The New Concept of High Speed TOF-MS

- Extremely Compact Design
- High Sample Throughput
- Enhanced Sensitivity and Resolution

Master TOF Plus
Time of Flight GC/MS
A NEW CONCEPT OF HIGH SPEED TOF-MS
FOR THE LATEST GC TECHNIQUES’ GENERATION

WHEN PRODUCTIVITY IS THE NAME OF THE GAME, MASTER TOF-MS PLUS IS THE ANSWER

Productivity has become of vital importance in most modern laboratories. The automated and unattended processing of a larger number of samples per day is the real challenge to increase productivity and reduce cost/analysis. Additionally, Fast GC has resulted in a very effective way to address this challenge providing a significant decrease in the analysis time.

However, when a positive identification is mandatory and mass spectrometric detection is needed, Time of Flight Mass Spectrometry (TOF-MS) is the only technology capable of properly describing very narrow chromatographic peaks due to its fast acquisition rate, independently of the mass range of interest.

DANI Master TOF Plus MS detector performs the fastest acquisition rates (up to 1000 spectra/s) and the widest dynamic range (>10^5) available on the market.

DANI Master TOF Plus is now even more sensitive to match demanding analytical requirement. Approaching the SIM mode sensitivity of common quadrupoles, the new Master TOF Plus is extremely suitable to detect analytes at trace levels, keeping the additional benefits of the full mass spectra information always available.

These capabilities are offered in a truly affordable and extremely compact bench-top instrument. In combination with the Master GC, the system is the ideal solution for Fast GC and GCxGC analyses to obtain improved productivity and performance.
HIGH SAMPLE THROUGHPUT

The use of automated instrumentation and Fast GC methods is the right approach for modern laboratories to enhance their productivity, reducing the run time and increasing the accuracy and precision of their analyses. The Master TOF Plus Time of Flight GC/MS system fulfills all the stringent requirements that Fast GC imposes to the analytical instrumentation, including the fast heating and cooling rate of the GC oven, the high pressure limit of the gas control and, finally, the fast acquisition rate of the MS detector.

THE FASTEST MS DETECTION AVAILABLE ON THE MARKET

The Master TOF Plus provides an acquisition rate up to 30,000 native spectra/s offering the fastest MS detection available on the market, up to 1,000 saved-to-disk spectra/s. Such high speed of acquisition assures always the optimum number of data points required to correctly describe chromatographic peaks, even in case of a signal as fast as tens of milliseconds.

FAST DETECTION CAPABILITY OVER THE FULL MASS RANGE

In addition, the TOF-MS technology allows the fast detection capability over the full mass range: in fact, all the ions generated in the ion source are continuously pulsed into the analyzer and no filtering of selected masses is applied.

NO SPECTRAL SKewing EFFECT

The entire mass range is available independently on the acquisition speed and without any spectral skewing effect likely produced by scanning instruments during acquisition of fast transient signal.

EASY DATA HANDLING

In addition, the system offers an outstanding dynamic range with a linearity exceeding 5 orders of magnitude, remarkably reducing sample preparation steps, e.g. dilutions and concentrations, as well as the number of analyses.
In today’s world economy, even analytical laboratories have to deal with the increasing cost of their work environment; consequently, their choices are often restricted by a limited space.

For this reason, the compactness of the instrumentation is increasing in importance and manufacturers have to pay special attention to this aspect.

The New Master TOF Plus is still featuring the extremely compact design of the previous platform, continuing to be the smallest bench-top instrument of its class.

In a minimal benchspace, Master TOF Plus includes the baking pump thus providing a highly handy and noise-free instrument.

**EXTREMELY COMPACT DESIGN**

The simplicity of the Master TOF Plus design permits the user to easily access the ion source. Fast, uncomplicated, and efficient maintenance procedures can be carried out requiring just an Allen wrench and low labor input.

For extra convenience, the Master TOF Plus is equipped with a double filament assembly. In case of filament damage, the second filament can be used proceeding with the analyses without stopping the work schedule of the laboratory.

**EASY MAINTENANCE**

[www.instrument-solutions.com](http://www.instrument-solutions.com)
ENHANCED SENSITIVITY, RESOLUTION AND DYNAMIC RANGE

IMPROVED RESOLUTION

A very good resolution over 2000 (FWHM) is also achieved considering the short flight path. Any possible ion energy variation generated into the source, can be efficiently compensated through the orthogonal acceleration design, in which ions are accelerated in a pulsed mode into the flight tube perpendicularly to the primary continuous beam direction from the source. Besides, an efficient ion package refocusing is also assured by the action of the reflectron which acts as an electrical field mirror for flying ions, doubling the ions flight path.

Enhanced sensitivity is achieved through the use of differential pumping, enabling improved vacuum conditions. Therefore, an elongated ion mean free path is achieved, avoiding collision on their transit through the flight tube to the detector, increasing even more the transmission efficiency of the analyzer.

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The New Master TOF-MS Plus is able to approach the sensitivity of a quadrupole working in SIM mode, without compromising mass spectra information. Unlike scanning quadrupole MS, the TOF-MS technology allows to expand the detection and the identification to a larger number of unknown contaminants without the need of prior knowledge.

Besides, the mass spectra information always available, gives the user the possibility of data post-processing for the detection of upcoming new toxic compounds without the need of re-injection, cutting additional work and higher costs.

**EXTENDED DYNAMIC RANGE**

Extended dynamic range over five orders of magnitude are assured by the discrete dynode Electron Multiplier used as detector. The robustness of the detector and the wide voltage operating range permits longer detector lifetime working at constant gain.

**NOT ONLY TARGET COMPOUNDS BUT ALSO YET-TO-BE-DISCOVERED CONTAMINANTS AT YOUR FINGERTIP**

Dynamic Range > 5 orders
Evaluated with OFN extracted mass m/z 272

![Diagram showing extended dynamic range over five orders of magnitude](image-url)
A COMPLETE LINE FOR TOTAL SOLUTIONS

In combination with the Master GC, the Master TOF-MS Plus is the ideal solution for Fast GC and GCxGC analyses to obtain improved productivity and performance. In addition, the Master TOF Plus benefits of the complete DANI Master Autosamplers line for volatile and semivolatile organic compounds extraction.

**DANI Master GC** is uniquely designed to perform conventional and fast gas chromatographic analyses fulfilling the demands of routine and research. The Master GC features a maximum heating rate of up to 140°C/min and a typical cooling time of 4 min from 300°C to 50°C. The system can be equipped with an array of inlet systems and a wide selection of detectors, engineered with fast electronics to handle sharp peaks generated in Fast GC; data acquisition rates of up to 300 Hz are performed for all the detectors. The instrument integrates leading-edge technology with total system control delivering outstanding reliability, repeatability, and performance.

**DANI Master SHS Static Headspace Sampler** is the most flexible system that delivers the highest performance to overcome daily new challenges. It supplies trustworthy and enhanced results for the determination of the volatile fraction of liquid or solid samples. Among its benefits: limited or no sample preparation, no contamination risk, diminished inlet or column maintenance, completely automated analysis, easy-to-use, robust and trouble-free design. The 120-position vial tray, designed to lodge any type of headspace vials, along with the unmatched oven capacity (18 vials simultaneously), assures the highest sample capacity and maximum sample throughput to meet high productivity requirement. Highly stable control of sample temperature, constant incubation time, the Valve & Loop technique and the entirely chemical inert flow path provide reliable results and exceptional repeatability.

**DANI Master DHS/P&T Dynamic Headspace and Purge&Trap Sampler** provides you with the most versatile, state-of-the-art system for headspace analysis. It combines the high sensitivity of the dynamic headspace technique with the productivity, ease of use, and flexibility of a completely automated solution. In addition, the Master DHS/P&T can process liquid samples in purging mode thus further lowering the detection limits and featuring the capabilities of a Purge&Trap system. Master DHS/P&T represents a dynamic approach to high sensitive headspace analysis.

**DANI Master TD Thermal Desorber** offers superior sensitivity, versatility, and productivity for the extraction of volatile and semivolatile organic compounds from air and solid matrices. The excellent analytical performance of the system is guaranteed by the two-stage thermal desorption process and supported by the patented “Instant Desorption” of the trap. The design assures the fastest transfer of the analytes and preserves chromatographic resolution and accuracy.
Walkaway Automation

In combination with the Master AS, a robotic X-Y-Z sampling system, the Master TOF-MS Plus system delivers complete automation of all operation steps, including standard addition. Hence, the complete system increases sample throughput allowing unattended sequences up to 160 samples with enhanced precision and accuracy, improving analysis performance.

The simple and intuitive Master LAB Software offers the proper tool for a reliable control of the entire system, from MS autotuning procedures to GC and sample sequences management. The Master LAB software delivers complete system control through a user-friendly interface without requiring high experienced operator skills.

FULL INSTRUMENT CONTROL
AND POWERFUL DATA MANAGEMENT

The maximum productivity is obtained through the full automation of all the process, starting from sampling, to acquisition, data processing and reporting.
Methods and sequences can be easily created, edited, stored, and uploaded to the instruments.
A full diagnostic is also included and provides information on the instrument status.

In addition to the local control, DANI is also capable to provide a remote control function based on internet connection. The online support connection allows the DANI service staff to remotely operate on the instrument located at customer site.
DANI remote control service permits basic diagnostic tests and quicker flow of information from the specialist to the user.
Minimized dead times and reduced on-site service costs add a further improvement towards highest productivity.
INNOVATIVE MASTER LAB SOFTWARE SOLUTION

The proprietary Master LAB Software solution is based on an innovative platform for acquiring and processing mass spectral data. The software ensures high level performance and maximized productivity, while delivering the flexibility and robustness required in laboratories with high sample throughput. The instrument control and acquisition page as well as the reprocessing main screen are intuitive for minimum learning efforts. All the commands are readily available on the same screen and the layout can be fully customized according to the user needs.

AUTOTUNING AND MASS CALIBRATION

The autotuning and mass calibration procedures are fully automated in order to rapidly optimize the operation conditions of the machine. A manual tuning procedure is also available to customize tuning conditions which could fit specific analytical requirement.

The tuning file can be saved and stored along with the tuning report.

DATA EXPORT

Acquired data can be automatically exported as open data formats, e.g. .netCDF and .txt files. The qualitative and quantitative results summarized in the Compound Table can be easily exported as .xls worksheet for further elaboration.

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TAKE ADVANTAGES FROM FASTER ANALYSES WITH DECONVOLUTION

Analytical challenges today are more frequently related to complex samples where co-elutions of analytes and the matrix interferences are prone to occur, especially when the analysis run time is reduced.

Master LAB software includes an automatic deconvolution algorithm capable to recognize different co-eluted compounds by reconstructing the mass spectra according to only a slight different retention time of each single ion peak.

Then the reconstructed spectra are used for the identification by library matching. The software supports the NIST® mass spectral library and all other libraries compatible to NIST®. Custom libraries can also be generated by exporting the mass spectra as NIST® compatible format.

With deconvolution improved effectiveness and confidence in the identification and screening of target and nontarget compounds are achieved.

SPECTRA QUALITY

The Master TOF Plus is delivering high spectra quality with very high library similarity matching for reliable identification of unknown and confirmation of targets.

A 70eV EI ion source is producing typical fragmentation reported in common MS spectra libraries.

Cluster profile of polyalogenated fragments are perfectly matching the NIST library references, as required for PCBs and PBDEs compounds.
MASTER TOF PLUS: THE RIGHT TOOL FOR DEMANDING GC-MS ANALYSES IN ANY APPLICATION FIELD

The combination of the Master GC and the Master AS hyphenated to the Master TOF Plus is the right solution for your daunting analytical tasks and is adequate for a broad range of applications.

COSMETIC AND TOILETRIES (C&T)

The investigation of allergens in Personal Care Products (PCPs) matrices is of utmost importance for safety evaluation procedures. Allergens are strictly regulated and maximum residue limits for leave-on and rinse-off cosmetic products are of 10 ppm and 100 ppm respectively. The Master GC-TOF-MS Plus system permits reliable allergens mass spectral identification due to automatic deconvolution in a total analysis time of less than 7 minutes.

FLAVOR AND FRAGRANCES (F&F)

Fragrance materials are composed of a wide range of compounds blended to create sophisticated perfumes. As it is well known, the use of modern analytical methods boosted the achievement of higher perfumery raw material knowledge and GC has been widely employed in perfumery industries. Perfume profile for Home & Personal Care Products is of primary importance for perfume industry for quality assessment, perfume formulation, competitors benchmarking, trace analysis of markers. In the F&F application field faster analysis, rapid and reliable peak assignment are continuously required. The Master TOF MS Plus system fulfills these productivity requirements.

The TIC chromatogram obtained from the Fast GC analysis of a perfumery raw material shows several co-eluting peaks. The constant ion abundance ratios across the chromatographic peak, the high acquisition rates, and the unskewed mass spectra are uniquely produced by the Master TOF-MS Plus and support the deconvolution algorithm for the peak picking of the components. Productivity and accurate peak identification are obtained simultaneously.
Analysis of volatile and semi volatile organic pollutants in environmental matrices is of increasing interest due to critical environment contamination from several sources as gasoline, oil spills and industrial solvents. Especially for drinking water, possible contamination is of great concern for potential human health effect. Strict official guidelines establish analytical procedures along with detection limits and instrumentation requirements. The Master TOF Plus has been validated in full compliance with the EPA ion ratio criteria and proven without the need of dedicated instrument tuning. Default autotuning procedures can be regularly performed before any new calibration sequence.

<table>
<thead>
<tr>
<th>Ion m/z</th>
<th>EPA 524 Ion Ratio Criteria</th>
<th>Master TOF Plus % Relative Intensity</th>
<th>Pass / Fail</th>
</tr>
</thead>
<tbody>
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<td>50</td>
<td>15-40 % of mass 95</td>
<td>15.7</td>
<td>√ Pass</td>
</tr>
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<td>174</td>
<td>&gt; 50 % of mass 95</td>
<td>74.6</td>
<td>√ Pass</td>
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<td>175</td>
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</tr>
<tr>
<td>177</td>
<td>5-10 % of mass 176</td>
<td>6.6</td>
<td>√ Pass</td>
</tr>
</tbody>
</table>

BFB Spectrum compliance with EPA method 524

VOC Analysis:
52 compounds in 14.3 min

Peak 1
Peak 2

Propane, 1,3-dichloro-
Tetrachloroethylene

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MAST er yor M y Ti M e 
wiTH THe dANi MAST er TOF MS PlU S SOLuTI ONS

The ability to provide the proper configuration to meet the most challenging analytical demands comes from a long and proven experience and a deep industry knowledge. As requirements are constantly changing, even a highly reliable instrumentation could not be enough to succeed in getting trustworthy results: complete and guaranteed solutions are essential to comply with the latest industry standards and specifications.

After a long working relationship with its customers to know and to best match their real needs, DANI Instruments has developed key analytical solutions that cover a broad array of applications, requirements and protocols in key markets.

Exploit DANI expertise to configure the hardware for better matching any analytical needs. Dedicated packages, including columns and consumables, are available to meet general analytical requirements in different application fields.

Based on the versatility, flexibility and robustness of the proven Master Line Hardware, DANI Master TOF MS Plus Solutions are assembled to provide you with the necessary tools to fit standard requirements and are also ready to be developed for special configurations according to customers specific requirements.

**Do you need a Turnkey System?**

DANI expertise is also available to set up dedicated systems specifically designed and configured to fully match customer’s applications. Whether complying official regulations or satisfying customers needs, the DANI Master TOF MS Plus Analyzers are pre-configured, pre-assembled and factory-tested systems targeting defined analytical specification. The analyzers include the hardware, the software, columns and consumables, the optimized analysis method, the analytical conditions, and the documentation to run up your analysis from day one.

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**PRE-CONFIGURED, PRE-ASSEMBLED AND FACTORY-TESTED SYSTEMS**

The installation process is faster than ever before and all the startup procedure is oversimplified ensuring immediate analytical performance and results.

**HARDWARE AND SOFTWARE**

DANI Analyzers are pre-engineered systems based on the versatility, flexibility and robustness of the proven Master Line hardware. All the parameters are set prior the shipment.

**COLUMNS AND CONSUMABLES**

No more doubts about the proper column, parts and supplies. DANI Analyzers are delivered with all you may need for your analysis.

**OPTIMIZED ANALYSIS METHOD**

Analytical methods are pre-loaded to be immediately used. Whenever possible, reduction of analysis time and amounts of toxic solvents are considered. Method development time and costs are thus dramatically reduced.

**DOCUMENTATION**

A getting started manual, calibration and method files, and all the information for a quick startup are included.
FLAVORS AND FRAGRANCE SOLUTION

Flavors and Fragrances analysis benefit from the use of faster instrumental configurations for both research and quality control purposes. The GC approaches to speed up analysis include the utilization of shorter capillary columns with decreased column internal diameter and thinner stationary phase, higher carrier gas velocities, and faster GC oven temperature programming rates. Moreover, the Master TOF Plus has the necessary technology to provide high speed acquisition rate to collect sufficient information (15-20 points/peak) for reliable reconstruction of very narrow peaks over the entire mass range. Thereby the Master Flavors and Fragrances Solution enables accurate recognition and quantification of unknown and co-eluting peaks, even in trace-level concentrations. The Flavors and Fragrance Solution allows a detailed and fast characterization of Essential Oils Composition for quality assessment and origin discrimination.

DRINKING WATER SOLUTION

The Drinking Water Solution employs the flexible Master Dynamic Headspace and Purge&Trap Sampler working in purging mode as a valid alternative to traditional Purge&Trap autosamplers. The system is able to highlight the several benefits of this approach in terms of extended automation, overlapping incubation time capability and absence of cross-contamination between samples. In addition, the Master TOF Plus as detector offers the possibility to discriminate even between coeluted compounds, exploiting the deconvolution algorithm of Master Lab Processing Software. The sub-ppb/ppt concentration levels of volatile organic compounds which can be reached by this solution are suitable to match the official regulation imposed to control organic contamination in drinking water.
Life Science

FORENSIC SOLUTION

DANI Master Forensic Solution is an accurate, and versatile GC-MS system for the forensic application field. Exploiting the benefits of the Fast GC-MS approach, the system delivers accurate results in shorter time for quick analytical response. It is suitable for street drugs characterization and adulterants identification in seized material and abused drug metabolites identification in extracts of biological samples as blood, urine, and hair.

As it is well known, solvents used in the manufacture of pharmaceutical products must be eliminated before human consumption. The USP <467> (United States Pharmacopoeia) is the official guideline of reference which gives strict indication about the hardware configuration and the analytical method to be used. Specifically for the sampling procedure of most toxic solvents grouped in class 1 and 2, the USP 467 indicates the use of the Static Headspace technique with Valve & Loop technology, due to its highest performances in terms of reliability and precision of the results.

PHARMA

RESIDUAL SOLVENTS - USP 467

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ENVIRONMENTAL

VOCs IN AIR TO-14, TO-15, TO-17

Monitoring Volatile Organic Compounds (VOCs) in air is a complex technical task, due to their presence in a wide polarity range often at very low concentrations (typically from low ppb to high ppt).

The VOCs in Air Solution offers an accurate, sensitive, and robust package for the measurement of VOCs in Air. The collection of large sample volumes and the use of an enrichment step is required to reach high sensitivity, while a suitable gas chromatographic configuration is able to resolve the complexity of the analysis.

The Master Air Sampler, with the Master TD Thermal Desorber, permits the automated extraction of 53 VOCs. Minimum detectable levels are well below currently recommended limits.
**CHEMICAL MATERIAL**

**PACKAGING MATERIAL SOLUTION**

Monitoring residual contaminants in packaging material is of growing relevance to prevent possible release of toxic compounds to sensible contents. The Master Packaging Material Solution is focused to the determination of residual solvents, mainly from printing ink, which are of high concern in food packaging. DANI Master SHS Static Headspace Sampler permits the complete automatic sampling into the analytical system: the determination of the residual solvents is obtained at minimum detectable levels below those currently recommended by the norms. The Master GC Fast Gas Chromatograph coupled to the Master TOF Plus delivers the high selectivity and sensitivity needed for a reliable identification and quantitation of the substances released by the package and which can potentially be transferred into the food stuff.

**[PETRO]CHEMICAL MATERIAL SCREENING**

In the two dimensional chromatogram of B20, it is possible to distinguish well separated groups of compounds according to the chemical family, as paraffins, aromatics and the FAMEs fraction representing the biodiesel content. MasterLAB software is used to generate the 2D chromatogram with the capability of automatically generating blobs through the association of modulated peaks. Once blobs are formed, the correspondent mass spectrum is compared to the NIST Library for identification.

Petrochemicals are among the most complex matrices to be analyzed, due to the heterogeneity of the contained species, the wide boiling point and the huge number of isomeric compounds. The DANI Master (Petro)Chemical Material Screening Solution provides a very high resolving power in the analysis of petrochemical material, characterizing very complex samples when a second chromatographic dimension is added to the analytical system. The Comprehensive Two Dimensional GC (GCxGC) approach offers the highest separation capability in a chromatographic system. Thanks to this advanced technique, two dimensional chromatograms are generated, visualizing the sample composition in a picture and delivering the highest amount of analytical information at a first glance.
Comprehensive two dimensional GC is the most suitable technique to address the most complex matrices. GCxGC employs two capillary columns in series with different specificity. Between the two columns, a device called modulator refocuses fractions of sample eluted from the first column; after the refocusing, the portions of the compound are periodically sent to the second column (2D) through the same modulator. The entire sample is hence subjected to two independent separations on different stationary phases. The technique provides not only increased peak capacity, but also a 2D chromatogram of chemically-similar compound patterns. The hyphenation of a TOF to a GCxGC setup adds a third analytical dimension to the system guaranteeing reliable peak assignment and quantification. Furthermore, it is worth noting that the high acquisition rate of Master TOF Plus allows to correctly describe the fast peaks typical of GCxGC chromatograms with enough data points for an accurate quantification.

The advent of GCxGC has enabled a deeper insight into several matrices and revealed unexpected complexity for several samples. Coupling a Fast MS detection as third dimension, unprecedent amount of information can obtain from a single analysis, opening new opportunities for even more performing analytical approaches.

The Master GCxGC-TOF Plus meets the requirements of most challenging analytical needs in major vertical markets as Environmental, Petrochemical, Food & Beverage, Forensic/Tox.
MAKE THE MOST OF YOUR INVESTMENT WITH DANI SERVICE & SUPPORT

DANI Service & Support agreement plans are designed for those laboratories pursuing superior productivity through the highest level of professional services. The use of automated instrumentation is the right approach to meet today’s laboratories productivity requirements, reducing analysis run times, enhancing sample throughput, and increasing analytical accuracy and precision. In this view, preventive maintenance is very important to maximize laboratory uptime and avoiding unexpected expenses.

In addition to the analytical goal, proper installation and maintenance are required to achieve optimal performance. DANI Instruments provides flexible service and support management solutions focused on your laboratory real objectives.

Through the established network of partners DANI can provide effective support throughout the world and maintain the perfect reliability of customer’s instrumentation and minimize the laboratory downtime.

SERVICES AND PRODUCTS

- Software update
- Remote diagnosis and service
- Warranty Extension
- Method Development
- Special Maintenance Pack focused instrument no-stop
- Hardware update
- Education and trainings
- Applicative and technical support
- All in, full risk and light contracts

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