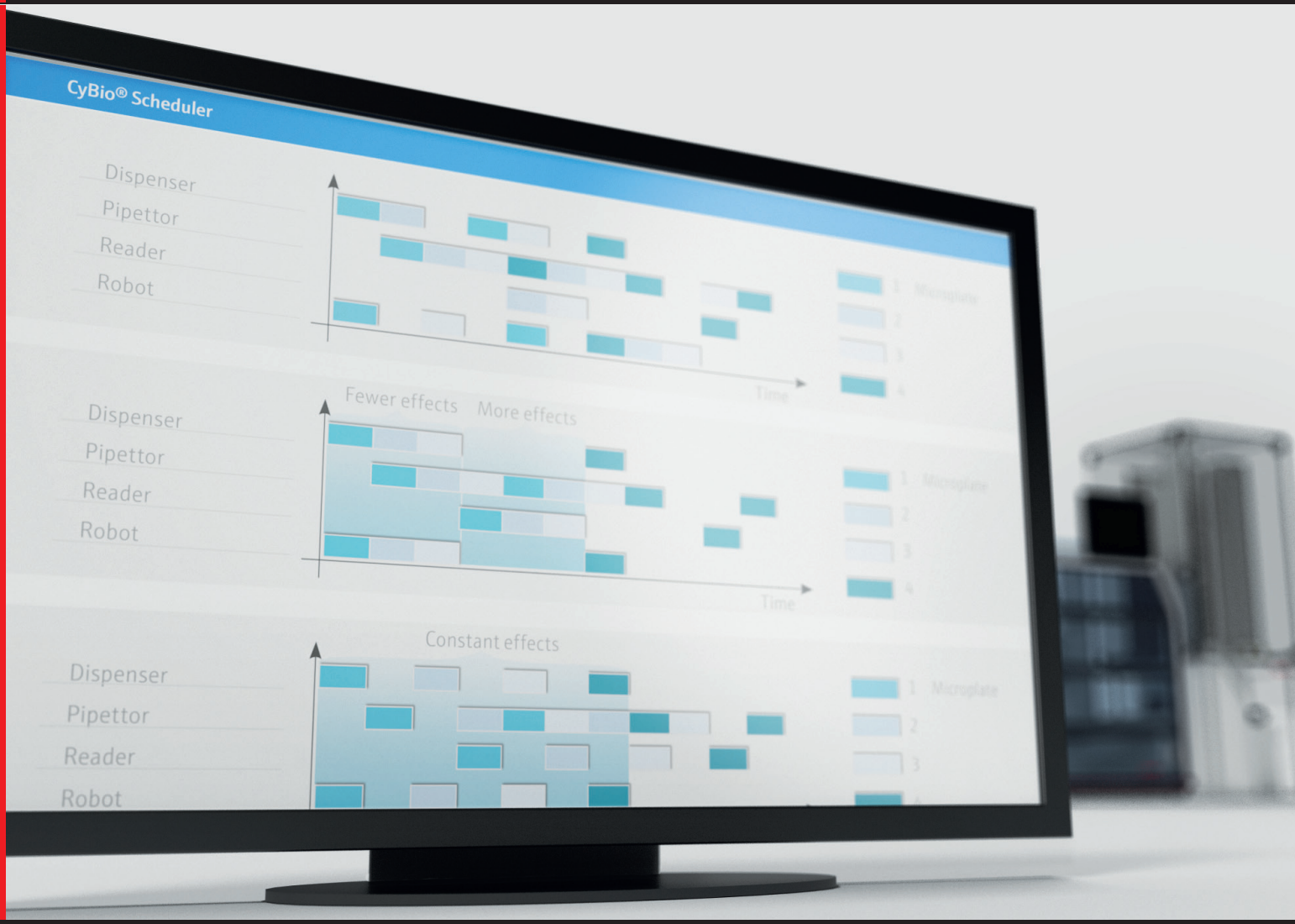
Intelligent Timing Makes the Difference

CyBio® Scheduler

Lab Automation



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Intelligent Timing Makes the Difference

At a Glance

Laboratory automation comprises a great variety of automation tasks, ranging from the automation of individual laboratory steps and instruments to the autonomous and fully automated control of complex laboratory installations. The resulting requirements on control software differ widely and make differentiated solutions necessary.

01

Stable

For the past 15 years, CyBio® Scheduler software has been in productive use. During this time, our customers have successfully undertaken a number of screening campaigns on systems from Analytik Jena. Its process safety and long-term stability are just some of the outstanding features of the CyBio® Scheduler software.

02

Efficient

Predictive planning and the optimization process developed in cooperation with renowned scientific institutions provide the highest levels of efficiency when executing assays. An intuitive, microplate-based depiction of workflows permits the quick creation of new workflows.

03

Dynamic

New assay procedures, different workflows when executing assays, the processing of emergency samples and flexible strategies to reduce unavoidable environmental influences require flexible scheduling. The CyBio® Scheduler software has the necessary dynamics to meet these as well as future requirements.

CyBio® Scheduler

A Flexible Automation Platform

24 hours, 7 days a week

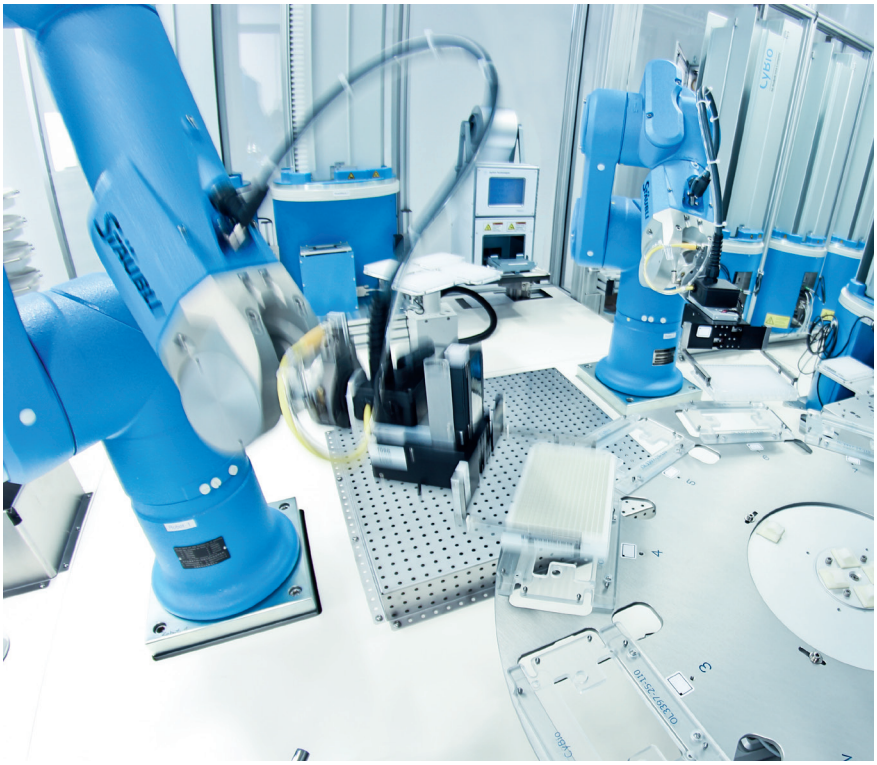
The CyBio® Scheduler software allows for the parallel and time-optimized control of several laboratory instruments to execute a number of diverse workflows.

Integrated automated optimization processes not only ensure the efficient utilization of existing laboratory instruments, but can also reduce the impact of changes in temperature as well as crystallization and precipitation effects, in turn improving the comparison of measurement results of different samples.
Dynamic scheduling permits the processing of emergency samples in a timely manner in assays already being executed and to re-use samples, depending on the process conditions or results. The parameters of a workflow can be varied during its execution to determine ideal process parameters or to react to changing environmental conditions.

Flexible error handling guarantees robust and error-tolerant automation solutions; customized error handling concepts can be implemented through different error handling options. A high-capacity database with integrated assay and microplate management, a powerful assay editor as well as different options to access external data allows for using the automation solution as an individual or an integrated workstation in an existing automation or IT environment.

Software tools for the evaluation of the run-time behavior of an assay facilitate an early detection and the elimination of possible sources of errors and thus support the implementation of a high-quality laboratory environment.
Besides the instruments from Analytik Jena, instruments from other manufacturers can also be integrated. Currently, more than 140 different types of instruments are supported for a great variety of applications. If a desired instrument should not yet be available, the flexible software interfaces make a quick and cost-efficient integration possible.

Thanks to the option of quickly adapting it to different hardware and IT environments, the CyBio® Scheduler software can still be used when assays and operational conditions change. Naturally, should any problems occur, our excellent service team is available 24 hours, 7 days a week.



Creating a Workflow

Controlling Single Instruments

01 Creating a workflow

A user-friendly workflow editor is applied in creating a workflow for the CyBio® Scheduler. Drag & Drop is used to drag the individual process steps from the toolbox into the workflow. Consequently, the creation of a workflow is very simple to perform.

02 Microplate-based depiction

The microplate-based depiction of the workflow provides excellent visual clarity. Every microplate is allocated with the process steps to be executed. If process steps should require more than one microplate, links between the microplates can be established.

03 Microplate transfers

Required microplate transfers from one instrument to another are automatically included. This results in a less labor-intensive creation of a workflow.

04 CyBio® Composer

The single instruments can be controlled via CyBio® Composer – Analytik Jena's software for controlling single instruments. This software is characterized by a powerful graphical user interface that enables easy access to all of the instruments.

05 Incubation times

The incubation of microplates is defined in the workflow; this includes the possibility of specifying a tolerance for the incubation time. This tolerance is later applied by the automated optimization processes to determine admissible adjustments.

06 Zoom settings

A depiction of the different process steps in different colors and different zoom settings improves the overview of the entire workflow.

07 Instrument commands

Graphical instrument commands permitting direct access to all the instrument functions.

08 Property window

Every instrument command has different properties which can be displayed and determined by means of a property field. Selection lists and menus facilitate the input of the property.

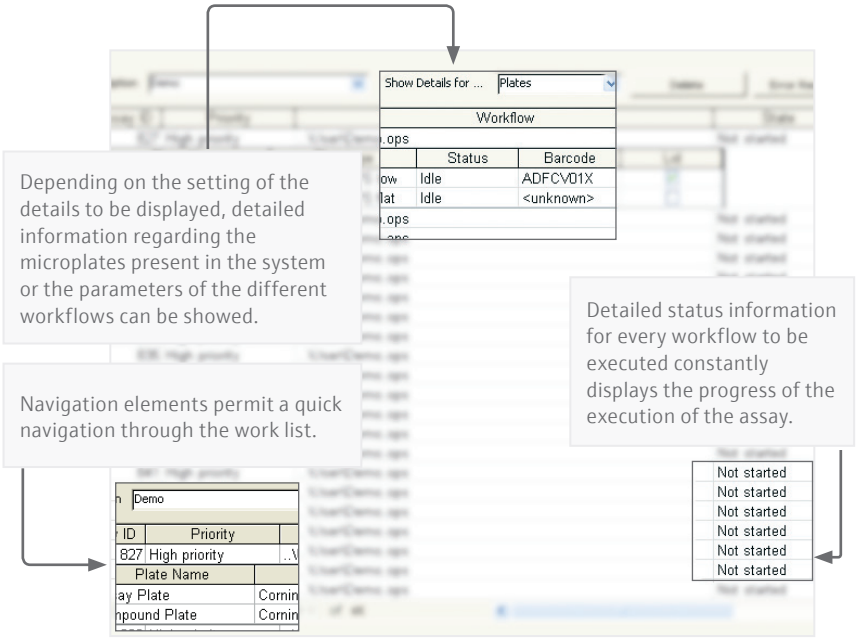
09 Liquid handling commands

Powerful liquid handling commands ensure that even complex pipetting tasks can be performed. The created pipetting routines can be tested and used independently of the CyBio® Scheduler.

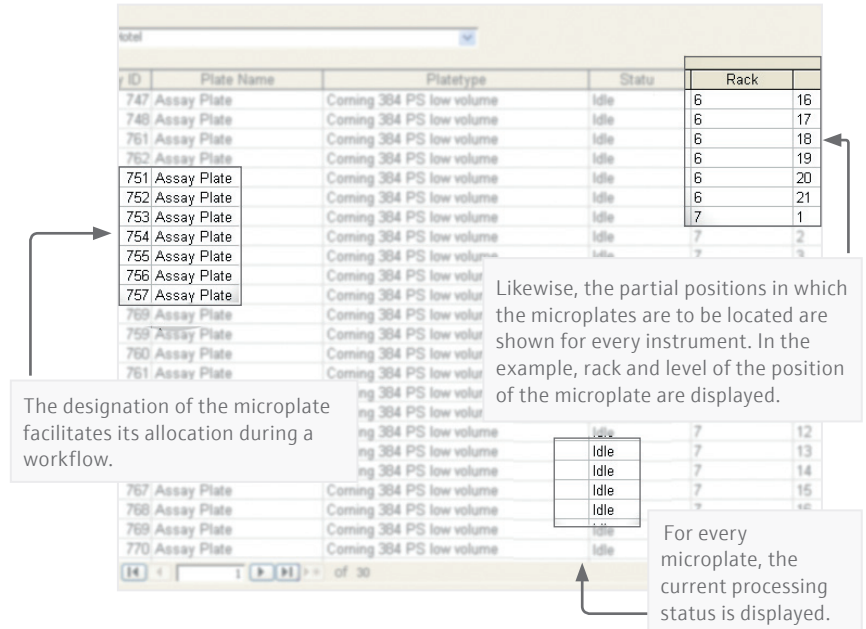
Data Management

The CyBio® Scheduler software includes a powerful data management tool - the CyBio® Plate Tracking module. This provides for the management of all data required for the execution of a workflow with the CyBio® Scheduler software, including the management of the work list to be executed and also all of the microplate-specific information, such as barcodes, volumes, storage positions etc.

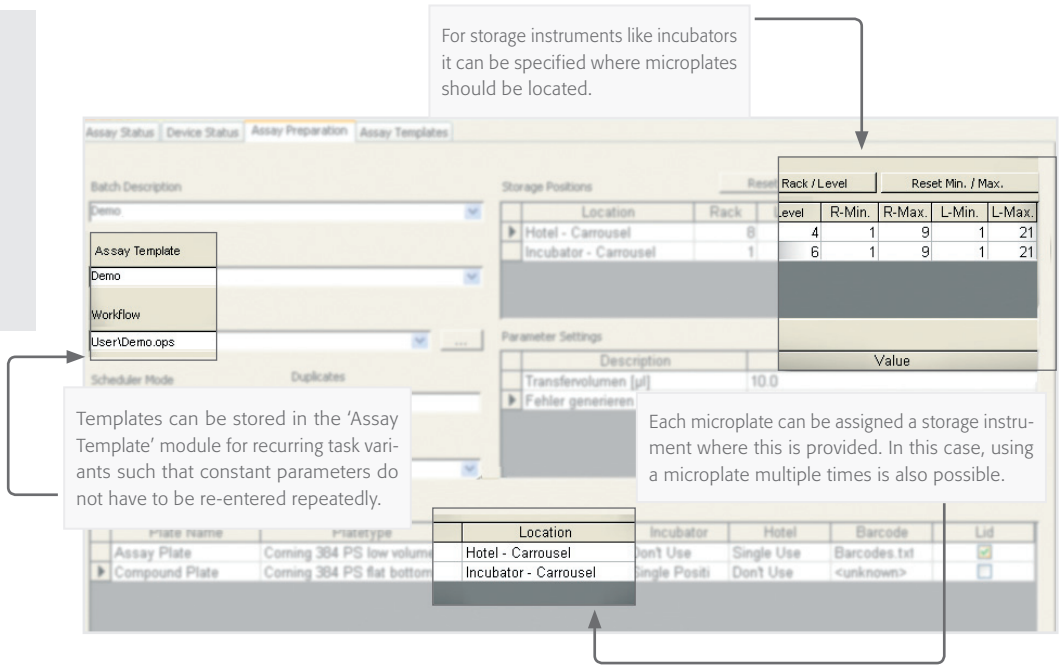
A detailed depiction of the work list provides a solid overview of all the assays currently existing in the system.



For every instrument, the microplates present in the instrument can be displayed. Therefore, it is possible to obtain an overview of which microplates are at which positions in the system at all times.

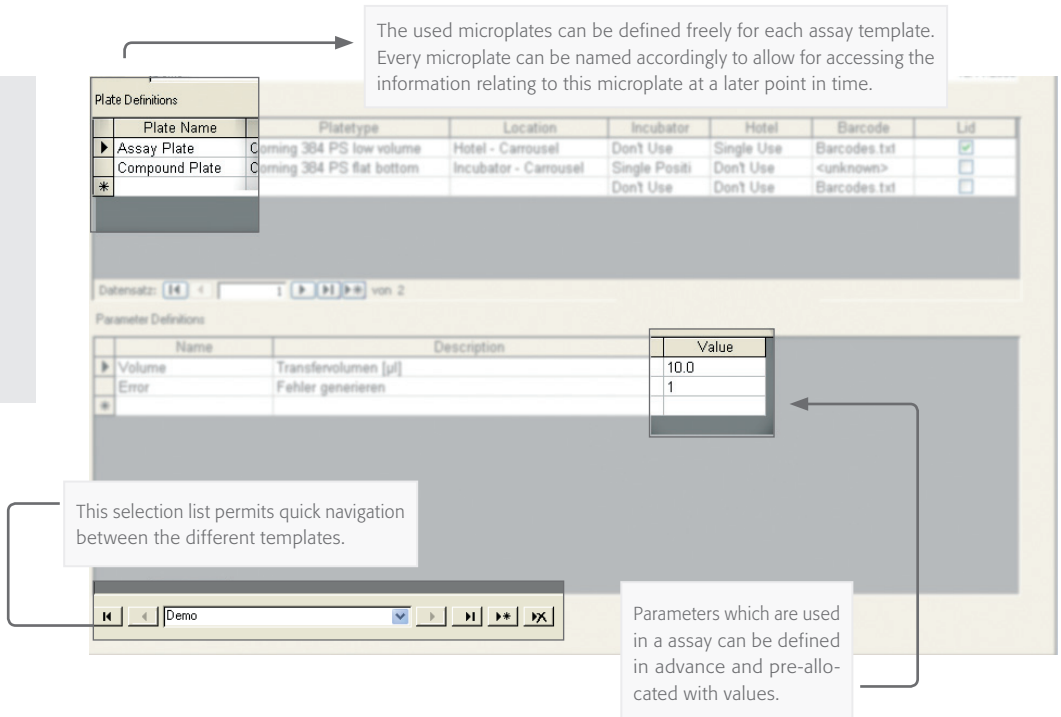


The ‘Assay Preparation’ module permits the flexible generation of batches in consideration of the existing storage instruments and their capacity.



Batches are generated in the CyBio® Plate Tracking module, it being possible to specify different properties, such as type of microplate, barcode, lid etc., for each assay. The option to define workflow parameters permits the creation of flexible workflows; of course, both workflow and microplate parameters can be used in a instrument script to control the workflow within the script. The option to provide each assay with a priority allows for the use of the CyBio® Scheduler software in application scenarios in which timely processing of emergency samples during normal operation is required.

Templates can be stored in the ‘Assay Template’ module for recurring task variants such that constant parameters do not have to be re-entered repeat-edly.



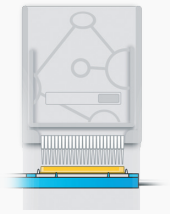
Time Measure Function

After creating a workflow, normally the workflow runs at least once to test that it can be executed in a correct manner. The CyBio® Scheduler uses this test run to measure the duration of each individual process step. This is performed automatically and the time values are included in the workflow.

In particular with regard to liquid handling, different run-times are required based on the liquid used. Depending on the viscosity of a liquid, a different flow rate might be necessary to achieve a satisfactory pipetting result. The differences in run-time can easily amount to one minute or more and can be detected through the time measure function and then taken into account in scheduling, resulting in higher throughput and time stability. The time measure function of the CyBio® Scheduler measures the time required for pipetting the liquid during the test run and applies this time to every subsequent execution.

As a result of the time shift illustrated above, changed incubation times can result, impairing the measurement results. Through the integrated time measure function, the CyBio® Scheduler detects process steps which require more time. Consequently, a longer duration can already be taken into account when calculating the scheduling. This unique time measure function ensures that workflows can be scheduled in an ideal manner. Through this functionality, it is possible to better react to process-specific conditions, compared with a solution applying a fixed timetable.

Pipetting of 250 µl at 10 µl/s

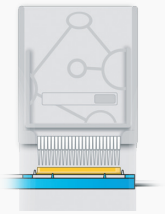


CyBio® Scheduler

Conventional schedulers with a fixed time table

Schedulers with a fixed timetable apply a fixed time value, regardless of the required time, resulting in 5 valuable seconds being wasted in each pipetting step in the example. Through the integrated time measure function, the CyBio® Scheduler achieves a higher throughput.

Pipetting of 250 µl at 25 µl/s



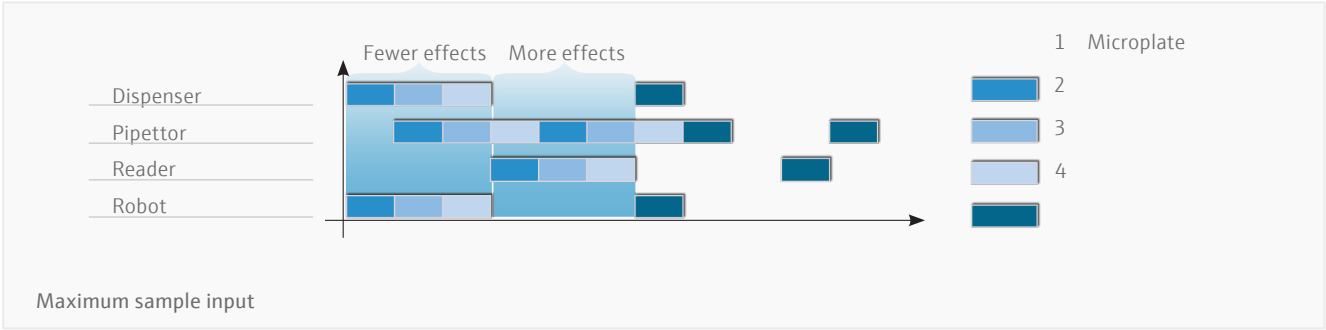
CyBio® Scheduler

Conventional schedulers with a fixed timetable

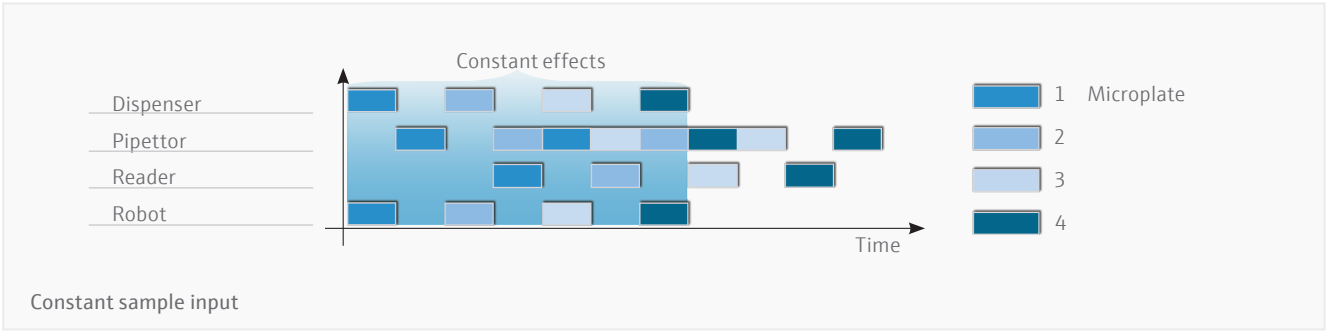
Schedulers with a fixed timetable often apply a mean value to the duration of a process step. If the process step takes longer than the time stored in the timetable, time shifts occur during the execution, which can lead to a time shift of the entire work list.

Scheduling Method

The CyBio® Scheduler software supports two scheduling methods for the execution of a work list.



Maximum sample input



Constant sample input

Maximum sample input

The 'maximum sample input' method delivers the highest level of flexibility and is excellently suited to execute dynamic work lists. During the course of this method, the workflows included in the work list are executed as quickly as possible. In particular, this results in advantages in applications which rely on the quick processing of samples or the workflow of which has not been completely determined at the time of starting with the work list. These include, for example, the processing of emergency samples or the execution of variable workflows, such as in assay development. The following graphic displays the execution of different workflows by means of this method.

Due to its dynamic behavior, this method results in variations in the utilization of the individual instruments. This again causes undesirable effects, in particular in liquid handling, when dealing with the comparability of measurement results of individual samples. These especially include precipitation and crystallization effects as well as changes in temperature which are caused by the interrupted flow of liquids in tubes and reservoirs. The graphic shows the multiple execution of a workflow by means of this method and the impact of the different effects.

Constant sample input

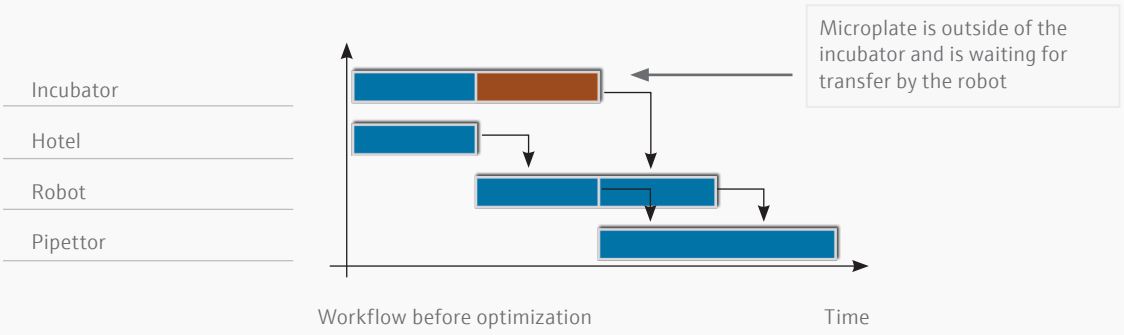
However, particularly in the case of drug screening, equal treatment of the samples is desired. To meet this requirement, the CyBio® Scheduler software includes the 'constant sample input' method. This method attempts to keep the interval of a sample to the previous sample constant. Whilst the effects described above cannot be avoided by this approach, their impact is virtually constant for each sample and therefore affects the comparability of the measurement results only to a very limited degree.

Optimization

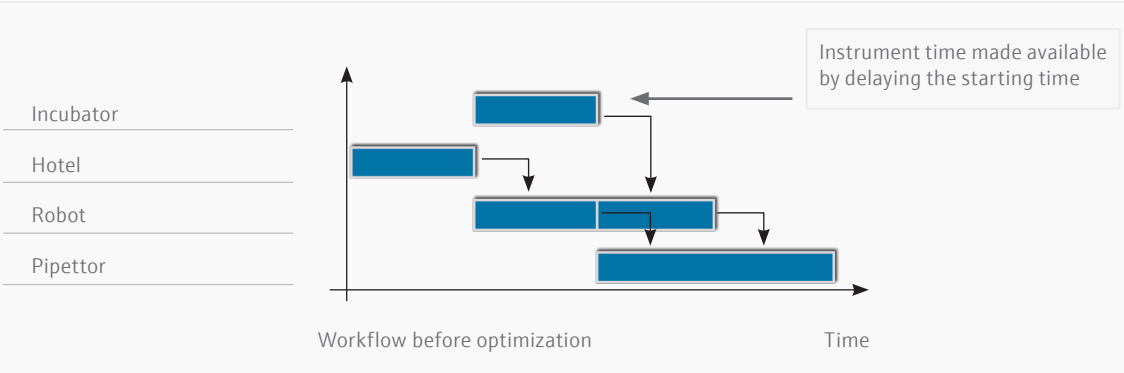
The CyBio® Scheduler includes several integrated, automated optimization processes. Through these optimizations, an increase of the throughput during the execution of a work list is achieved. The optimization of a workflow takes place over two stages.

Eliminating avoidable holding times

The first optimization stage is performed fully automatically after completing the time measurement. In the course of this optimization, the system analyzes the workflow and eliminates avoidable holding times.



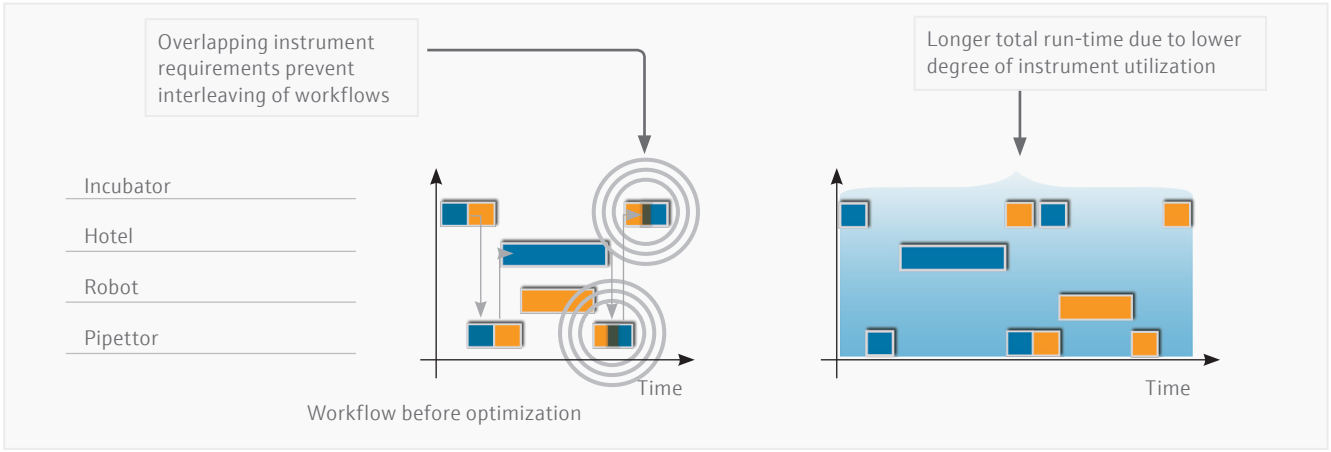
To this end, starting times for process steps are adapted such that no holding times occur between the individual steps, as far as possible. This makes it possible to achieve a higher throughput and the period of time that microplates are outside of a tempered environment can be shortened.

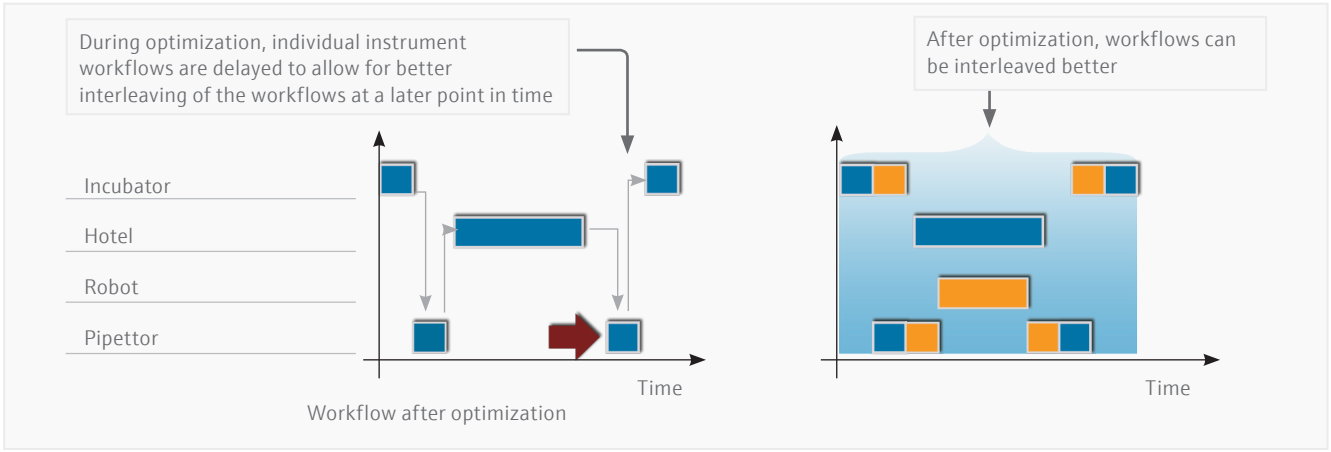


User-controlled, fully automated optimization

The second optimization stage is likewise performed automatically; however, it can be influenced by the user. This stage optimizes the given workflow such that the best possible throughput is experienced. To achieve this, individual process steps are rescheduled and their durations optionally adapted. However, the optimization is performed in such a manner that values below the measured instrument run-times are avoided. To ensure that incubation times are not undercut or exceeded and to maintain further required conditions, it is possible to define restrictions. During optimization, adherence to these restrictions is ensured.

The CyBio® Scheduler recognizes the bottlenecks depicted above and can eliminate them. Delaying a microplate transfer through the robot allows for better interleaving of the individual instrument processes, resulting in the possibility of significantly increasing the throughput. To ensure the maintenance of required incubation times and further restrictions, admissible maximum delays can be defined. Based on the current times, it is ensured that the boundaries defined by the restrictions are not exceeded.

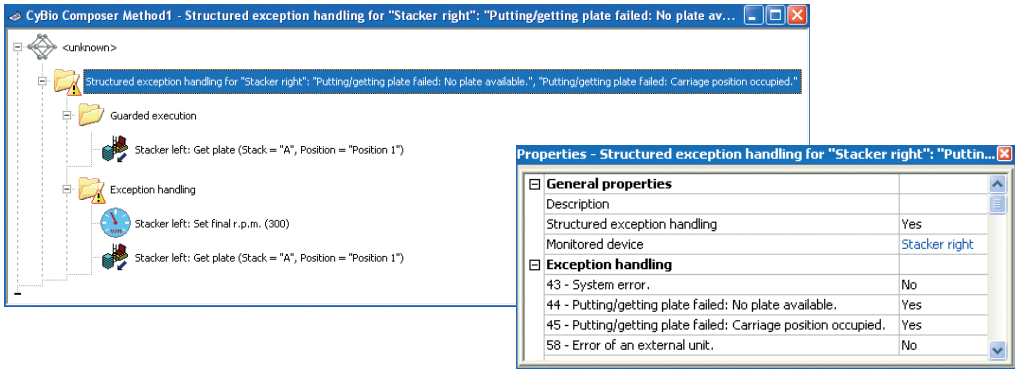




Error Handling

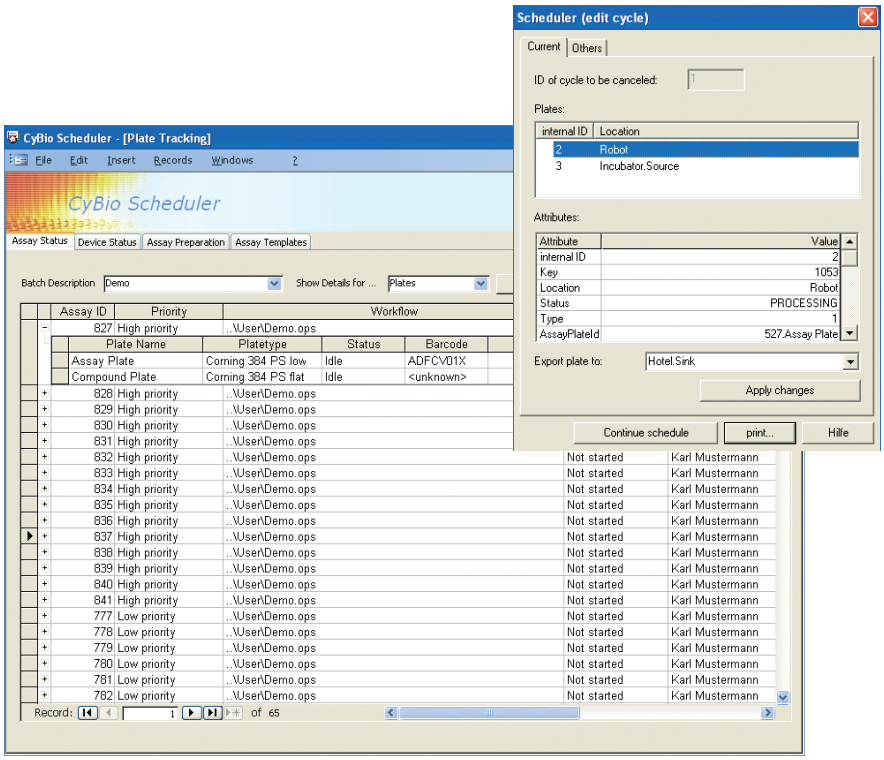
In automation solutions, it is particularly important to ensure that – if possible – they can perform their task fully automatically and without the need for user intervention.

This represents a challenge as a temporary fault is barely avoidable when many system components interact. However, the goal is to likewise eliminate these faults fully automatically without user intervention and to execute the current task in time and in full. To this end, the CyBio® Scheduler software offers a multi-stage error handling concept which can easily be adapted to the different requirements in practice.



Automatic error handling in the instrument driver

Every instrument driver has its own error handling function that handles the most common causes of faults. Therefore, every instrument driver attempts to perform a fully automated error handling, assuming this is possible. The error handling takes the current instrument status into account and, based on the current situation, attempts to set the instrument up in a status which allows for further processing. If this cannot be done in the instrument driver, the fault is forwarded to the invoking control script.



Automatic error handling in the control script

If the instrument driver could not eliminate the fault, there is the option of automatically eliminating it in the invoking control script. Often, a more flexible error handling can be defined within the scope of the control script as more information about the environment of the instrument is available in its context. Therefore, the statuses and positions of microplates, reservoirs etc can be much better taken into account to achieve an ideal error handling. Should automated fault elimination also not be possible within the scope of the script, this fault is forwarded to the CyBio® Scheduler.

Error handling with user intervention

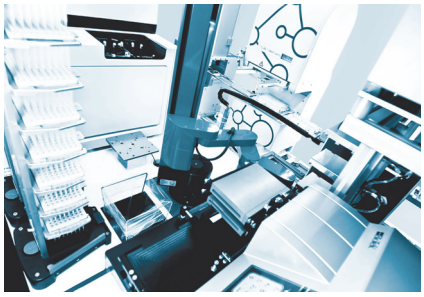
If a control script signals a fault, the user is also notified of this fault by email, cellular phone or the signaling instrument. The user can then eliminates the fault manually, remove the faulty microplate from the system or stop the execution of the work list. During the manual intervention, the user can execute control scripts to fully or partially perform automated recovery and maintenance functions. If a microplate has to be removed from the system, detailed information about the status and position of the microplate is available to ensure a safe identification of the microplate.

Examples

Some examples of automation solutions which can be controlled by the CyBio® Scheduler software are shown below.

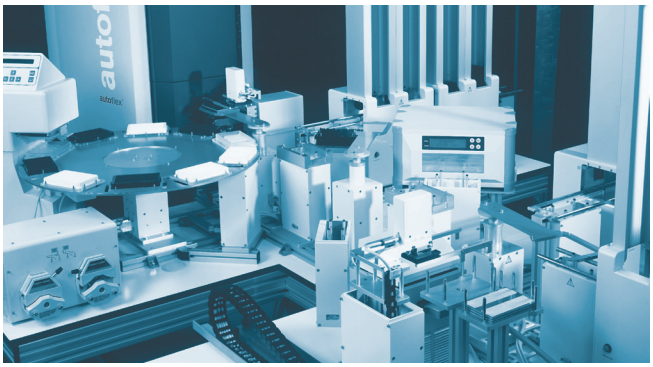
Automation solution for the execution of biochemical and cell-based assays

System components
- 1 Pipetting robots CyBio® Well vario
- 1 Washer Biotek ELX 405
- 1 Robot KiNEDx KX-300x660
- 1 Incubator Thermo Cytomat 6000
- 2 Stackers
- 1 Tip tray hotel & Plate depot
- 1 CyBio Lid Handling System
- 1 Imager GE IN Cell Analyzer 2000
- 1 Reader BMG POLARstar Omega



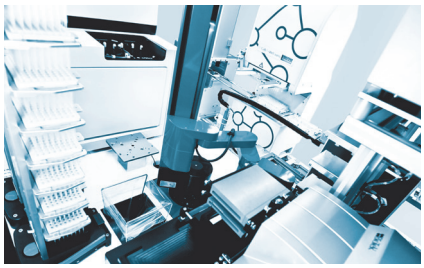
Automation solution for the execution of Single Nucleotide Polymorphism analyses

System components
- 1 Pipetting robot CyBio® Well
- 1 Reader Bruker autoflex®
- 3 Stackers
- 1 Plate handling system CyBio® Ways
- 1 Microplate lid dispenser
- 1 Bruker UV lamp
- 1 Clemens thermocycler



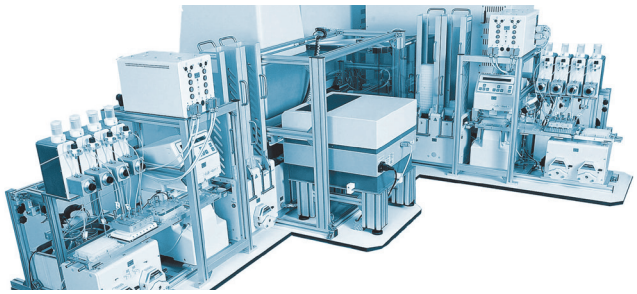
Full automated compound management solution

System components
- 1 Pipetting robot CyBio® Well vario
- 1 Pipetting robot CyBio® DiluS
- 1 Dispenser CyBio® Drop
- 1 Gas dispenser
- 1 Stäubli TX60L
- 3 Stackers
- 7 Tip tray hotel & Plate depot
- 1 Label printer CyBio® Print
- 1 Sealer Agilent PlateLoc
- 1 Decapper REMP ACD 96



Automation solution for the execution of Single Nucleotide Polymorphism analyses

System components
- 2 Pipetting robots CyBio® Well
- 2 Dispensers CyBio® Drop
- 1 Short-time incubator CyBio® Tower
- 2 Kendro Cytomats 6000
- 1 BMG reader
- 2 Plate handling systems / CyBio® Ways



Device List/Supported Instruments

CyBio® Composer/CyBio® Scheduler Integrations
With Analytik Jena Automation, the full range of laboratory equipment is available for integration. CyBio® Scheduler and CyBio® Composer plugins help to expand your research platforms functionality including a comprehensive error handling.

Barcode Labelers
- CyBio® Print vario
- CyBio® Quadprint
- CAB Apollo
- CAB Hermes+
- CAB A4+
- Domino Inkjet
- Bartender

Barcode Readers
- FluidX XTR-96 2D Tube Scanner
- Datalogic DS2100A
- Opticon NLV series

Capper/ Decapper
- Brooks/ REMP ACD
- FluidX XDC 96 pro
- Thermo / TAP Capit-All
- Hamilton LabElite Decapper

Centrifuge
- Agilent Microplate centrifuge (Vspin)
- BioNex HiG
- Sias Ixion

Lid Handler
- CyBio CoverStore
- CyBio Vacuum Delid Station

Dispensers
- Biotek MultiFlo
- Biotek MicroFill
- CyBio® NanoJet
- CyBio® Drop series
- CyBio® Argon Dispenser
- Labcyte Deerac LX
- Thermo Multidrop combi
- Thermo Multidrop combi nL
- Thermo Multidrop micro 384
- Thermo Wellmate
- Deerac Latitude

Liquid Handlers
- CyBio® DiluS/ CyBio® DiluS^{pro}
- CyBio® Disk
- CyBio® Disk vario
- CyBio® Robospense
- CyBio® Well
- CyBio® Well vario
- CyBio® CrystalCreator
- CyBio® FeliX
- FluidX Xpp-721
- Labcyte Echo series
- CyBio® InLine
- CyBio® HummingWell
- TTP mosquito

Microplate Handlers
- CyBio® Ways
- CyBio® Turn Station
- HighRes MicroServe
- LabServices PlateDispenser
- PAA/ Peak Robotics KiNEDx series
- PAA/ Peak Robotics ProNEDx series
- Precise Automation PreciseFlex PF400
- PTM gripper
- Microplate Handlers
- Staubli TX robots
- CyBio® Carry

Microplate Storage
- Agilent Labware Stacker
- Agilent Minihub
- Agilent Platehub
- CyBio® Stacker
- CyBio® QuadStack
- CyBio® Tower
- Inheco Incubator Shaker
- Inheco HeatPAC
- Inheco CPAC units
- LiCONiC Automated incubators
- LiCONiC Plate hotels
- PAA Carousels
- PAA FIFO Q-Stacker
- PAA FILO Plate Stack
- PAA Random Access Hotel
- Thermo Cytomat series

Plate Sealers
- Abgene ALPS 300
- Abgene ALPS 3000
- Abgene ASP-50
- Abgene Seal-it 100
- Agilent PlateLoc
- Brandel RS-3000
- KBiosystems Chameleon
- KBiosystems KAPS-500
- KBiosystems Wasp Plate Sealer
- Brooks/ REMP PHS / LHS
- Brooks/ REMP CSP

Peelers & Piercers
- Agilent Microplate Seal Piercer
- Brandel RS-3000
- H+J Bioanalytik Robopierce
- KBiosystems K-Pierce
- Brooks/ NEXUS XPeel
- Brooks/ REMP APP

Plate Washer
- Biotek ELx405 series
- Biotek EL 406 series
- Biotek 405 LS
- Biotek 405 Touch
- Molecular Devices Embla 96/384 Washer
- Tecan PW-384

Measurement System
- AssayMetrics Fluospec FL
- Biotek Synergy series
- Biotek Epoch
- BMG FLUOstar Optima
- BMG LABTECH Galaxy FLUOstar
- BMG LABTECH Galaxy FLUOstar Optima
- BMG LABTECH Optima RUBYstar
- BMG LABTECH PheraStar FS
- BMG LABTECH POLARstar Galaxy
- Synentec/Roche CellaVista
- Tecan Infinite F5000
- Measurement System
- Tecan Infinite M1000
- Till ID Openmore
- Yokogawa CellVoyager CV7000
- Zeiss Spinning Disc Microscope
- Corning EPIC
- GE Healthcare IN Cell 6000 Analyzer
- GE Healthcare IN Cell 2000 Analyzer
- LJL Biosystems Acquest
- Molecular Devices FLIPR TETRA
- Molecular Devices ImageXpress Micro
- Molecular Devices SpectraMax
- PerkinElmer EnVision
- PerkinElmer LumiLux
- PerkinElmer Operetta
- PerkinElmer (Wallac) Viewlux
- Tecan Infinite 200 PRO
- Sophion Qube
- Synentec NyOne
- Tecan Safire
- Tecan Safire 2
- Tecan Spectra Fluor
- Tecan Spectra Fluor Plus
- Tecan Ultra
- Tecan Ultra Evolution
- Tecan Ultra FLT
- TTP Labtech Acumen
- Wallac MicroBetaTriLux
- TTP Labtech ameon®
- Yokogawa Cell Voyager CV 7000S
- Bruker rapiflex™
- Bruker autoflex™
- BMG PheraStar FSX

Device List/Supported Instruments

Shakers
H+P Variomag Teleshake
H+P Variomag Thermoshake
Q.Instruments Bioshake elm series
Thermal Cycler
Biometra TRobot Thermocycler
Clemens Primus Robot
Roche LightCycler 480 System
Roche LightCycler 1536 System
Analytik Jena qTower^3 auto
Other
ADAM CPWplus balances
CMOS Cap Detection Analysis System
Analytik Jena collision sensors
Analytik Jena I/O control
ISMATEC pumps
Logitech video monitoring
MéCour thermal towers
MicroSonic sensors
Millipore Vacuum Filtration Station
Moduloplate Scale
Sony video monitoring
Tecan Cavro Syringes
Vacuubrand 2/4/10 vario
WERMA KombiSign signal towers
Zaxis VMP

Beside the listed devices, we are committed to developing new plugins for instruments of your choice.

Technical Data

System requirements	
Operating system	Microsoft Windows XP SP3; Microsoft Windows Vista SP2; Microsoft Windows 8
Minimum monitor resolution	1024 x 768 pixel, 24 Bit Colors
Additional hardware	CD (only for installation) Network adapter (only for distributed installations) RS232 ports (depending on installed devices)

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Pictures: Analytik Jena AG
Subjects to changes in design and scope of delivery as well as further technical development!

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