide the Lid release button forwards until the Lid springs open. Simply insert the paper roll into the printer, close the Lid and the paper is loaded.

Pressing the paper feed button should advance the paper at 50mm per second.

Check that the paper still advances properly, and tear off any excess by pulling the paper sharply towards you across the serrated edges.

LED indicators

The LED indicator at the front of the printer has a number of colour combinations, which repeat in up to a 4-phase pattern to provide status information.

Generally, if the LED is flashing on and off it indicates that the printer is running from a battery pack; steady illumination means that the battery is charging. Green confirms that all is normal; orange advises that the paper is low or the printer is in spooling mode; red warns of a low battery. No light indicates that the unit is in sleep mode, has a flat battery or has no battery fitted.

Pattern				Battery	Paper	Buffer
Green				Charging	OK	Normal
Green	Orange	Green	Orange	Charging	Low	Normal
Orange				Charging	*	Spooling
Green	Off	Green	Off	Running	OK	Normal
Green	Off	Orange	Off	Running	Low	Normal
Orange	Off	Orange	Off	Running	*	Spooling
Red	Off	Red	Off	Low	OK	Normal
Red	Off	Orange	Off	Low	Low	Spooling
No light				Flat, or in sleep mode		

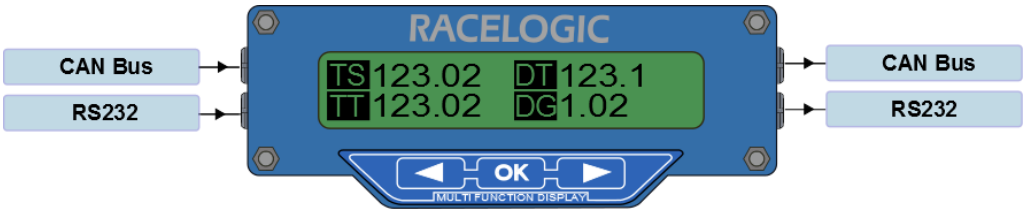
CAN output

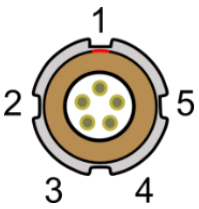
The MFD has a CAN output which is present on the two upper 5-way connectors.
Data format: Motorola; Baud rate: 500Kb/s.

Format	Motorola						
ID**	Data Bytes						
	1	2	3	4	5	6	7	8
0x500	1 2 Un-used	(3) Trigger_Speed		(4) Trigger_Distance				Unused
0x501	(5) Time_from_Trigger				(6) Peak_Decel		(7) Average_Decel	
0x502	Unused	(8) MFDD		(9) Corrected_Dist				Unused
0x503	Unused	(10) Start_Speed		(11) Test_Time				Unused
0x504	Unused	(12) End Speed		(13) Distance_Travelled				Unused
0x505	Unused	(14) Start_Speed		(15) Test_Time				Unused
0x506	Unused	(16) End_Speed		(17) Distance_Travelled				Unused
0x507	Unused	(18) Target_Distance				(19) Velocity_at_Target_Dis		Unused
0x508	Unused	(20) Time_To_Complete_Test				Unused		

(1) Distance units indication, single bit, 0 = Feet 1 = Meters.
(2) Velocity units indication, single bit, 0 = MPH 1 = KPH.
(3) Velocity when brake trigger activated, 0.01 kph/mph per bit.
(4) Distance travelled from activation of brake trigger, 0.01 m/ft per bit.
(5) Time from brake trigger being activated until rest, 0.01 seconds per bit.
(6) Maximum deceleration achieved during brake test, 0.001 G per per bit.
(7) Average deceleration, sum of the deceleration value at every sample divided by the number of samples, 0.001 G per bit.
(8) MFDD, 0.01 per bit.
(9) Corrected distance from brake trigger to rest - distance from start speed to nearest 10kph/mph, 0.01 m/ft per bit.
(10) Start speed for accel test, 1 kph/mph per bit.
(11) Time taken to go from start speed to end speed for accel tests, 0.01 seconds per bit.
(12) End speed for accel test, 1 kph/mph per bit.
(13) Distance travelled during accel test, 0.01 m/ft per bit.
(14) Start speed for decel test, 1 kph/mph per bit.
(15) Time taken to go from start speed to end speed for decel tests, 0.01 seconds per bit.
(16) End speed for decel test, 1 kph/mph per bit.
(17) Distance travelled during decel test, 0.01 m/ft per bit.
(18) Target distance for test, 1 m/ft per bit.
(19) Velocity travelling upon reaching target distance, 0.1 kph/mph per bit.
(20) Time taken to reach target distance and complete test, 0.1 seconds per bit.

Connection data





4 x 5 pin LEMO sockets

CAN Connectors (Top Left & Top Right)

Pin	I/O	Function
1	O	RxD, Serial Data Transmit – COM2
2	-	-
3	I/O	CAN High
4	I/O	CAN Low
5	O	+12 V Power
Chassis		Ground

RS232 Connectors (Bottom Left & Bottom Right)

Pin	I/O	Function	Note
1	O	TxD, Serial Data Transmit – COM1	Firmware upgrade
2	I	RxD, Serial Data Receive – COM1	Firmware upgrade
3	O	Digital Output 1	Lap timing pulse/toggle
4	O	Digital Output 2	Unused
5	O	+12 V Power	
Chassis		Ground	

Mounting

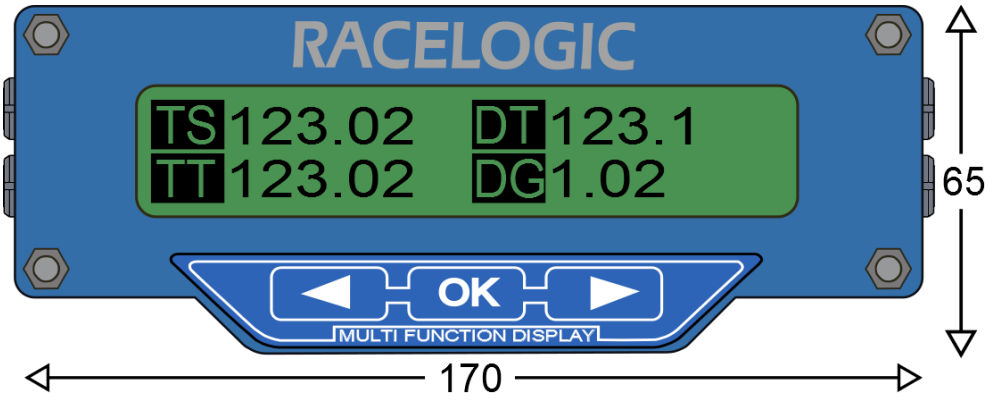
The MF display is supplied with a windscreen suction mount. This can be connected using the ¼ 20 fitting on the rear side of the display. Make sure the hole on the rear of the display that is used for the buzzer is not obstructed.

Firmware upgrade

MFD firmware can be downloaded from the support section of the velocitybox website.

Supply power to the MFD – e.g. via the CAN port on a VBOX. Before firmware can be updated the 'REPROG STATUS' of the display must be enabled through the 'CONFIG DISPLAY' menu. Connect a RLCAB001 RS232 cable from a PC serial port to either of the serial ports on the MFD. When the display is connected and setup, double click on the firmware file to start the upgrade. Racelogic Upgrader software should be launched, simply select the correct COM port the MFD is connected to (this can be checked in device manager) and click upgrade to begin. When the upgrade is complete, make sure to power cycle the MFD to complete the process.

Specifications



DATA	
Height	**65mm / 2.56”**
Width	**170mm / 6.69”**
Depth	**35mm / 1.37”**
Mounting	**Either Velcro mounting suction cups or ¼ - 20 screw mounting**
Weight	**Approx 400g / 14.1oz**
Display	**20 x 2 Line LCD with contrast control and adjustable backlight**
Operating	**0° to +60°**
Storage	**-40° to +85°**

Contact information

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