



# DIAGNOSTIC TOOL SET

## System Overview

The Diagnostic Tool Set makes it possible for developers, engineers and technicians to create consistent diagnostic functions and sequences on the basis of international standards and to ensure that vehicle diagnostics works reliably over the entire value chain.

### SUCCESSFULLY MASTERING CHALLENGES

Increased competition, frequent model changes and the electrification of vehicles are major challenges for the manufacturers of cars and commercial vehicles as well as for system suppliers. Vehicles are becoming more and more powerful, safe and environmentally-friendly all the time. These innovations nearly always entail new software developments. The number of ECUs and the complexity of networking are thus continually increasing. The growing complexity must be mastered over the entire lifetime of the vehicles not only in terms of the control functions but also the diagnostic functions.

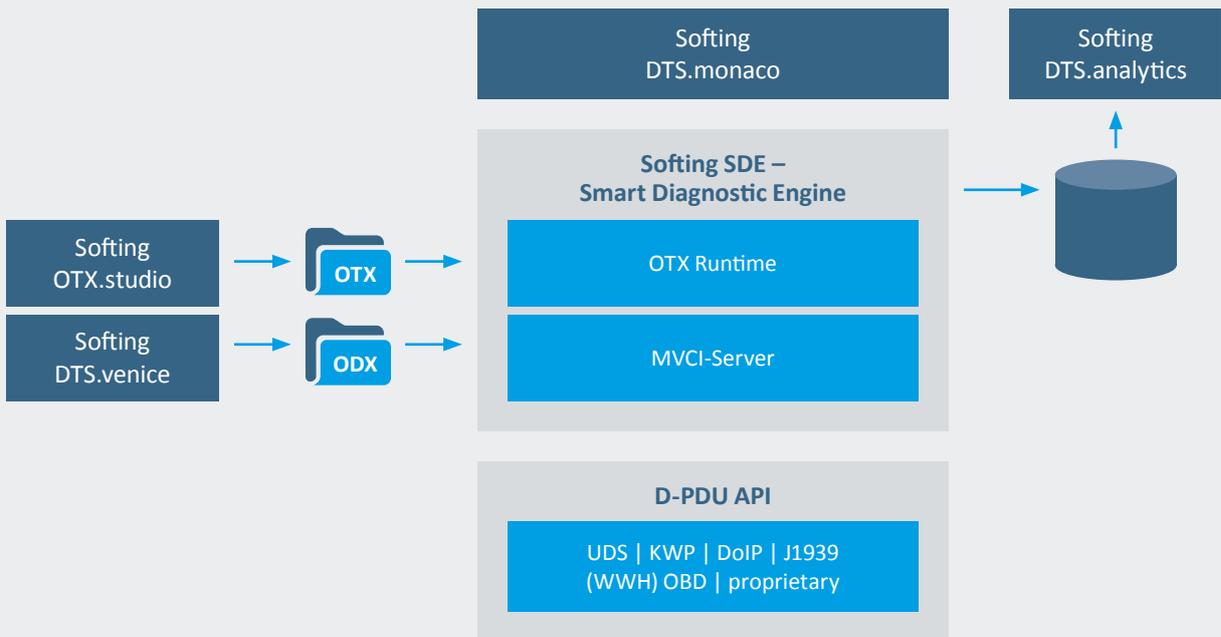
### DEFINING DIAGNOSTIC FUNCTIONS RELIABLY

To ensure that diagnostic functions are understood and used in a uniform manner from engineering through manufacturing right into the repair shop, ODX (Open Diagnostic Data Exchange) and OTX (Open Test Sequence Exchange) were specified as standards which can simultaneously be deployed as an executable specification

and exchange format. The ODX data, which specifies the communication between tester and ECU, is created using the Softing DTS.venice tool. Diagnostic and test sequences are developed with Softing OTX.studio with adapted access available for different user groups. A standardized runtime behavior is offered uniformly in all applications via the Softing SDE. In addition to the standardized MVCI server, this offers an OTX runtime environment and a functional API and is also remote-capable.

### DEVELOPING AND RELEASING DIAGNOSTICS

Softing DTS.automation is a massively simplified API which is made available specially for the often limited use of diagnostics in automation systems. All diagnostics to be operated manually are made available to users in Softing DTS.monaco – from ECU engineering through diagnostic release to test drives. All traces and reports created using the applications and runtime systems can then be evaluated offline with the help of Softing DTS.analytics. This makes it easy to detect and document irregularities.



▲ Fig.: Softing Diagnostic Tool Set



# SOFTING DTS.MONACO

The Off-Board Diagnostic Tool for Professional Vehicle Engineering.

## AREAS OF APPLICATION

- Engineering of diagnostics and control functions for vehicle ECUs
- Function test and validation
- Integration and system test
- Preparation of test sequences for manufacturing and after-sales service
- Analysis of returns and quality assurance
- Commissioning of test benches and HiL systems
- Preparation and update of vehicles for endurance testing
- Execution of diagnostic tests for safeguarding functional safety in compliance with ISO 26262

## BENEFITS

- Cost reduction and shorter familiarization time as Softing DTS.monaco covers the functionality of several tools that were separate to date
- Fast results due to intuitive operation and preconfigured templates
- Top quality thanks to early detection and remedy of communication problems and function errors
- Highly effective as it can be flexibly adapted to suit a range of tasks
- Complete documentation of communication data and test results
- Plug and play of vehicle communication interfaces

17

Softing DTS.monaco is an extensive offboard diagnostic tool for the engineering sector which covers the entire range of application cases from ECU testing through to vehicle release. It is easily integrated into the test sequences and corporate processes, not least because of its flexible interfaces which can be configured to suit the relevant test step.

## OUR EXTENSIVE EXPERIENCE PAYS OFF FOR THE USER

Softing DTS.monaco is the flagship of the Diagnostic Tool Set, the expert tool for professional diagnostics that has grown over the decades. It is based on the Softing Diagnostic Base System and thus benefits from cross-manufacturer experience in off-board diagnostics throughout the entire vehicle life cycle. New solutions are continuously being integrated into the stable and scalable tool base for the latest E/E architectures and security mechanisms.

## PROCESS-ORIENTED AND FLEXIBLY ADJUSTABLE FOR EVERY WORKING STEP

The name MONACO – Modular Analyzer for Vehicle Communication – already clearly indicates one advantage of the application: modularity. Thanks to the division of the interfaces into fixed and flexibly configurable parts, it is possible to arrange working steps

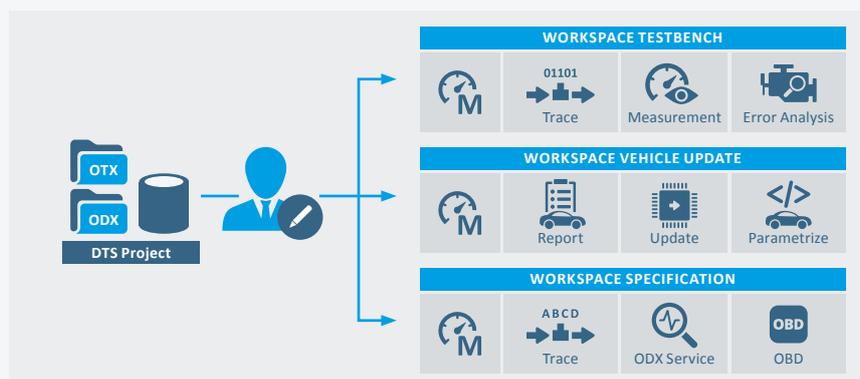
required for the testing process logically and efficiently. What are referred to as layouts in the Monaco workspace help the user to sort the topics. In turn, the specially developed diagnostic control elements can be placed within these freely configurable interfaces. The delivery scope also includes a few examples of widely-used application cases (OBD, WWH-OBD, J1939-73), thus considerably facilitating getting started with Softing DTS.monaco.

## THE RIGHT CONTROL ELEMENT FOR EVERY DIAGNOSTIC FUNCTION

Monaco Controls are available for typical application cases. Users without in-depth knowledge can take advantage of these intuitively. The diagnostic commands and communication parameter behind those controls are preconfigured by experts at diagnostic service or diagnostic job level. Furthermore, diagnostic sequences can be directly incorporated in OTX (ISO 13209) and started. These are created using Softing OTX.studio.

## FUNCTIONS

- Testing communication
- Analyzing data on the bus
- Testing ODX data against ECU
- Reading/clearing error memory
- Identifying variants
- Programming flash memory
- Displaying measurement values
- Testing actuators
- Parameterizing ECUs
- Coding variants
- Running ECU routines
- Testing OBD functions
- Creating/executing test sequences



▲ Fig.: Can be Flexibly Adapted to the Application Case – Workspaces, Layouts and Control Units



COMMUNICATION	CONTROL	FUNCTION	MEASUREMENT
<b>Bus Trace</b> Fundamental analysis of diagnostic and on-board communication at bus level in hexadecimal notation.	<b>Annotation</b> Visualizing tests with pictures, text or link to RTF/PDF/CHM files.	<b>DTC *</b> Reading out and clearing the ECU error memory.	<b>Graphical Instrument</b> Visualizing and modifying ECU variables using various graphic elements. (Measuring, parameterizing and actuator diagnostics)
<b>Diagnostic Services</b> Data verification and communication test with full access to functions and sequences of the database for experts.	<b>Communication Control</b> Automated setup and tear-down of communication to ECUs.	<b>ECU Identification *</b> Reading out the identification information of individual ECUs or an entire vehicle.	<b>Recorder</b> Recording/saving ECU variables (list, instruments or oscilloscope) and modifying them (actuator).
<b>Symbolic Trace</b> Analysis of diagnostic communication at the application level in symbolic notation.	<b>Logical Link List</b> Monitoring and influencing the communication state of ECUs.	<b>Flash</b> Programming of individual or multiple memory areas of ECUs.	
<b>Service Table</b> One-off or cyclical execution of list control for diagnostic services in service or parameter notation.	<b>Toggle</b> Activation/deactivation of a switch, each starts a sequence of services (e.g. change ECU state).	<b>OBD</b> Validation and release of OBD self-diagnosis and the different modes for K-line and CAN protocols..	
<b>OTX</b> Execution of complex diagnostic or test sequences in compliance with ISO 13209 (OTX).		<b>Soft Key</b> Running sequences of services, jobs or sequences using buttons.	
		<b>Tool Quick Test*</b> Fast determination of vehicle status as regards ECU identification and error memory.	
		<b>Variant Coding *</b> Powerful expert tool for coding individual ECUs.	

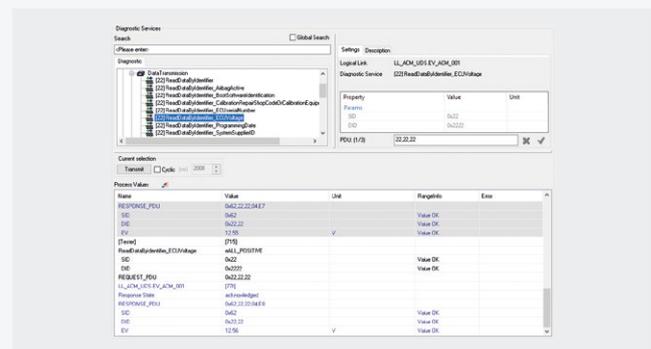
\* Configuration must be adapted to relevant ODX authoring guideline!

## Using DTS.monaco

Softing DTS.monaco is used in numerous engineering departments all over the world to take care of diagnostic tasks. The range of ODX and expert application cases extends through ECU release to the commissioning of HiL systems and test benches. The tool is also regularly used for updating and validating vehicles during on-road tests.

### TESTING AND DEBUGGING THE ESTABLISHING OF TESTER ECU COMMUNICATION

Regardless of the integration level of software and ECUs, communication problems along the OSI communication layers result in specific challenges for diagnostic experts. These problems are critical for the remaining life cycle of the vehicle because, for example, in manufacturing, this behavior can lead to delays in or an entire absence of vehicle programming. The debugging of this kind of defective communication behavior thus necessitates an interface which both sends out services and jobs individually or cyclically to the test system and interprets information from offboard communication in detail and records on-board messages.



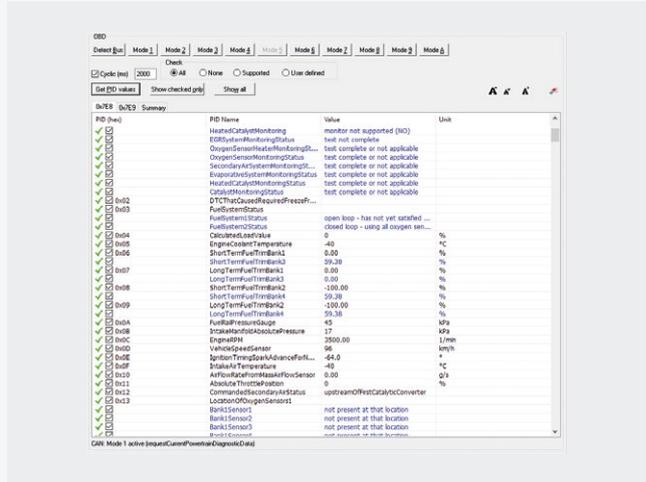
▲ Fig.: Testing Diagnostic Communication

The complexity of this kind of analysis is growing increasingly in the latest E/E architectures and their security measures against undesired external tampering attempts. Softing DTS.monaco is always up to date here and reliably supports corresponding protocols and mechanisms. This is supported in particular by the control units “Diagnostic Service”, “Symbolic Trace”, “Bus Trace” as well as the “Logical Link List” with reliable information on the status of the connection and the representation of the relevant services and bus communication. The DoIP monitor integrated in the new DTS9 generation is particularly helpful in this respect!



### VALIDATING ECU OR FUNCTIONAL DIAGNOSTIC SPECIFICATION (EXAMPLE ISO 15031)

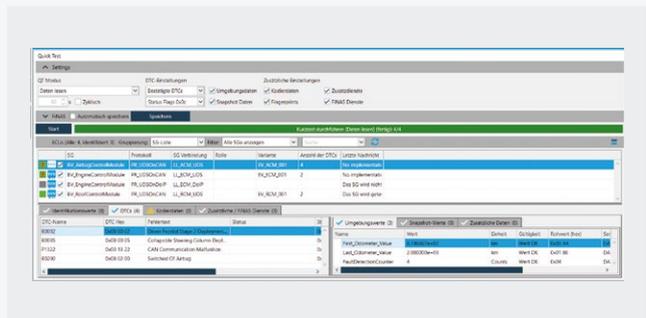
During the life cycle of an ECU/vehicle, various diagnostic services and functions specified by the OEM or legislator have to be supported. Softing DTS.monaco can be used for a first step in this partly approval-relevant validation. With the “Diagnostic Service” control (see figure above), it is possible to test the relevant services and responses for their correct implementation in detail in the diagnostic database (ODX 2.0.1 or ODX 2.2). The tool also offers a special control unit with underlying ISO-compatible database for OBD validation. Here it is possible to reliably test the different modes and functional command groups of the OBD specification. No expert knowledge is necessary for this as the procedure is determined by the user interface. This simplification means that a result can be quickly and efficiently determined with the HiL system or vehicle.



▲ Fig.: OBD Diagnostics

### IDENTIFYING AND TESTING ERRORS WITH DOCUMENTATION

The identification of a test unit as well as the reading out of the error memory are activities which are repeated throughout the product life cycle. Regardless of whether HiL, test bench or vehicle – the versions as well as any error memory entries which might occur must be acquired and documented in every test sequence. The most important aspect here is a simple and intuitive operation as well as reliable documentation (in part with a direct central link to IT systems). This kind of identification and error report can be generated and stored by Softing DTS.monaco. An XML file format for reports is expedient here. This is supported in particular by the control units “ECU Identification”, “DTC” and “Tool Quicktest”.



▲ Fig.: ECU Quick Test

### VISUALIZING MEASUREMENTS AND ACTUATOR INTERACTION

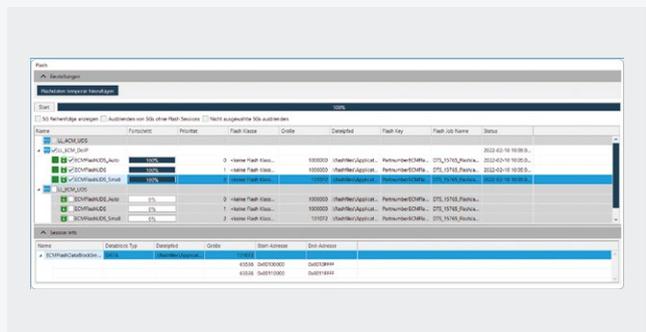
The visually meaningful representation of measurement parameters and their thresholds is necessary particularly at the test bench and in vehicle validation. Softing DTS.monaco helps visualize various states regardless of whether a NOx sensor has to fulfill its values within a certain time or if it has to be indicated that pressure or temperature has reached a threshold value. Corresponding services and parameters can be configured for this in a data server and reused. Naturally interaction with actuators is also possible. To ensure this is all documented, Softing DTS.monaco contains a recorder which records and can reproduce data reliably.



▲ Fig.: Graphical Instruments

### UPDATING ECUS – FLASH PROGRAMMING

ECU and vehicle updating is an important application area for Softing DTS.monaco, as an accompanying measure in the engineering process to validate various software versions, but also to prepare the automated flash procedure for manufacturing and after-sales service. The compatibility to all kinds of methods and file formats is just as important here as simple and reliable operation. A process usually consists of several substeps as well as an initialization routine – now often additionally safeguarded with the Seed & Key procedure. Naturally, with its “flash” control element and numerous configuration possibilities, Softing DTS.monaco offers sufficient flexibility to be able to support



▲ Fig.: Flash Programming

complex procedures. In other words: ODX-D + Flash Job (with reference in ODX-F), External Flash Files (HEX, MOT, BIN, S3 and S19), Flash Sequences, Security Access, Latebound Flash Files, Flash Files > 4GB (“64-bit Flashing”), among others, are supported.



# Highlights in Use with Latest System Architectures

Softing DTS9 is continuing the journey and extending the product with new, innovative functions to support our customers in their engineering work in the future.

## SETTING NEW ACCENTS WITHOUT LOSING THE BASE

New application cases and the growing significance of diagnostics for vehicle engineering are demanding completely new approaches in collaboration, for example as regards the licensing, packet assembling and distribution of our software package. Furthermore, the necessity for new features outside the diagnostics core competency sector has also grown steadily. This is why we have re-engineered DTS9 from scratch – as a future-oriented platform for diagnostics, analysis and simulation in local and remote application cases. To ensure DTS8 customers can continue to work seamlessly, projects already created are migrated in entirety including interface configurations.

## DTS9 IMPRESSES WITH NEW FEATURES AND TECHNOLOGY IN ALL AREAS

DTS still stands for Diagnostic Tool Set, but in the future will continue to see extensive growth in the areas measuring, analysis and simulation. Particularly important aspects are the functionalities OTX support and functional diagnostics (please also refer to Softing SDE). Measurement values and parameters are provided simply

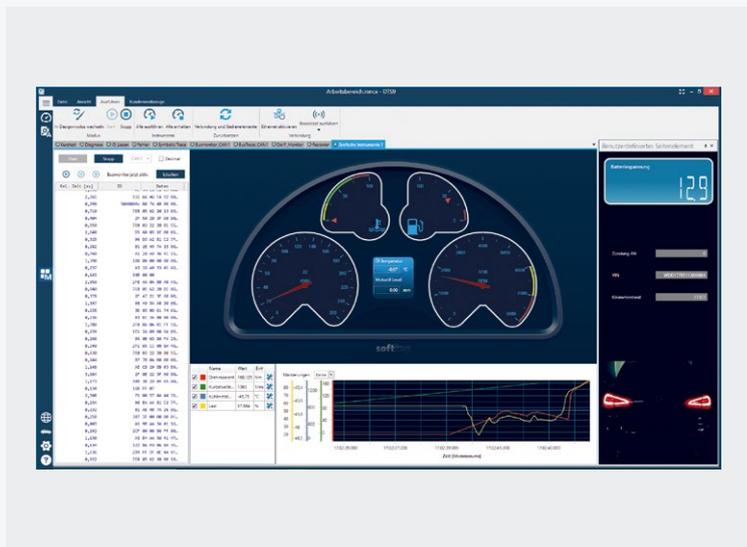
with both functionalities. During runtime, the user can search for these measurement values directly and select them. In-depth knowledge of diagnostic data is not necessary.

## AUTOMOTIVE ETHERNET AND DIAGNOSTICS OVER IP AS NEW CORE TECHNOLOGY FOR DIAGNOSTICS

The subject of Automotive Ethernet with the DoIP diagnostic protocol is also particularly worthy of mention in the new product generation. Considerable focus was placed on the aspect of tracing to be able to analyze DoIP communication.

## INCREASED EFFICIENCY WITH USE OF THE ENGINEERING NETWORK – SOFTING DIAGNOSTICS 4.0

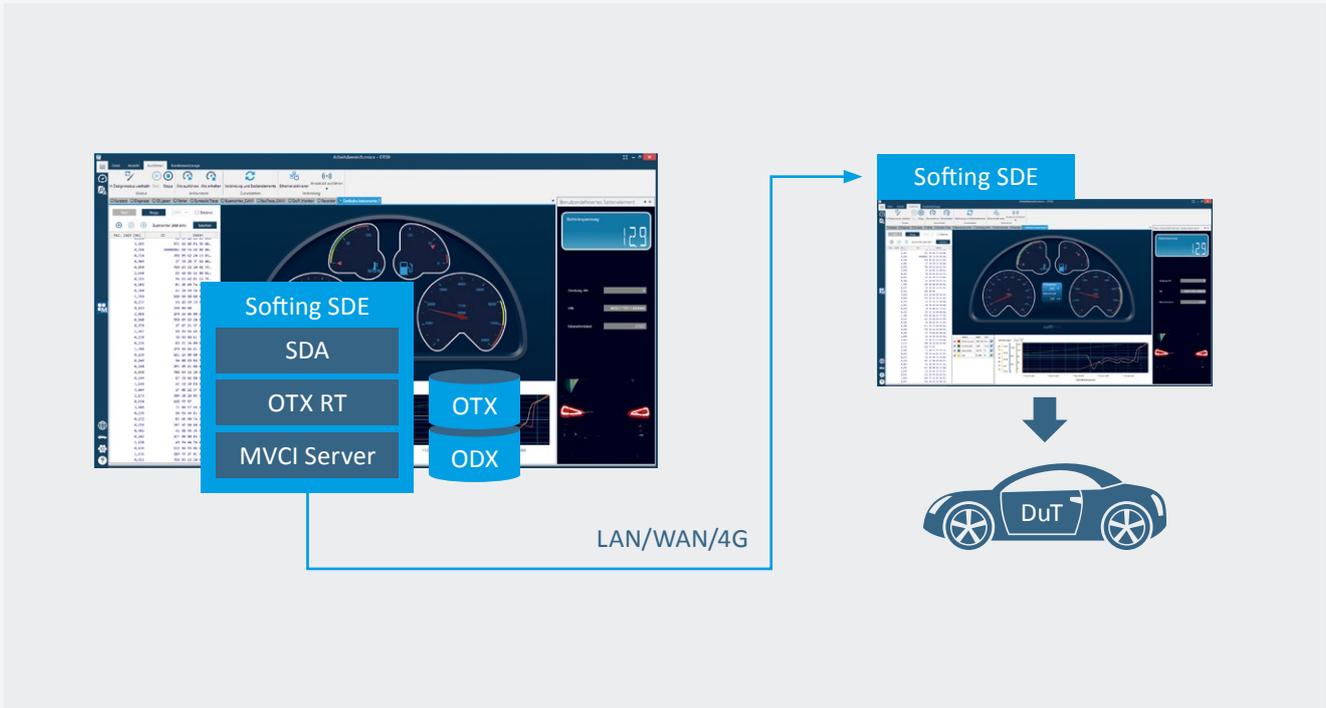
As ECUs and vehicles as well as test benches are rare and sought-after resources in the early stages of engineering, commissioning and access regulations are often a critical point. To structure this more efficiently and create more synergies between experts within a company, Softing DTS.monaco makes it possible to run diagnostic functions remotely over the engineering network. Initially identification, error memory acquisition, measuring and monitoring will support this scenario; in the future, support will also be provided by the familiar Monaco workspaces and their control elements.



▲ Fig.: Softing DTS.monaco (Generation 9) – New Platform, Graphical Instruments and DoIP Monitor

### HIGHLIGHTS – AT A GLANCE

- Multitest (1-8 vehicles)
- Remote diagnostic support in the engineering network
- Representation and recording of Ethernet communication (DoIP)
- New functions in the area of OTX support (new OTX standard) as well as functional diagnostics (see also Softing SDE)
- Extended functions in the areas of measurement and analysis
- Revised security concept
- 64-bit software with multilingual interface
- New graphical instruments for measurement and actuator diagnostics
- Intuitive, touch-enabled navigation and program structure
- Recording of measurement data in .csv
- New licensing options via activation key and server licensing
- Migration and conversion of interfaces and projects of the previous version (Softing DTS 8)



▲ Fig.: Softing DTS.monaco in Remote Use

## Delivery Packages

PRODUCTS						
DTS		DTS 9 Framework			Add-on Tools	
		Softing DTS.monaco			Softing OTX.studio	
	PACKAGES	BASE	PROFESSIONAL	TESTBENCH	BASE	PROFESSIONAL
Engineering Tester	ODX, OTX, Protocol, DiagService, OBD, Measurement	●	●	●		
	Flash, VarCode, DTC, ECU Ident		●	●		
	Testbench (API Interface Usage)			●		
Add-on	OTX editor/debugger, FCE, admin, comfort mode				●	●
	GUI, guided diagnostics, TCE, templates, signatures					●

INCLUDED IN THE SCOPE OF DELIVERY	
<b>Templates</b>	Communication and analysis, error memory, measuring and parameterizing, on-board diagnostics, flash programming, test sequences.
<b>Sample Workspace</b>	Extensive Monaco sample workspace as introduction to the main functions based on the sample database in the delivery scope.