WinTAX4

Data Analysis PC Software

DESCRIPTION

Marelli WinTAX4 is a complete suite of analysis software developed for the most advanced levels of motorsport.

WinTAX4 is currently without a doubt one of the best PC applications for data acquisition and analysis in Motorsport competition.

It is the result of more than 20 years of continuous evolution and close partnership with the top teams in F1, WEC, Formula E, ELMS, WRC, WTCC, DTM, MotoGP, Superbike, as well as event organizers such as FIA, ACO and FOM.

When combined with Marelli's ground-breaking Telemetry System, WinTAX4 provides highly-advanced real time analysis functions as well as a standard interface for team proprietary software applications.

Via a radio link, vehicles can even be monitored from remote base stations.

With an Ethernet cable link, the telemetry information can be used either in the laboratory or on the dyno.
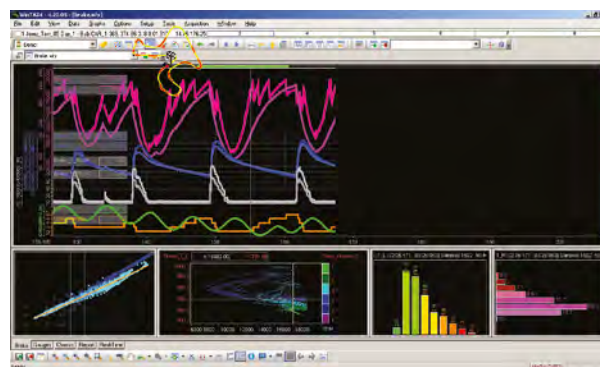
WinTAX is equally suitable as a data analysis software for third-party telemetry systems. Its extra modules allow you to decode uploaded data or live telemetry from any external Data logger or data format.

The integrated CAN-line analyser with DBC file support is the perfect integrated instrument for the live monitoring of either electronic devices or full car diagnostics via the OBD plug.

Offering data protection, add-on modules and dedicated support for the development of innovative and integrated solutions, WinTAX4, Marelli's flagship data management tool, is the perfect solution for the most ambitious development programmes.

Quick, easy to use, fully customisable
WinTAX4 is your essential tool for both the race track and the dyno
Thanks to its open nature WinTAX4 is the ideal tool for the data analysis of third-party systems

MAIN FEATURES

- WinTAX4 is compatible with all the latest Microsoft Operating systems such as Windows® 7 32/64 bit, Windows® 8 32/64 bit and Windows® 10 32/64 bit.

- A wide range of analysis and reporting windows: time/distance line, 2d Scatter, 3d Scatter, Bar graph, Frequency, Histogram, Trends, lap-based Report, sector-based Report, Events, Alarms, Pop-ups, Diagnostics, Numeric data, Gauges, Bitmap, Notes…

- Support for data acquisition and elaboration at up to 100 kHz. Real time CAN acquisition and USB/Flash acquisition support.

- High performance and reliable data storage system with encryption mechanisms. Support for any kind of data architecture via customizable Data Plugins.

- Circuit data-mapping and analysis of vehicle GPS trajectories with the use of satellite images (Google Earth®, Google Maps®), with an integrated designer.

- Real time computation engine with full function libraries and an integrated debug instrument. Available functions can be extended by the user via external DLLs.

- Full Customisation: layouts, graphs, mathematical libraries, keyboard shortcuts, User privileges, colours schemes can all be tailored to suit user preferences or to adapt to the team environment.
All custom settings can be shared between users or forced by the team administrator. Global & Local setting levels.

- Open to external commercial tools such as Excel®, Matlab®, including Import/Export of textual data from/to any proprietary format.

- Data-Video synchronisation, high-speed camera support with up to nanosecond precision.

- Support of Vector® MDF - ASAM standard data format and Vector® BLF Logging File.

- OLE/Automation inter-process communication protocol supported via VBScript® and JScript®.

- Interfaced with third-party data systems via dedicated and documented APIs, complete with examples.

- ECU virtualisation: PC-run Simulink-based model of the on-board ECU.

- Car modelling and simulation ➞ interface with VI-Grade®, Cruden®, ChassisSim® and rFactor®

- Multicast real time telemetry (radio & dyno) data distribution over TCP/IP network. Multi-vehicle display and simultaneous analysis of up to 64 devices with "pause" and "roll-back" features.

- Multi-language user interface and extensive Help with context-sensitive links: English, French, German, Italian, Japanese.

- Multi-installation which can be managed either with USB key or password protection. Master/Satellite protection paradigm support.

- Execution with standard user privileges.

- Support for 4k monitor displays.

- Dedicated Expert Support.

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WinTAX4 analysis windows

The main screen area of WinTAX4 contains graphic or alphanumeric analysis windows in which logged data can be represented in a variety of different ways. Each User can save commonly-used combinations of analysis windows as Layouts, which allow the waveforms to be organised into logical screen compartments.
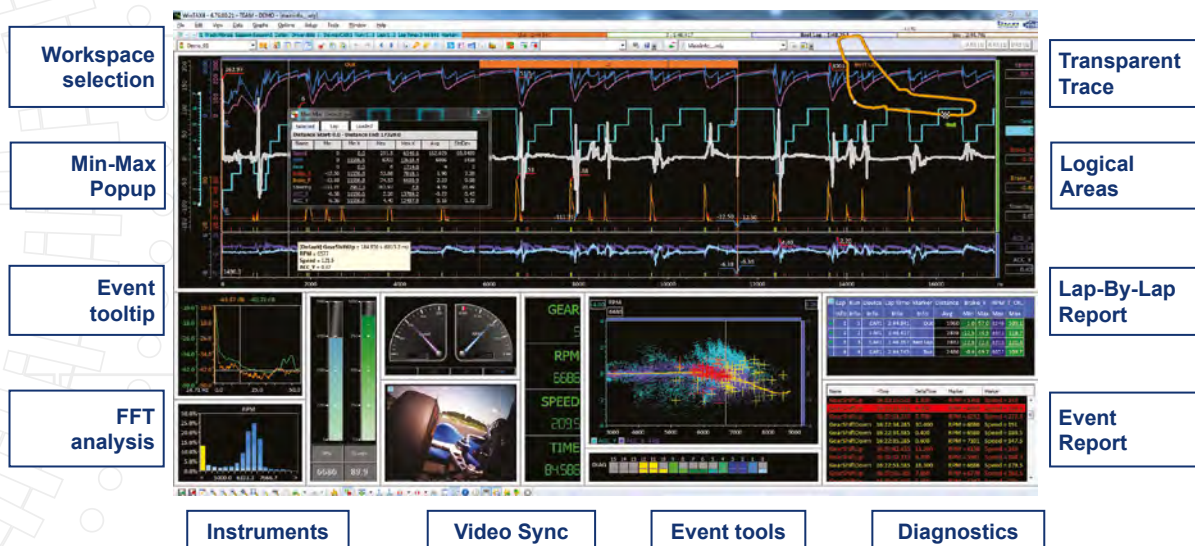All displays are linked so they can all show the same point of interest at the same time.

Channel Parameters define global settings for all channels e.g. colour, scale, display format, Offset&Gain, Alarm, Filters…

Colour schemes for the overall appearance of WinTAX4 may be changed to suit User preferences or ambient light conditions (e.g. Pitwall, Garage etc.).

Global settings can be modified locally to each window making WinTAX4 completely configurable and adaptable to user requirements. For each window: changes can be made to colours, styles, fonts, scales, filters, channel position…

User-configurable accelerator keys make WinTAX4 easy and fast to use. Import & Export of WinTAX4 settings allows users to share setups.

Workspace selection		Transparent Trace
Min-Max Popup		Logical Areas
Event tooltip		Lap-By-Lap Report
FFT analysis		Event Report

Instruments	Video Sync	Event tools	Diagnostics

Graph

Shows channels as waveforms against time, absolute time, distance or revolutions.

- Compare data against distance or GPS position
- Compare data in difference or average mode
- Compare offline and real time data
- Controls for channel layouts, lap offset adjustment, navigation and data analysis
- Logical Areas with quick resize, keyboard show/hide
- Show time variance between compared laps
- Fixed Zoom, Box Zoom, Pan
- Copy & Paste elements and styles from/to other waveforms/ displays
- Display of events, alarms, pop-ups, delta values, slopes
- Display of Min/Max values into graphs, Min/Max Peak-to-peak
- Hide channels, blink channels, Multi-coloured channels
- Open data in Excel® or Matlab®
- Notations and free drawing
- Event-base scripting
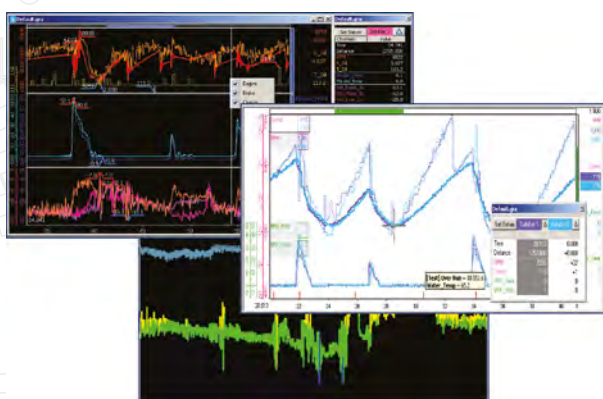
WinTAX4 Graph is capable of displaying finish line as well as sector separation.

By using the panning feature, data can be temporarily shifted: channel vs channel, lap vs lap, channel vs lap.

2D-3D Scatter (XY, XYZ)

- Shows the relationship of pairs of parameters in a cross plot
- Advanced 2d, 3d waveforms with multi-axes representation (x & y), best-fit curve, data gating, logarithmic scales, hide channels
- Link between XY plots and Graphs and vice versa
- Data can be exported in an Excel® spreadsheet just by mouse right click
- Multi best fit representation on the 2D display (XY)→ e.g. separated best fit line of Speed versus Engine revolution for each Gear number. Display of best-fit coefficients
- Generate math channel formula from Best Fit equation
- 3D view, Smooth view, Density view
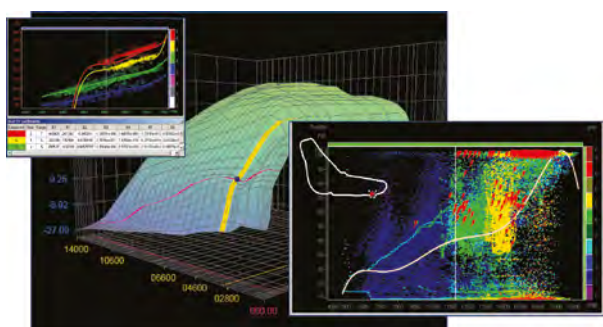
Circuit & Google Earth Maps

WinTAX4 allows you to calculate and display the trajectories of the vehicles along the track. The circuit map is auto-created from basic logged channels such as acceleration, speed and distance or using GPS coordinates.

Track report channels, useful to identify for example brakes and acceleration areas, can be displayed over Google Earth background image as gradients of colours.

Track values: values of channels are displayed together with cursor when moving.
Sections report channels show statistics in a graphic format along the circuit split areas

Measurement functionality is available on Track displays to show:

- flight distance between two points
- circuit distance between two points → distance travelled on track.
- circuit distance comparison among trajectories → comparison of travelled distance (CAR/Driver versus another CAR/Driver; CAR/Driver versus itself)

WinTAX4 designed for the Boat applications allows to define the race area and the buoy positioning & style
Google Earth images can be used directly in WinTAX4 through standard commands such as zoom, pan, rotate and fine calibration.

Lap-by-Lap Reports - Section Time Reports - Trend

Channel reports allow users to view statistical summaries across track sections (or laps, runs, sessions) for any number of configured channels. Statistical functions include min, max, average, change and standard deviation as well as section start and end values.

- Display absolute min, absolute max
- Background Colour Level → colour percentage of cells w.r.t. value
- Display conditional alarms and warning colours
- Trend Display allowing graph visualization
- Lap Filter based on main lap properties

Sector-analysis shows sector time comparison with ideal and rolling lap computation.

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On-Demand virtual channels allow users to enter maths equations for quick data inspection.

Comparison functions are supported both in Lap Report and Trend window so that you can calculate and compare statistics of more than one vehicle at the same time.

Histograms, Diagnostics, Instruments, GG
Histograms show the distribution of a parameter and support:

• Horizontal or vertical layout
• Bars or Line display
• Time or percentage
• 3D, cumulative mode, comparison
• Colour Z axis channel

Diagnostics shows the status of bit-mapped channels bit per bit

• Multiplexed bit-mapped diagnostic
• Single-Bit value interpretation
• Labels, colours, latch-up times for each bit

The Steering Wheel is dedicated to steered angle value analysis and supports both "Clockwise" and "Counter clockwise" modes.
Beginning with lateral and longitudinal acceleration, the *GG acceleration window displays* the circle of accelerations.

The overall appearance of the instruments is fully configurable to suit your preferences or to adjust the display to different brightness scenarios (e.g. pit-lane, indoor garage etc.).

All instrument parts are configurable: scale, font, colours, hand, alarm, layout, ticks, as well as units and work in post processing and real time modes.

FFT Analysis
The power spectral density analysis functions are based on the Fast Fourier Transform (FFT) algorithm.

Windowing (Rectangular, Hanning, Hamming and Blackman/Harris) allows the reduction of both leakage and discontinuity effects for the time interval limits in the power spectrum computation.
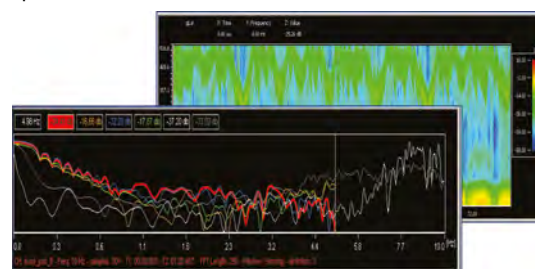

In addition to power spectrum density, the following functions are also included:

• Display of channel Phase & Module: calculation is based on the Fast Fourier Transform (FFT) algorithm
• Display of channel Power Spectrum Density (PSD)
• Display of channel Spectrogram: colour-based visualization of the evolution of power spectrum through time

Value and Picture display
The Condition Light window can be used to highlight conditions of the data with clear and immediate output. For example an alarm can be displayed with a custom blinking colour and custom text.
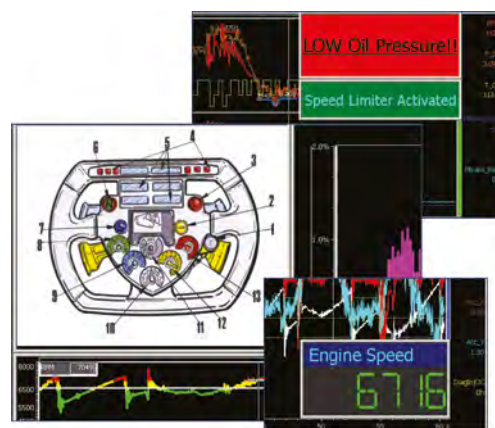

The Bitmap Window allows you to insert one or more images into WinTAX layouts. Standard Jpeg, Bmp, PNG and GIF files are supported.

The Display Value window allows you to display a channel value with a clear graphic format.
The window is fully configurable in terms of colour, font (7-segment included) and text and also supports enum values and alarms.

Data Preview

Via the Data Preview window, the user can see an overview of complete session data while browsing specific time segments without the need to have all the data in the memory.
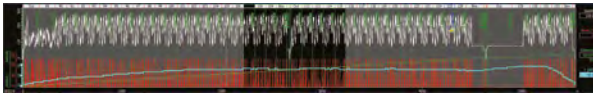
On-Demand virtual channels allow users to enter maths equations for quick data inspection.

Data preview allows measurement display organisation features and allows quick data loading via the data selection bar.

Playback Function

Replay function for the playback of the logged data in all WinTAX waveforms with the option to Play (with multiple play speeds), Pause, Loop, Rewind.

Run Time Analysis

VCH Math Channels

A graphical editor, with advanced features (such as find & replace, auto-compose, tooltips, import/export from CSV), allows complex math expressions to be constructed quickly with logged Data.
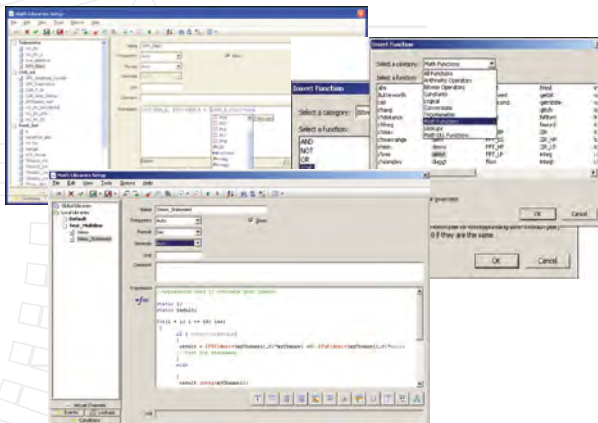
Virtual channels can be organised into libraries which can be shared between Users.

Debug Virtual Channels parses complex formulae and allows you to explore them graphically in order to find errors.

The statement formats available in WinTAX4 are:
• Local and global variables
• Control Flow statements (conditionals and iterations)
• Variables and relational operators

The main functions available in WinTAX4 are:
• Trigonometric, Boolean, Math and statistic operators
• Digital Low-Pass & High-Pass filters, IIR, Butterworth, FTT, Run Average filters
• Digital Filter up to 4th order: digital filter with customisable filter coefficients, allowing you to design Low, High, Pass band and Band stop filters
• Unlimited nested VCH formulae works for real time and post-processing analysis
• Global & Local libraries levels
• On-Demand VCH expression: as in Microsoft Excel®, WinTAX4 allows you to define temporary maths channels directly in graphs with simple syntax, e.g. A_Y_filtered = Filter (A_Y, 1 Hz)

• Custom advanced maths formulae can be generated by external applications through the optional MathDLL plug-in

Fast maths processing: maths channels are only calculated if required, this ensures excellent performances.

Events & Alarms

Advanced checks (Events & Alarms) for automated Engine & Chassis monitoring can be displayed in waveforms as graph symbols, with multiline reports and popups in post-processing / real time.

Events are basically changes in status of a variable from False to True or vice versa. The variable can be a logged channel, such as a diagnostic or an error flag, or a derived channel which has two meaningful states (e.g. a Boolean condition).
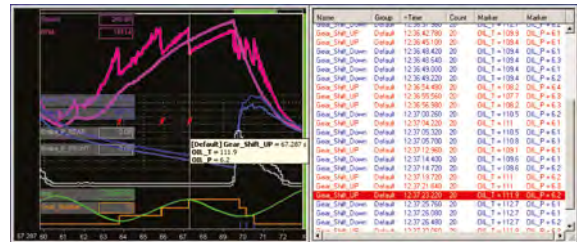
A variety of styles and options can be configured for individual event types.

In defining each event it is possible to search when the event has occurred. A time offset parameter is used to place the cursor and centre the zoom at a predefined time either before or after the event.

• Events can be displayed either as icons on graphs or multiline reports
• It is possible to set up a specific layout which will open when the event is detected, or a zoom range that is automatically applied when focusing
• Values of other channels can also be displayed within event occurrences. WinTAX can compute min, max and average statistic value in the selected time range
• Preconfigured Events like "Gear Change" are also available in WinTAX4

Real time Telemetry

WinTAX4 includes modules for displaying and recording telemetry either from a radio or wire link (Dyno cable telemetry).

WinTAX4 supports both wide band and narrow band radio telemetry. Radio telemetry can be distributed to the garage network via the WinTAX Telemetry Server (WTS) to an unlimited number of clients. Telemetry can also be replayed for debugging purposes.

• Each waveform can switch from post-processing to real time mode through a quickly-configurable shortcut
• Each Layout can contain post and real time waveforms
• Advanced "real time freeze" & and "real time compare" utilities
• Ability to backfile radio dropout data (fifo and lifo) and live data simultaneously

Communication with 3rd party applications

OLE / Automaton

WinTAX4 provides powerful possibilities for interfacing with external applications via Automation Server technology (formerly OLE Automation Server).

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In this way WinTAX4 can be run and controlled by any program which has the characteristics of Automation controller and vice versa. Examples of applications which make excellent use of Automation are Microsoft Excel®, Access®, Matlab®, Simulink® and many others written in C#, Visual Basic or Visual C++.

It is possible, for example, to open a WinTAX4 window from an Excel spreadsheet, analyse information via Matlab or run print or copy commands directly from an application written in Visual Basic.

Matlab & Simulink Integration
WinTAX4 provides powerful possibilities for interfacing with Matlab and Simulink.

Just a few source code lines in WinTAX4 allow the content of the Matlab® workspace to be displayed without loading logged laps ➞ WinTAX4 becomes a Matlab displayer.

The logged telemetry data can be also exported as Matlab sessions and Matlab files can be imported into WinTAX4 to be displayed and analysed against logged parameters.

Management of multi frequency MAT files: WinTAX4 can import/export MAT binary files which contain arrays with different logging rates.

Import & Export ASCII
WinTAX4 provides the possibility to import and export textual data (e.g. CSV, ASCII, and XLS) saved in any proprietary formats.

A custom wizard, as in Excel®, interprets the text files with a run-time preview. The User can select, for example, column data type, column separators, channel frequencies, and much more.


Import & Export Matlab
WinTAX4 provides the possibility to import and export Matlab® data (mat files).

An internal wizard, as for ASCII Import & Export, interprets the Matlab® files with a run-time preview. The import multi files option permits large data archives from other tools to be quickly converted.

Video Management

WinTAX4 includes an integrated video function. This feature allows a video file to be linked to the logged data from a vehicle and displayed along with the rest of data within WinTAX4 with nanosecond precision.
Video produced from high speed cameras (400fps or more) allow very accurate analysis of events of interest and can be used, for example, for medical/safety purposes.
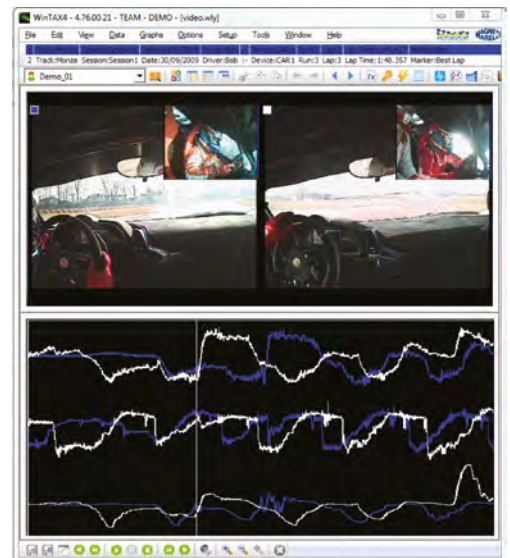
Once the data and video are loaded, overlaying laps also overlays the video files. It is then possible to see how racing lines differ from lap to lap, or how driver technique affects lap times.
• Compare laps and videos
• The most common video formats/containers such as MPEG-2, MPEG-4, H264, TS, AVI are supported
• Runtime video rotation of -90°, +90° or +180° can be applied in the event of special camera installation
• Manual video sync adjustment

Data Acquisition from CAN Lines

WinTAX has a function that allows direct acquisition of data from CAN lines.
A powerful graphical editor allows you to define the structure of the CAN packets to be acquired.
Simultaneous acquisition from up to four CAN lines.
• Multiplexed signal support
• CAN Signal Database storage for load/save
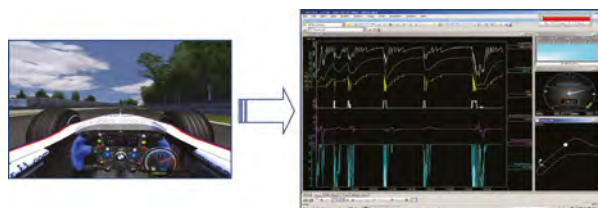• Import DBC files for automatic CAN packet definition

- Supported for most commercial PC CAN cards such as Vector, Peak, and CanDo.
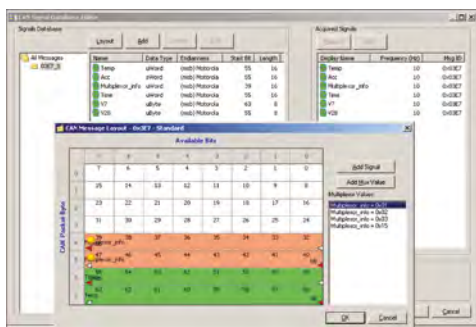
Product Extensions

A complete suite of add-on modules increases the potential of WinTAX4, and the API interfaces allow WinTAX4 to be used in conjunction with external applications or third-party telemetry systems.

WTS: WinTAX4 Telemetry Server

WTS is the real time telemetry data distribution infrastructure. The system efficiently and reliably distributes real time live telemetry fluxes over the garage network to an unlimited number of PC clients.

WTS distributes all "off-car" setup files, synchronising all PCs to the same session and vehicle setup.
WTS can distribute simulated data as well as car data.

WTS provides an option for simultaneously activating more than one Server within the same network. In this scenario it is therefore possible, for example, to configure one WTS Server to manage the data streams from the first vehicle and the other Server to manage data streams relating to the second vehicle or to use a second server as backup.

A remarkably-intuitive user interface and low system resources are the main characteristics of this WinTAX4 add-on.

VMS: ECU Virtualization

Simulink-based models of the on-board ECU running on the PC allow the user to simulate or compare controls and strategies in off-line mode against logged data.
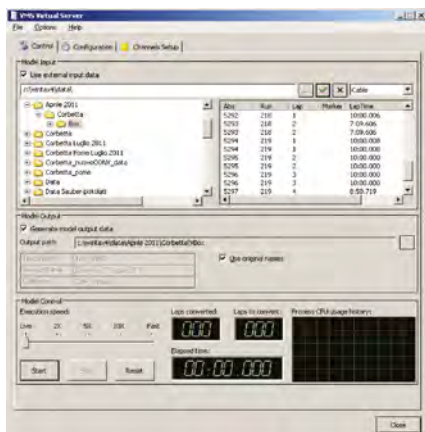
The VMS Server module, the WinTAX4 add-on, is the dedicated Marelli software for running ECU Simulink® models.
The Simulink® model can be executed in post processing, generating a set of simulated data that is treated by WinTAX4 as standard logged data (e.g. comparable with logged car data).

Several operational modes, such as play speed, allow you to simulate cases of real use.

rFactor: Vehicle & Driver Simulator integration

rFactor is probably one of the world's most advanced and well-known racing simulators. It is used by Formula 1 teams both for driver training and driver capability evaluation.

The real time result of rFactor can be viewed and analysed in WinTAX4. This allows team engineers, mechanics and drivers to analyse every parameter of the car's performance live.

While the driver is on the Simulator, the data are transmitted via Ethernet to several WinTAX4 workstations for analysing.

WinTAX4 APIs – Plug-Ins

TelDataX

WinTAX4 data access library: allows the reading of WinTAX4 data from 3rd party applications. It includes a WinTAX4 computation engine to access Virtual Channels and user Math DLL Plugins.

TelDataZTX

WinTAX4 data creation library: allows the generation of WinTAX4 data from 3rd party applications. It supports writing the complete data context and vehicle setup.

TelDSTClient

Library for the reading of the WinTAX4 real time Telemetry stream by 3rd party applications. By using this library, the WinTAX4 Data stream can be pushed into a 3rd party system.

TelRTClient

Plug-In Library for the generation of a WinTAX4 real time Telemetry stream from 3rd party applications. By using this library, a 3rd party system data stream can be pushed into WinTAX4.

MathDLL

External math channel definition: it is possible to enhance the current math functions (e.g. SIN, COS, INTEG, etc.) available in WinTAX4 with a series of "Custom Math Functions" with an unlimited number of parameters and no limits regarding programming language.

DataBrowser Plug-In

This enables WinTAX4 to display any kind of data such as NoSQL JSON databases or custom Matlab formats.

The DataBrowser plug-in allows you to transfer generic data into WinTAX4 with the same performance as its own data format, but at the same time in an extremely flexible and scalable way.

The DataBrowser UI can be driven from any external application or can be completely by-passed.

**MARELLI
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WinTAX4 License Levels

WinTAX4 is provided with four different licensing levels, each offering different functions, ranging from JUNIOR level up to the TEAM and PRO formula used by professional data analysts working in Motorsport.

- JUNIOR is a simple WintAX4 version with basic features and no protection
- USER is a more complete version, USB key protected; it can optionally include real time acquisition in a dedicated version – usually for teams with a limited number of users
- TEAM provides powerful features with personal data encryption ensuring confidentiality – usually for a structured team
- PRO includes all the TEAM features plus real time acquisition

	JUNIOR	USER	TEAM	PRO
Licensing & Main Features				
License	Multi Workstation	Single Workstation	Multi Workstation	Multi Workstation
Protection		USB Key	USB Key or Password	USB Key or Password
Data encryption	Shared	Shared	Private	Private
Multi Language	English Only	✔	✔	✔
Master/Satellite support			Optional	Optional
Analysis windows				
Graph	2 Graphs, 16 channels per Graph	Unlimited	Unlimited	Unlimited
XY	1 XY, 2 channels	Unlimited	Unlimited	Unlimited
XY advanced features			✔	✔
XYZ		✔	✔	✔
XYZ advanced features			✔	✔
Histogram	1 Histogram	✔	✔	✔
Track	Basic Track	✔	✔	✔
Compare / Multiple overlay	Max 2	✔	✔	✔
Lap Report	Basic, Single Lap	✔	✔	✔
Data Preview	✔	✔	✔	✔
Alarms	✔	✔	✔	✔
Compare – Difference		✔	✔	✔
Google Earth Maps		✔	✔	✔
Section Time Report		✔	✔	✔
Trend		✔	✔	✔
Diagnostics		✔	✔	✔
Gauge/Instrument		✔	✔	✔
Events		✔	✔	✔
Events – advanced			✔	✔
Power Spectrum Density		✔	✔	✔
PSD advanced			✔	✔
Video management		✔	✔	✔
Display Value/Bitmap/GG			✔	✔

	JUNIOR	USER	TEAM	PRO
Real Time analysis				
CAN Line Analyser			✔	✔
Dyno Ethernet Telemetry		Optional	Optional	✔
Real time Telemetry		Optional	Optional	✔
Real time Telemetry - Advanced			Optional	✔
Real time Maths Channels			Optional	✔
Maths analysis				
Maths Channels		✔	✔	✔
Maths Channel Statements			✔	✔
On-demand Maths Channels		✔	✔	✔
Lookup Table		✔	✔	✔
FFT – Run AVG Filters		✔	✔	✔
IIR – Digital Filters			✔	✔
Math plug-in - external Math Functions			Optional	Optional
Import & Export Data				
Export ASCII		✔	✔	✔
Import ASCII			✔	✔
Import/Export Matlab			✔	✔
Ole/Automation - Scripts			✔	✔
Object Control window			✔	✔
WinTAX4 APIs				
TelDataX – Read WinTAX4 data			Optional	Optional
TelDataZTX – Write WinTAX4 data			Optional	Optional
TelDSTClient – Read WinTAX4 stream			Optional	Optional
RT-PlugIn – Create WinTAX4 stream			Optional	Optional
Data plug-in – Make WinTAX4 read any data			Optional	Optional
rFactor plug-in for real time data			Optional	Optional
Product Extensions				
WinTAX4 Telemetry Server		Optional	Optional	✔
Virtual ECU Manager			Optional	✔
Services				
Software upgrades			✔	✔
Software assistance			✔	✔
Pay for Customizations			✔	✔