

Excellence in Lab Scale Technology



Chemistry | Pharmacy | Biotechnology | Food



Catalogue excerpt Automation Technique 2015/2016



Laboratory | Pilot plant | Mini-plant

#### Dear reader,

The products and services shown in this excerpt of our main catalogue only represent a small part of our complete range. Further products and services may be found in our other catalogue excerpts or in our main catalogue which you can request in printed form or download as a PDF file via our website under www.hitec-zang.com.

Please note that the page links (hyperlinks) only function within this excerpt.

We wish you inspirational insights while reviewing the following pages.

HiTec Zang GmbH

#### Summary of the subject areas of the main catalogue 2015/2016



#### Laboratory Reactor Systems

Automatic laboratory reactor systems, parallel reactor systems, micro-reaction systems, autoclaves, reaction calorimeters, laboratory sewage plants, formulation stations, customized pilot and mini-plant equipment in glass, stainless steel, Hastelloy ...



#### Fermentation Technique

Bioprocess optimisation, fed-batch, fermenter systems, parallel fermenter systems, fixed-bed reactors, gas analysis systems, gas mixing systems ...



#### Automation Technique, Hardware & Software

Automation systems with NAMUR-compliant equipment, measuring amplifiers, laboratory process control software, batch control and administration, electronic laboratory notebook, laboratory information management system, peripherals ...



#### Liquid Handling & Laboratory Robots

Synthesis robots, sample collectors and sample dispensers, multifunctional laboratory robots, cell culture and active substance screening systems, multi-directional valves ...



#### Dosing Systems & Pumps

Dosing, filling and dispensing systems for solid matter, melts, liquids and gases, gravimetric dosing, hose pumps, syringe dosers, gear pumps ...



#### Laboratory Apparatus & Accessoires

Torque measuring stirrers and stirrer blades, liquid phase separation, glass components, total evaporators, balances, thermostats, valves and stop-cocks ...



#### **Process Analytics & Sensors**

Pressure, temperature, level, humidity and flow sensors, ATR-FTIR-spectrometry, in-situ particle sizers, turbidity-, reflection-submersible probes, phase limit detectors ...



#### Services & Didactics

Consultancy, planning, application programming, training, service and support ...

For quick and easy orientation the following symbols are used:







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# **%**

# **Automation Technique**

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## **Automation Technique**

## LabManager<sup>®</sup>-laboratory automation system



The LabManager® system is an automation system which is especially suited for laboratory-, mini- and bench plants. It is suitable for the automation of virtually all chemical procedures, ranging from batch to continuous processes.

The LabManager<sup>®</sup> system was developed in close cooperation with specialists from laboratories and pilot plants of major global chemical companies. It has proved its worth as a standard tool over a wide area in over 1,000 applications.

Particular care has been directed to develop a user-friendly man-machine interface, a compact design, and a high application flexibility in accordance with the requirements of the NAMUR working party for research process control computer systems (RPCCS).

The LabManager® RPCCS is especially distinguished by the fact that it is also transparent and easy to handle for personnel inexperienced in automation techniques.

#### The advantages

- Extremely high accuracy »
- More intensive utilization of your personnel and equipment » resources
- » Release of the lab personnel from routine activities
- » GLP/GMP raked working method without additional outlay
- Optimal reproducibility of your recipes, even after years »
- Complete documentation of the entire process »
- Saving in instrumentation thanks to virtual devices »
- Can be scaled from a simple data logging system up to a » networked process control system
- » Shorter "time to market" period for your products
- » Increase in quality
- » Lowering of potential danger
- » Lowering of costs

Thus, thanks to such as the standardised NAMUR connection technology, you can connect your sensors, actuating element and devices yourself or, with help from the graphically programmable batch control system, HiBatch™, and the unit operation library, you can "program" the control program for a complex synthesis in a few minutes.

The LabManager<sup>®</sup> system combines in a unique way user-friendliness, measuring accuracy and industrial robustness.

The systems generally have a pay-back period of below one year.



## LabManager<sup>®</sup>, the interface genius!

## LabManager®-laboratory automation system

## Fields of application



The LabManager® is used in fields such as:

- > Chemistry
- > Pharmacology
- > Biotechnology
- › Food technology
- > Environmental technology
- > Quality assurance
- > Experimental plants and test beds

#### Applications

The possible applications in chemistry laboratories, in pilot plants, for mini-plants and in companies are virtually unlimited thanks to its unique flexibility. Typical applications of the system in the fields of chemistry and pharmacology are:

- > Process development
- > Process optimization
- > Scale-up
- > Exothermic early warning system
- > Single- and parallel reactor systems
- > High-throughput experimentation (HTE)
- > Bench plant installations
- > Mini-plant Installations
- > Micro-reaction equipment
- Continuous processes
- > Batch processes
- > Semi-batch processes
- Syntheses
- > Reaction calorimetry
- > Screening
- > Polymerization
- > Distillation
- > Extraction
- > Crystallization
- > Production oriented labs (raw material control)
- Quality assurance

The system offers all the functions of automation systems and process control engineering, such as:

- > Data logging
- Process control
- Batch control
- Closed-loop control
- Process monitoring
- Process visualization
- Alarming
- Online intervention
- > Logging
- > Filing

All basic unit operations, ranging from dosing up to sample drawing, are automated (see Automation with the LabManager®).

All measured values are collected, visualized (see LabVision®), and automatically evaluated (see HiText<sup>™</sup>, eJournal<sup>™</sup>, HiLIMS<sup>™</sup> and KalDas<sup>™</sup>).



## Calculation of profitability



The calculation of profitability is conducted using the example of a polymerisation process in a laboratory reactor.

#### I. Manual operation mode

#### Test

Total	11 h
Emptying and cleaning	1 h
Secondary polymerisation	4 h
Dosing	4 h
Heating	1 h
Weighing out	1 h

Test start, for example at 7:30 am, test completed at 6:30 pm – Using this system, a maximum of one test per day is possible!

#### II. Automated test control with the LabManager®

Unattended procedure with

- > Temperature control
- > Dosing
- > Torque monitoring
- > Recording of test data
- > Online evaluation
- > Clear-text report (ELN, LIMS)
- > With remote alarming etc., if required

#### Daily routine:

First test start, for example at 7:30 am, test completed at

6:30 pm – In the meantime, the laboratory personnel is free for the evaluation of the previous night's automatic run and the preparations for the next tests.

Second test start, for example at 7 pm, test completed at 6 am (unattended) – Using this system, two tests per day are now possible!

#### The laboratory utilisation is improved by 100%

Costs	Amount
Direct costs of the laboratory automation	25,000€
Planning, familiarisation, plant upgrade	10,000€
User training	3,000€
Total Cost	38,000€

The amortisation period is evaluated out of the cost of one laboratory day (e.g. 750 euros) and the total cost:

#### Amortisation period $\approx$ 50 days!

Even in the worst case scenario, assuming an improvement laboratory utilisation of merely 15%, which accords to a saving of  $41,000 \in$  annually, the amortisation period is still below one year!

#### Additional beneficial effects

GLP-compliant mode of operation due to a significant improvement in the documentation, quality and reproducibility.

## Further pay-off calculation for chemistry laboratories

#### Catalyst research laboratory

Test series (savings due to unattended night operation):

#### Amortisation Period $\approx$ 3 months!

#### Colour laboratory

Frequently changing recipes (savings due to simplified parameterisaton via HiBatch<sup>™</sup> batch control and unattended night operation).

#### Amortisation Period $\approx$ 6 months!

Naturally, similar results are achieved in continuous operation, if, instead of having personnel directly at the location, it is only necessary to have an on-call duty and remote alarming.

It is a known fact that every single day which a product is launched earlier on to the market can result in six- to seven-digit additional revenue.

This clearly indicates how much laboratory automation is nowadays a must!

Using project module libraries shortens the process of creating projects significantly.

In contrast to conventional automation systems, almost all modifica-

tions which may become necessary in the course of a running test

LabManager® system, several cost calculations for the conventional

realisation of a number of measurement and control technology few are compared below with the corresponding realisation using the

can now be realised without having to shut down the plant.

LabManager® system.

In order to clearly demonstrate the cost-saving potential of the

## Conventional automation compared to LabManager®

With the application-oriented device components, typical automation basic functions, such as dosing, vacuum control, and the control of the reactor interior temperature, are achieved in an uncomplicated manner.

The application-oriented device components contain the required functions

The dosing device components additionally offer the possibility to automatically or manually refill the feed tank without dosing interruption. Parametering of controllers is no longer necessary and thus, one of the greatest and most time-consuming problems in practice is eliminated.

#### Example 1: A dosing circuit for liquids



Conventional realisation method



Realisation using the LabManager® system

GraviDos® complete and fittings for

included in delivery scope of GraviDos®

no longer necessary, self-documenting

connection to reactor

**GraviDos**<sup>®</sup>

2 hours\*

1 hour\*

1 hour\*

none

2 hours\*

**Realisation using HiTec Zang LabManager® and** 

#### Costs

#### **Realisation using conventional EMSR/PLT** and individual components

Cost factor		Costs
Clarification of the task	2 hours*	160.00€
Engineering	6 hours*	480.00€
Procurement	4 hours*	320.00€
Instrumentation of components	Pumps, balance, valve, fittings	2,500.00€
Additional devices	Interface for balance	500.00€
Additional material	Control cabinet proportionately, cables, accessories etc.	500.00€
Realisation, test	12 hours*	960.00€
documentation	4 hours*	320.00€
Total Cost		5,740.00€

Total Cost

\* 80.00 €/h

The savings due to the LabManager®, according to the above calculation, already add up to 3.560 euros!

This is more than 60 %!

Or, in other words, a conventional solution is 2.6 times more expensivel

Further savings are generated by the significantly reduced required space of the LabManager and the significantly lower costs in the case of later upgrading.

Here, the typical saving is about 70 to 80 %!

Costs

160.00€

80.00€

80.00€

€ 00.0

0.00€

160.00€ 0.00€

2,180.00€

1,700.00€

#### Example 2: Dosing control of gases with a mass-flow controller

Costs

#### **Realisation using conventional EMSR/PLT** and individual components

#### **Realisation using LabManager®**

Costs 80.00€ € 00.08 € 00.08

1,580.00€

€ 0.00

€ 0.00

€ 00.08

€ 0.00 1,900.00€

Cost factor		Costs	
Clarification of the task	1 hour*	80.00€	1 hour*
Engineering	12 hours*	960.00€	1 hour*
Procurement	4 hours*	320.00€	1 hour*
Instrumentation	Mass-flow controller	1,500.00€	Mass-flow controller, ready for connection
Additional devices	Interface/control unit/regulator 2,000.00 €		Integrated in LabManager®
Additional material	Control cabinet proportionately, cables, accessories etc.	500.00€	no longer necessary
Realisation	10 hour*	800.00€	1 hour*
documentation	4 hours*	320.00€	no longer necessary, self-documenting
Total Cost		6,480.00€	

#### Iotal Cost

\* 80.00 €/h

The savings for this individual task already add up to in excess of 4,500.00 euros, which is approximately 70 %!

Or, in other words, a conventional solution is 3.5 times more expensive!

The essential savings potential is, however, shown during its daily use, in particular in cases of frequently changing processes and frequently changing recipes. A new recipe control can be established an d processed by the laboratory technician with the help of the unit operations library in LabVision® within a time-frame which, if conventional methods were applied, would already be needed for the technical clarification alone.

Additional significant savings are generated by the smaller space taken up by the LabManager and the lower costs in the case of later upgrading.

Further substantial advantages in regard to costs, time, and flexibility result from the fact that the LabManager® laboratory automation system is easy to upgrade and expand in case the plant should require this at a later stage.

The devices can expanded at any time by the retrofitting of modules.

The modification of the application software can be conducted by the company's own personnel or by our project engineers.

Software modifications, a new connection or a replacement of sensors and actors can usually be carried out while the plant is in operation, without shutting it down.

It is only possible to estimate the savings on a rudimentary basis, but according to estimations by long-term users, they are considerable. These advantages are mainly demonstrated by the LabManager® system in daily operation in laboratories and pilot plants.

Not entirely convinced?

We will gladly introduce you to experienced users of the LabManager® system.

## And this is what our customers say

Laboratory Reactor Systems "As yet we have not found such flexibility anywhere else" "I am impressed by how easy your software is to handle" Fermentation Technique "In our experience we have been able to reduce the time for the realisation of our projects by about a fifth by using the LabManager® system compared with conventional automation systems" Automation Technigue "I do not think your slogan "Your one-stop-shop around the laboratory reactor" is an exaggeration. The software is particularly impressive, as flexibility and simplicity of operation cannot generally be combined" "We were able to reduce the time needed for the carrying out of the tests using your system from one week to 40 minutes. And the results achieved were significantly better" Liquid Handling -aboratory Robots "By using your LabManager® system we were able to reduce the previous manual test control procedure with 800 manual operations from 3 weeks to 5 days" "The automation of our pilot plant using conventional automation sys-**Dosing Systems** tems was estimated to cost 900,000 euros. With the HiTec Zang LabManager® system it cost only 60,000 euros in the end" "The start-up of a comparable laboratory unit has taken an eternity up to now  $\cdot$  With the LabManager $\otimes$  system I was able to complete the start-up after two days" Laboratory Apparatus Accessories "I would like to thank you for your great, excellent support in the programming of the \*\*\*\* program and for the "bug-fixes". The program is now complete and has already been able to be run several times. The checking of the online and automatically determined \*\*\*\* values with the raw data stored in the tables was also successful" Process Analytics Sensors "I thank you for the speedy processing. Many thanks, too, for the spirit of cooperation which is wonderful in your company" "By the way, yesterday, I called Hitec Zang directly two times and each time I received a prompt and accurate advice - excellent support!" Services Didactics

These and further customer comments are archived in our company with the name of the firm and the contact person. We will be happy to put you personally in contact with one of these customers on request.

## System construction



An automation system is composed of an automation system (AS), in this case the LabManager®, and an operator station (OS).

#### Functions of an AS

An AS includes interfaces for the connection of the sensors, actuators, and devices. It is used for

- Collecting
- Converting
- > Linking of signals
- > Monitoring
- > Controlling
- > Automatic controlling etc.

LabManager<sup>®</sup> ASs are equipped for the special ambient conditions in the laboratory or pilot plants. The required space for the devices is therefore kept to a minimum.

#### Functions of an OS

The OS, also referred to as a user PC, represents the interface between user and process and is used for

- > Parametering
- Operating
- Monitoring
- > Reporting
- > Logging
- > Saving
- Evaluation

It is comprised of a special PC running under the Windows 7 operating system or higher and the required LabVision® software modules

#### Technical characteristics

The high functional level of the HiTec Zang automation system, compared to a traditional automation system is particularly evident in the following areas:

#### Interfaces



The extensive choice of interfaces includes all the interfaces for sensors, actuators and devices which are used in a laboratory, from a temperature sensor to an analyser.

Interface panels with standardised connection sockets are available for the different types of interfaces.

The construction and electric wiring of the connections comply with the recommendations and guidelines for laboratory apparatus of the chemical industry (NAMUR NE28 recommendation). Incorrect connections can be therefore eliminated.

Suitable connecting cables for standard laboratory apparatus are available. For this reason, customers without special EMSR technical and electrical knowledge are also able to connect sensors, actuators and laboratory apparatus without outside assistance.

EMC robust interfaces guarantee a problem-free application, even where deployed under rough conditions.

In addition to the measurement value collection and control function units, the devices also include the most frequent process measurement and control (PMC) components for:

- > Signal input/output
- > Potential separation
- > Amplifying
- > Filtering
- > Linearisation
- > Control
- Closed-loop control
- > Monitoring and reporting (alarming)
- > Supply of sensors and actuators with power

External transducers, buffer amplifier etc. are no longer necessary. Due to the compact design of the device, the required space is reduced to a minimum so that it fits in any rack and on any lab table. If conventionally constructed, a comparable technology would fill one or even several control cabinets.

The possibility to mount the device directly on to the plant represents a significant help in saving costs for project planning and cabling and allows an easy remounting of the instrumentation.



LabManager directly mounted on a process cell

#### **Replaces several individual devices**

A LabManager® replaces the electronic and control elements of various individual devices or complete standard laboratory automation units, such as:

- > Dosing devices
- > Titration devices
- > Vacuum stations
- > Closed loop controllers
- > Plotters
- Transducers
- > Data loggers
- > Sensor-actuator-power supply

Instead of connecting costly devices only a LabManager<sup>®</sup> or a Lab I/O<sup>™</sup> and simple device components are needed. What was previously only possible using extensive and costly planning can now be supplied as a turn-key solution in these compact devices.

#### The basic configuration of all LabManager® devices

- » 2-point scaling/calibration for all data points (inputs, outputs,...)
- » Limit and warn values for all data points
- » Manual/automatic mode for all data points
- » Integrated filter functions: low pass, averaging, min., max., distribution, variance
- » Linearisation tables for Pt100, NiCr-Ni, Fe-CuNi (type L), etc. and user-defined tables in the flash memory
- » Device components for connections of data points
- » Sensor and conductor error detection

Scaling and filter functions enable an optimal adaptation to each measuring sensor.

#### Device components

Device components enable a direct connection of data points inside an AS. This leads to a logical module whose inputs and outputs can be connected freely.

#### Application-related device components (option)

- > Dosing control
- Vacuum control
- Temperature cascade control
- > pH value controller
- > Titration controller

#### Technical measurement and control functions

- > PID and application-related controller (optional)
- > Comparer
- > Ramp
- Set point generator (profiles)
- > Timer impulse
- > Timer start delay
- > Timer stop delay
- > Balance, thermostat and stirrer communication
- > Temperature compensation
- > Sample & hold (scan and hold element)

#### Mathematical functions

- > Differentiator
- > Integrator
- > Adder
- > Subtracter
- > Multiplier
- > Divider
- Averaging
- > Algebraic polynomial differentiator

#### Logical functions

- > AND element
- > OR element
- > Exclusive OR element
- > NOT element
- > Counter

#### Switching functions

- > Switch 1 to n
- > Switch n to 1
- > Monitored output with/without feedback signal
- > Storage element (latch)

Device components belong to the standard equipment of a AS and do not have to be ordered separately (with exception of application-related device components, regulators and interface drivers).

#### Project modules (option)

Using the pre-configured project modules and the project module library, even users who have not had any technical training in automation techniques can in a very short time create an automation project for a laboratory or a pilot plant. Project modules are available for all major plant functions, such as

- > Temperature controlling
- > Dosing
- > Stirring
- > Etc.

#### Modularity

The AS devices can be modified or upgraded by the user at any time and thus be adapted to the changed or increased demands. It is therefore possible to upgrade a device, which was initially only used for measuring and monitoring, to a regulation and control system. In addition, a system can be extended almost completely as desired by parallel connection of additional ASs.

LabManager<sup>®</sup> ASs are available in different housing sizes ranging from 5 to 12 free panel places. Sub-stations may be connected for the provision of additional slots.

The power supply for the sensor and the actuator can also be integrated into the devices.

All devices are available as individually equipped basic devices.

#### Security

Due to their integrated 32 bit processor, the AS devices are also able to run on an autonomous basis, i.e. without a PC. The CPU is monitored by a hardware watchdog device and boots automatically in case of troubles. The LabManager<sup>®</sup> is designed in accordance with DIN EN 61010/EN 61508 and the firmware/function has been developed in accordance with DIN EN 61508/EN 61311. The AS meets at the minimum the AK1 classification (SIL 1 on request).

The OS is equipped with an uninterrupted power supply (UPS) and a UPS management system. In case of a longer-lasting power failure, an OS will be shut down in a controlled manner.

The LabManager® firmware has been produced in accordance with an adjusted JSF coding standard and meets the demands of MISRA-C. In addition, the software has been validated using a CCCC test tool. The hardware has been validated for its reliability by the calculation of FIT values.



Changing a LabManager® slide-in module

## System configuration



LabVision® supports various topologies and media for the coupling of an AS and OS in order to provide projecting and system hardware suited to an application.

As standard, an AS is coupled with an OS through a RJ45 Ethernet interface, optionally a an RS-232 is possible.

Light guides are available for the bridging of greater distances



Several ASs can also be connected to an OS via an Ethernet switch or multiple interface cards.

In order to run several independent applications, several LabVision® licenses can work in parallel on an OS.

Ethernet OS OS **Evaluation PC** Operator station with LabVision®/ with LabVision® WebVision<sup>™</sup> PNK LabManager® other manufacturers AS Plant Office

An evaluation computer in the office with the WebVision™ or WebVision<sup>™</sup> Plus software may be connected using an existing network in order to call up the data for evaluation.

In the same way a touchscreen may be installed at the rack so that the most important process values and alarms are displayed there, set points can be changed and alarms acknowledged.

Devices of other manufacturers and field buses, such as Modbus, PROFIBUS DP or HART protocol, can also be integrated via OPC.



For more information, see "WebVision™" on page 151

Dosing Systems Pumps

Laboratory Apparatus

**Process Analytics** 

Sensors

Accessories

Systems

## LabManager<sup>®</sup> & SoftManager<sup>™</sup> system structure

#### LabManager® AS with its own CPU



In addition to the LabManager® AS up to seven sub-stations with slide-in modules can be fitted. Laboratory and process devices are connected using data interface switches.

A LabManager<sup>®</sup> module rack 3 offers 12 slots for slide-in modules. The number of available slots reduces to 11 and 10 when using a bus coupling module (for up to four sub-stations) or two bus coupling modules (for up to seven sub-stations) respectively. An LM-BCUI card is fitted in the sub-stations in place of the CPU card. Thus, a physical maximum of 380 interfaces and up to 64 serial interfaces can be achieved via ComServer.

Up to eight LabManager<sup>®</sup> ASs can be connected to an OS. As a result, up to 3,040 interfaces are possible on slide-in modules.

#### SoftManager™



The SoftManager<sup>™</sup> system consists of an OS and a software AS which runs on the OS work station as well as I/O modules and data interfaces.

A physical maximum of 376 interfaces can be realised using the Soft-Manager™ system.

## LabManager®-laboratory automation system

## Communication with external devices and systems

Various interfaces and reports are available for communication with external devices and bus and I/O systems.

> Ethernet extension

> DeviceNet extension

> CANopen extension

> HART extension

These include

- Modbus OS and AS driver
- > OPC driver
- PROFIBUS extension
- > PROFINET extension
- > EtherCAT extension

Further protocols on request



Detailed information may be found on page 129.

#### Serial communication via I/O modules

The serial I/O modules each offer four serial channels in accordance with RS-232, RS-422 or RS-485 standards and, like other slide-in modules, are fitted into the LabManager® module rack slots.

## Serial communication via other interfaces

The LabManager<sup>®</sup> CPU has two RS-232 and one RS-485 interfaces on its front panel. These optional interfaces may be used to connect laboratory and process devices and for individually programmed drivers.

In addition, further serial interfaces in the form of ComServers can be connected via Ethernet to the LabManager® CPU.

A total of 64 additional external serial channels may be addressed.

## Automation using the LabManager<sup>®</sup> system

The LabManager<sup>®</sup> system is suitable for the automation of virtually all process engineering operations and functions such as:

#### Temperature regulation and control

Regulated temperature control by heating/cooling thermostats, heating elements or steam for:

- > Heating and chilling reactions defined by any desired number of curves and/or profiles
- > Distillation and reflux distillation
- Crystallization
- > Determination of calorific key data
- > Temperature-controlled dosing of exothermic mixtures

The special device component for the temperature regulation cascade, in connection with the auto-parameterisation module, HiTune™, significantly cuts down the time-consuming parameterisation procedure.

The configuration of the interfaces must be carried out using the

The use of other interfaces (i. e. all interfaces outside the HiBus™ slide-

manufacturer-specific configuration tools when using external

serial interfaces such as ComServers.

in module system) requires the option, SF-IFPTS.

LabVision® may also be operated as a slave to other automation systems.



Detailed information may be found on page 191.

Laboratory Reactor

Systems

## **Automation Technique**

For the reaction calorimetry both LabKit<sup>™</sup>-rc and individual hardware and software modules are available as ready-to-operate systems for the retrofitting of existing plants.

#### Dosing

Regulated and controlled dosing of solid matters, liquids and gases using:

- > Balances
- > Flow rate sensors
- > Clocked and proportional valves
- > LabDos<sup>™</sup> peristaltic pumps
- > SyrDos<sup>™</sup> syringe dosing devices
- > AlfaDos<sup>™</sup> (controlled dropping funnels)
- > GraviDos<sup>®</sup> (controlled dropping funnels)
- > SoliDos<sup>™</sup> solid matter dosing devices
- > Mass-flow controllers

The self-parametering dosing device components also enable users who are inexperienced in control system technology to configure a precisely working gravimetric dosing system within a few minutes.

#### **Pressure and Vacuum**

Flexible strategies for the pressure regulation from vacuum up to high pressures, even under difficult conditions.

- > Simple and dual sensors
- > Automatic changeover rough / detailed sensors
- > Vacuum and aeration program control
- > Inerting

The self-parametering vacuum regulation device component supports systems with and without ventilation/inerting.

#### pH value / RedOx potential

pH value and RedOx potentials can be monitored and controlled using:

- > One-sided automatic control (acid or base)
- > Bilateral automatic control (acid and base)
- > Titration







## LabManager<sup>®</sup>-laboratory automation system

#### Stirring with Torque and Viscosity Recording

The recording and control of the stirrer torque can supply important additional information about the process:

- Viscosity
- > Dissipation
- > Reaction progression

#### Sampling

Controlled sampling and drawing off of liquids using:

- > Single valves
- > Multi-directional valves (MultiValve™)
- > Pipetting robots (SciBot™)
- > Auto samplers (AutoSam™)

In addition, many further, even more complex operations, such as oxidation, phase separation, fractionated distillation or crystallisation, are available.

We will be glad to create special operations to your specifications.



Essentially, all sensors, actuators and laboratory apparatus that have an interface or are supplied electrically can be linked into the automation process, for example:

> Conductivity

> Gas concentration

> Rotational speed

> Phase limit

> Turbidity

> Density

#### Sensors

- Temperature
- > Pressure
- > Flow
- > Liquid level
- > Weight and power
- > pH/RedOx

#### Actuators

- > Valves
- > Electrical and pneumatic bottom outlet valves
- > Pumps
- Heating
- > Reflux separators
- > Drives



#### Laboratory apparatus and instrumenting components

- > Balance (GraviDos®)
- > Heating/cooling thermostats
- > Stirrers (ViscoPakt<sup>®</sup>)
- > Dosing devices (LabDos<sup>™</sup>, SyrDos<sup>™</sup>)
- > Phase separation (PhaSep™)
- > Analysers (on request)
- > In-situ spectrometers (MoleculeEye®)
- > In-situ particle sensors (MoleculeEye®)

Laboratory Apparatus

**Process Analytics** 

Sensors

Accessories

## The LabManager<sup>®</sup> product family

The LabManager<sup>®</sup> product family contains automation devices of different sizes that are built up in a modular manner. This ensures that you always obtain a device which best meets your requirements.

#### LabManager® 1 to 3

The LabManager<sup>®</sup> 1 is the standard device for laboratory and pilot plants with up to 20 interfaces.

The LabManager® 2 can be equipped with 32 interfaces and the LabManager® 3 with 48 interfaces.

All devices in the LabManager<sup>®</sup> family can be expanded to include additional sub-stations using a BCU module (bus coupling module).

The LabManager module racks<sup>®</sup> generally equipped with a 32-bit CPU slide-in module. Communication is carried out with the operator station using Ethernet or an optional RS-232. interface.

The power-saving processor technology produces very little heat loss so that the devices can be generally run without forced ventilation. This ensures high reliability and service life.

The robust metal case of the LabManager is suitable for free-standing arrangement and for the mounting in control cabinets or 19-inch racks. The user interfaces for the basic device functions are located on the front panel of the LabManager.

#### Characteristics

- > 32-bit CPU
- > Redundant time base and system monitoring system (Watchdog)
- > USB interfaces for data media and optional interfaces
- > RS-485 Modbus interfaces
- > Ethernet and RS-232 interface
- > Integrated power supply for sensors and actuators

All devices are available as a module rack for individual mounting.

The connecting technology is uniformly based on slide-in modules with standardized plugs and sockets.

#### Assembly options

In the standard assembly of the LabManager, the slide-in modules form the rear panel of the device.



Where it is planned that several racks be supplied by a LabManager<sup>®</sup> or little space is available on site for the connection equipment, the interfaces can be distributed across sub-stations (see Sub-stations).

## LabManager® module rack for individual mounting

A LabManager<sup>®</sup> module rack for individual mounting will be fitted with slide-in modules in accordance with your demands.

- A LabManager® AS for measuring tasks may comprise:
- > A LabManager® module rack (e.g. LM-LABM1B)
- > A CPU slide-in module (LM-CPU)
- > Interface slide-in modules (e.g. 2 x LM-AI and 2 x LM-RTD-P)

This sample configuration then has eight potential-free universal analogue inputs and eight inputs for Pt100 temperature sensors and is suitable for acting as a data logging and monitoring system.

If more than 8 module racks are required in addition to the CPU slidein module, a LabManager® module rack 3 or additional sub-stations may be used. Where there is a further requirement for interfaces, several devices can be operated from one OS.

A power supply for sensors and actuators is already integrated into the LabManager® module racks.

The CPU slide-in module (LM-CPU) and interface slide-in modules are additionally required for use as an independent AS. Should the LabManager® module rack be simply required to act as a sub-station for another AS, a BCU module (LM-BCUI) is required in place of a CPU module.

#### LabManager<sup>®</sup> module rack 1

LM-FAN slide-in module

The module rack can be individually fitted with the components offered.

The total load limit is no longer required when using the



Arrangement example: LabManager® 1

#### **Technical data**

<b>Dimensions</b> ( $W \times H \times D$ )	238 x 188 x188 mm (4 HE without feet)	anb
Extension reserve	Up to 5 slide-in modules, additional external I/O modules and sub-stations	chnic
Working temperature	040 °C, non-condensing	ion Te
Storage temperature	0…85 ℃	omat
Degree of protection	IP20	Aut
Security	EN 61010, EN 61508	
EMC	EN 61326-1	bu
Power consumption	Depending on configuration 15120 W	andli
Power output	60 W (100 W temporary*) analogue/digital modules when using LM-FAN: 100 W analogue/digital modules	Liquid H
Power supply	100240 V 50/60 Hz	-
Unladen weight	4.3 kg	
Scope of delivery	LabManager® module rack 1 manual	sms

\* "temporary" means a max. of 5 min. within one hour.

**Product code** LM-LABM1B

Description

LabManager® 1 module rack for individual mounting

#### LabManager<sup>®</sup> module rack 2

The module rack can be individually fitted with the components offered.



The total load limit is no longer required when using the LM-FAN slide-in module

Arrangement example: LabManager® 2

#### **Technical data**

<b>Dimensions</b> (W × H × D)	344 x 188 x 188 mm (4 HE without feet)	
Extension reserve	Up to 8 slide-in modules, additional external I/O modules and sub-stations	
Working temperature	040 °C, non-condensing	U
Storage temperature	085 ℃	

Laboratory Reactor Systems

Technical data	
Degree of protection	IP20
Security	EN 61010, EN 61508
EMC	EN 61326-1
Power consumption	Depending on configuration 20240 W
Power output	max. 100 W analogue modules + max. 100 W digital modules, total load 100 W (200 W temporary)
Power supply	100240 V 50/60 Hz
Unladen weight	5.3 kg
Scope of delivery	LabManager® module rack 2 manual

\* "temporary" means a max. of 5 min. within one hour.

Product code LM-LABM2B

LabManager<sup>®</sup> 2 module rack for individual mounting

#### LabManager<sup>®</sup> module rack 3

LM-FAN slide-in module

The module rack can be individually fitted with the components offered.

The total load limit is no longer required when using the

Description



Arrangement example: LabManager® 3

#### **Technical data**

<b>Dimensions</b> (W x H x D)	451 x 188 x 188 mm (4 HE without feet)		
Extension reserve	Up to 12 slide-in modules, additional external I/O modules and sub-stations		
Working temperature	040 °C, non-condensing		
Storage temperature	085 °C		
Degree of protection	IP20		
Security	EN 61010, EN 61508		
EMC	EN 61326-1		
Power consumption	Depending on configuration 20240 W		
Power output	max. 100 W analogue modules + max. 100 W digital modules, total load 150 W (200 W temporary*) with a 200 W-Option: max. 100 W analogue modules + max. 200 W digital modules, total load 150 W (200 W temporary*)		
Power supply	100240 V 50/60 Hz		
Unladen weight	6.2 kg		
Scope of delivery	LabManager® module rack 3 manual		

\* "temporary" means a max. of 5 min. within one hour.

Product code	Description
LM-LABM3B	LabManager® 3 module rack for individual mounting
LM-LABPS200	200 W option for LabManager® module rack 3

## LabManager®-laboratory automation system

## LabManager<sup>®</sup>-sub-stations

If the instrumentation devices to be connected are physically well apart from each other, for instance across several racks, it is recommended that sub-stations be used in order to minimize the amount of cabling required.

Up to seven sub-stations can be connected to a LabManager®.

A sub-station comprises a LabManager® module rack and a bus coupler slide-in module. The sub-stations can be connected either by HiBus™ (LM-BCUI & LM-BCUO/LM-BCUSO) to a LabManager® or by Ethernet (LM-BCUE) to an OS for use with a SoftManager™.





If more slide-in modules are required than a LabManager® module rack can accept, then a sub-station can be connected as an expansion using the economical LM-BCUI and LM-BCUSO bus coupler. The maximum length of cable between the bus couplers for this is 1 m.

All LabManager® interface slide-in modules can be used.

For technical data see "LabManager® module rack for individual mounting" on page 96.

Example: LabManager® with two sub-stations

Product code	Description
LM-LABM1B	LabManager® module rack 1 for up to 5 slide-in modules
LM-LABM2B	LabManager® module rack 2 for up to 8 slide-in modules
LM-LABM3B	LabManager® module rack 3 for up to 12 slide-in modules
LM-LABPS200	200 W option for LabManager® module rack 3
LM-BCUI	Bus coupler slide-in module for sub-station, 1 x HiBus™ input
LM-BCUO	Bus coupler slide-in module for LabManager®, 3 x HiBus™ active outputs
LM-BCUE	Bus coupler slide-in module for sub-station to SoftManager™, Ethernet input
LM-BCUSO	Bus coupler slide-in module for LabManager®, 1 x HiBus™ passive output, point-to-point connection

## LabManager<sup>®</sup> housing accessories

#### 19"-Mounting parts

The mounting parts enable LabManager® devices and sub-stations to be fitted in 19-inch system cabinets.

Thereby the default side parts will be replaced by side parts for 19-inch mounting.

Mounting parts for 19-inch system cabinet for LabManager® module racks

6-

**Product code** 

LM-RACK19

Required bezels for mounting of LabManager® module racks LM-LABM1B or LM-LABM2B are available on request.

Description

Laboratory Reactor

Systems

Fermentation Technique

**Automation Technique** 

Liquid Handling Laboratory Robots

**Dosing Systems** 

Laboratory Apparatus Accessories

**Process Analytics** 

Sensors

Pumps

## LabManager<sup>®</sup> interfaces

The interfaces for the process are usually found on the AS (LabManager<sup>®</sup> and sub-stations).

Serial interfaces and bus interfaces can be provided on an AS and on an OS (see OS interfaces).

The AS is fitted with interface slide-in modules with standardized, NAMUR-compliant connections. There are suitable slide-in modules for the connection of virtually all actuators, sensors and devices to be found in a laboratory.

#### Which signal type/slide-in module suits which sensor, actuator, or device?

The following table shows you via which signal type the different instrumentation components such as sensors, actuators and laboratory apparatus communicate and how they can be connected to the LabManager® ASs.

Many laboratory apparatus have several connections available for selection, for example analogue I/O or RS-232. Experience shows that the analogue interfaces are more straightforward in practical use than serial devices since less settings have to be carried out and a simple multimeter suffices as test apparatus, if one is required.

Task, sensor/actuator/de- vice to be connected	Interface module	Signal type, connection, driver	Reference source for sensor/actuator/device		
Sensors					
Temperature (absolute, diff	erence)				
Pt100	LM-RTD	Connected directly	See sensors/Pt100		
Pt100, Precision	LM-RTD-P	Connected directly	See sensors/Pt100		
Thermoelements	LM-TC	Connected directly	See sensors/thermoelements		
Four wire transmitter	LM-AI	020 mA, connected directly	See sensors		
Two wire transmitter	LM-AI	420 mA, connected directly	See sensors		
Temperature controller	LM-DI	Binary	See temperature controller and watchdog device		
Pressure (absolute, relative,	, difference)				
2 conductor transmitters, pressure / vacuum	LM-AI	420 mA, connected directly	See sensors/pressure sensors		
Pirani vacuum measuring instrument (precise vacu- um) with RS-232 interface (analogue connection also possible)	LM-RS-232	Serial, NAMUR serial driver	on request		
Pressure controller	LM-DI	Binary	See pressure controller and watchdog device		
Gas flow					
Mass flow Mass flow meter	LM-AI	Voltage or current signal, sensor supply	See sensors/flow rate		
Mass flow Mass flow con- troller	LM-AI LM-AO	Input and output Voltage or current signal, sensor supply	See sensors/flow rate		
Mass flow rate Mass flow meter and controller	LM-RS232	Serial, NAMUR serial driver	See sensors/flow rate		
Volumetric with gas meter	LM-AI	Frequency signal	on request		
Gravimetric with gas bottle on a balance	LM-RS232	Driver for balances from SCALTEC, Kern, Sartorius and Mettler available	See laboratory apparatus/balances		
Liquid flow					
Mass flow Coriolis	LM-AI	0/420 mA	See sensors		
Volumetric with turbine wheel sensor	LM-DI	Frequency signal	See sensors/Teflon® flow meter		

Abbreviations: PWM: Pulse width modulated, PFM: Pulse frequency modulated

Task, sensor/actuator/de- vice to be connected	Interface module	Signal type, connection, driver	Reference source for sensor/actuator/device	tor
Gravimetric with scale	LM-RS232	Driver for balances from SCALTEC, Kern, Sartorius and Mettler in every HiTec Zang AS	See laboratory apparatus/balances	oratory Reac
Gravimetric with GraviDos® (single)	LM-AI	DMS load cell with GRADOMV1	See laboratory apparatus/dosing systems	Labo
Gravimetric with GraviDos® (system)	LM-SG	DMS load cell connected directly	See laboratory apparatus/dosing systems	
Flow insufficiency alarm (FIA)	LM-DI	Binary	See flow insufficiency alarm and watchdog device	entation
Liquid level				Ferm
Gravimetric with GraviDos® (single)	LM-AI	DMS load cell with GRADOMV1	See laboratory apparatus/dosing systems	
Gravimetric with GraviDos® (system)	LM-SG	DMS load cell connected directly	See laboratory apparatus/dosing systems	inique
Conductive, capacitive	LM-AI	010 V, 0/420 mA	See sensors	ר Tech
Trickling method, hydrostatic pressure	LM-AI	010 V, 0/420 mA	on request	tomation
Gravimetric with scale	LM-RS232	Drivers for balances in every HiTec Zang AS	See laboratory apparatus/balances	Aut
Level controller	LM-DI	Binary	See level controllers	D t
Weight				Poho
using laboratory balance	LM-RS232	Driver for balances from SCALTEC, Kern, Sartorius and Mettler in every HiTec Zang AS	See laboratory apparatus/balances	Liquid Hai
Gravimetric with GraviDos <sup>®</sup> (single)	LM-AI	DMS load cell with GRADOMV1	See laboratory apparatus/dosing systems	
Gravimetric with GraviDos® (system)	LM-SG	DMS load cell connected directly	See laboratory apparatus/dosing systems	stems
pH/RedOx				ng Sy
Glass probe	LM-AI	Electrode signal via cable boost- er IL-PHAMP1	See autoclavable sensors	Dosi
Ext. pH-Messgerät	LM-AI	010 V, 0/420 mA	See autoclavable sensors	
Distance				atus
Proximity sensor inductive, optical	LM-DI	Binary 24 V, feed	See sensors/distance	ry Appar
Rotational speed				orato
Proximity sensor inductive, optical	LM-DI	Binary 24 V, feed	See sensors/rotational speed	Lab
		Actuators		S
Electrical heating				alytic
Heating dome, calorific, immersion heaters, heating tanks	HP-B230VxxA	Binary and PWM, 230 V AC	See T-Pot™	Process And
3/2-way and open/closed va	alve, reflux separator			
Solenoid	LM-DO	Binary, connected directly	See laboratory apparatus/valves	

Abbreviations: PWM: Pulse width modulated, PFM: Pulse frequency modulated

151201

## **Automation Technique**

Task, sensor/actuator/de- vice to be connected	Interface module	Signal type, connection, driver	Reference source for sensor/actuator/device
Motor-operated valve digital control	LM-DO	2 x binary off for open and closed	on request
Final position acknowledge- ment	LM-DI	2 x binary on for open and closed	on request
Proportional valves			
Solenoid (proportional)	LM-DO	PWM	See laboratory apparatus/proportional valves
Motor-operated valve ana- logue control	LM-AO	010 V, 0/420 mA	on request
Motor-operated valve digital control	LM-DO	2 x binary off for open and closed	on request
Final position acknowledge- ment	LM-DI	2 x binary on for open and closed	on request
Position acknowledgement	LM-AI	1 x analogue on for position	on request
Multi-directional valves			
With stepping motor drive	LM-RS232, LM-RS485	Serial, NAMUR serial driver	See laboratory apparatus/multi-directional valves
		Laboratory apparatus	
Balances			
Laboratory balance from Kern, Sartorius and Mettler	LM-RS232	Driver for balances from Kern, Sartorius and Mettler in every HiTec Zang AS	See laboratory apparatus/balances
GraviDos®	LM-SG	DMS load cell connected directly	See laboratory apparatus/balances
Analysers, spectrometers			
GC, HPLC, NIR,	LM-RS232, LM-RS485	Serial on an AS via NAMUR serial driver or serial on an OS via AS driver	on request
Torque measuring stirrer			
ViscoPakt® analogue EA	LM-AO LM-AI		See laboratory apparatus
ViscoPakt <sup>®</sup> serial	LM-RS232	NAMUR serial driver	See laboratory apparatus/measuring stirrers
Dosing pumps			
Diaphragm pump	LM-DO	Pulse frequency	See laboratory apparatus/dosing pumps
Hose pump, reciprocating pump	LM-AO	010 V, 0/420 mA	See laboratory apparatus/dosing pumps
Serial dosing pumps	LM-RS232, LM-RS485	Serial, NAMUR serial driver	See laboratory apparatus/dosing pumps
Solid matter dosing devices			
SoliDos™	LM-DO	Pulse frequency	See laboratory apparatus/solid matter dosing devices
Heating/cooling thermostat	:		
Analogue EA	LM-AO, LM-AI	Inputs and outputs: 010 V, 0/420 mA	See laboratory apparatus/temperature control devices
Serial interface	LM-RS232, LM-RS485	Serial, NAMUR serial driver (drivers for standard thermostats from Haake, Huber, Julabo, Lau- da are already integrated)	See laboratory apparatus/temperature control devices
Calibration heating device			
Serial interface	LM-RS232	Serial, NAMUR driver	See laboratory apparatus/calibration heating devices

Abbreviations: PWM: Pulse width modulated, PFM: Pulse frequency modulated

## Slide-in modules for LabManager® module racks

Suitable slide-in modules based on the current NAMUR standard are available for all sensor-actuator interfaces for the connection of sensors, actuating elements and devices to the LabManager® ASs and sub-stations.

The range of interfaces also includes, in addition to the standard sensor-actuator interfaces for temperature, pressure, flow rate, valves,

#### Voltage and current inputs with feed



The slide-in module for analogue input is designed to record voltages of -10 to +10 V and current signals of 0/4 to 20 mA. Laboratory apparatus, such as thermostats, mixers or measuring sensors, can be connected to the four potential-free and EMC robust inputs.

Sensors with two and four-wire connections may be connected directly to a module socket, in other words without any external current supply.

Thus, the connection only requires a few seconds, as there is no need for switching to a current supply source.

pumps etc., special interfaces for high-precision temperature measurement or for the connection of strain gauge measurement bridges. The free slots may be fitted as desired with the slide-in modules offered.

Any inputs which are not used may be covered with plastic caps as protection against corrosion and dust.

#### The advantages

- » 4 analogue inputs for voltage and current (6-pin socket, DIN 45322)
- » Integrated sensor supply
- » Highly accurate thanks to the precise 24-bit analogue/digital converter

#### **Plug assignment**



Front view of 6-pin flanged socket (DIN 45322) 1. 50 Q/0.1 % to GND 2. Signal input 3. Signal input GND 4. Reserve 5. Sensor feed 24 V DC\* 6. Sensor feed GND

Current max. 3 A total load per module

#### Technical data

Signal	0/420 mA and -10+10 V
Connection type	6-pin socket, DIN 45322
Resolution (effective)	20-bit
Measuring range	Voltage: -0.1+0.1 V, -1+1 V, -10+10 V Current: 0/420 mA
Absolute measurement uncer- tainty from final value (within the maintenance interval)	-10+10 V: 0.05 %, -1+1 V: 0.05 %, -0.1 V+0.1 V: 0.05 %, 0/420 mA: 0.15 %
For the recording of	Analogue signals such as pressure, fill level, stirrer rotation speed, torque, tempera- ture output of a thermostat, pH-value via IL-PHAMP1 (external), etc.

Product code	Description
LM-AI	Slide-in module with 4 current/voltage inputs, sensor supply 24 V
LZ-AKTUB	Cover cap for 6-pin socket, DIN 45322 (LM-AI/LM-AO)

Laboratory Apparatus Accessories



**Automation Technique** 

## **Automation Technique**

#### Voltage and current outputs



This slide-in module controls laboratory apparatus with analogue voltage or current inputs for control and regulation purposes.

The module uses four 6-pin Tuchel sockets according to NAMUR standard for the output of analogue signals.

The logical signals can be harmonised with the physical targets by suitable scaling.

#### The advantages

- » 4 analogue outputs for voltage and current (6-pin socket, DIN 45322)
- » Short-circuit-proof

#### **Plug assignment**

O5 O4



2. NC 3. NC 4. Current output + (0/4...20 mA) 5. Voltage output + (-10...+10 V) 6. GND

Гес	hnica	l da	ta
6	nneci	tion	tvne

Connection type	6-pin socket, DIN 45322
Resolution	16-bit
Voltage outputs	-10+10 V, max. 2 mA
Current outputs	0/420 mA
Absolute uncertainty from final value (within the maintenance interval)	±0.2 % guaranteed
For the control of	Analogue actuators, such as control valves, dosing pumps, stirrer speed, external controllers for mass flow or pressure etc.

Product code	Description
LM-AO	Slide-in module with 4 current/voltage outputs
LZ-AKTUB	Cover cap for 6-pin socket, DIN 45322 (LM-AI/LM-AO)

#### Pt100 temperature sensor inputs



This module enables up to 4 Pt100 temperature sensors to be connected.

Due to the four-wire technology the length of the wire has no effect on the accuracy of measurement. The resolution is greater than 0.01 °C.

The measurement supplied by the resistance sensor is linearised and converted to °C.

The signals of the measuring sensor can be calibrated via the software.

**Technical data** 

#### The advantages

- » 4 inputs for Pt100 and resistance sensor (4-pin LEMO socket type S1)
- » Highly accurate thanks to the 24-bit analogue/digital converter
- » Malfunction and short-circuit detection

#### **Plug assignment**



Front view of 4-pin LEMO socket 1. I + = 5.3 mA measuring current, multiplexed 2. Signal + 3. Signal -

Signal	Pt100 signal with two- and four-wire connection
Connection type	4-pin socket, type LEMO S1
Resolution	0.01 °C, 20-bit guaranteed resolution
measuring range	-200+600 °C
Absolute measurement uncertainty (within the maintenance interval)	-50+300 °C: ±0.2 °C
For the recording of	temperatures using Pt100 sensors

Product code	Description
LM-RTD	Slide-in module for 4 Pt100 sensors in two- to four-wire technology in accordance with NAMUR
LZ-AKLES1	Cover cap for LEMO S1 socket

#### Pt100 precision temperature sensor inputs



The RTD-P high-precision measuring module has been developed for applications which place extremely high demands on resolution and measuring accuracy.

The RTD-P modules have an extremely accurate analogue-to-digital converter and a precision current source for resistance sensors.

The modern process-based circuit design makes compensation elements unnecessary. Thanks to dynamic self-calibration, temperature and ageing effects are reduced to the extremely low long-time drift value of the integrated high-precision reference elements.

The temperature sensors are connected via connection sockets to NAMUR standards.

#### The advantages

- » Extremely high measuring accuracy: 0.001 °C
- » Relative differential measurement uncertainty ±0.003 °C in the measuring range -180 to +266 °C
- » 4 channels virtually simultaneously recorded in < 1 s
- » Self-calibrating
- » Malfunction and short-circuit detection

#### Plug assignment



Front view of 4-pin LEMO socket 1. I + = 5.3 mA measuring current, multiplexed 2. Signal + 3. Signal -4.1-

#### **Technical data**

Technical data		Handling
Signal	Pt100 signal with two- and four-wire connection	iquid I boratc
Connection type	4-pin socket, type LEMO S1	ш Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц Ц
Resolution	0.001 ℃	
measuring range	-180+266 °C	su
Absolute measurement uncertainty within the mainte- nance interval)	$\pm$ 0,08 °C after calibration of the measurement chain	osing Systen Pumps
Relative measurement uncer- tainty (for differential measure- ment)	±0.003 °C	ŏ

Product code	Description
LM-RTD-P	Slide-in module for precision measurement for 4 Pt100 sensors in two- and four-wire technology in accordance with NAMUR
LZ-AKLES1	Cover cap for LEMO S1 socket

Laboratory Apparatus Accessories

Laboratory Reactor Systems

Fermentation Technique

**Automation Technique** 

#### Pt1000 temperature sensor inputs



Up to 4 Pt1000 or other resistance sensors can be directly connected to this module.

Due to the four-wire technology the length of the wire has no effect on the accuracy of measurement. The resolution is greater than 0.01 °C.

The measurement supplied by the resistance sensor is linearised and converted to °C.

The signals of the measuring sensor can be calibrated via the software.

#### The advantages

- » 4 inputs for Pt1000 and resistance sensor (4-pin LEMO socket type S1)
- » Highly accurate thanks to the 24-bit analogue/digital converter
- » Malfunction and short-circuit recognition

#### Plug assignment



Front view of 4-pin LEMO socket 1. I + = 0.53 mA measuring current, multiplexed 2. Signal + 3. Signal -

#### Technical data

Signal	Pt1000 signal with two- and four-wire connection
Connection type	4-pin socket, type LEMO S1
Resolution	0.01 °C
Measuring range	-200+600 ℃
Absolute measurement uncertainty (within the mainte- nance interval)	-50+300 °C: ±0.2 °C
For the recording of	temperatures using Pt1000 sensors
Description	
Slide in medule for 4 Dt1000 concert in two, and four wire technology in accordance with NAMUD	

Product code	Description
LM-RTD1000	Slide-in module for 4 Pt1000 sensors in two- and four-wire technology in accordance with NAMUR
LZ-AKLES1	Cover cap for LEMO S1 socket

#### Thermocouple inputs



This slide-in module is suitable for the connection of up to 4 thermocouples using a 2-pin LEMO plug type 1S. The cold junction compensation is carried out electronically and can be optionally switched off for the measurement of exact temperature differences.

The measurement supplied by the resistance sensor is linearised and converted to °C.

#### Supported types

- > PT13%Rh-Pt (type R, IEC 584)
- > Fe-CuNi (type J, IEC 584)
- > Fe-CuNi (type L, DIN 43710)
- > PT30%Rh-Pt6%Rh (type B, IEC 584)
- > Cu-CuNi (type T IEC 584)
- > NiCrSi-NiSi (type N, IEC 584)
- > PT10%Rh-Pt (type S, IEC 584)
- > NiCr-CuNi (type E, IEC 584)
- > NiCr-NiAl (type K, IEC 584)

Additional types can be evaluated via user tables

#### The advantages

- » 4 inputs for thermoelements (2-pin LEMO socket)
- » Electronic cold junction compensation
- » Malfunction detection
- » Highly accurate thanks to the 24-bit analogue/digital converter

#### **Plug** assignment



Front view of 2-pin LEMO socket

## LabManager®-laboratory automation system

For a direct connection of thermocouples	
2-pin socket, type LEMO S1	
0.05 °C	
Thermoelements (NiCr−Ni): -200+1,373 ℃	
	For a direct connection of thermocouples 2-pin socket, type LEMO S1 0.05 °C Thermoelements (NiCr-Ni): -200+1,373 °C

Product code	Description
LM-TC	Slide-in module for 4 thermocouple inputs
LZ-AKLES1	Cover cap for LEMO S1 socket

#### Strain gauge bridge inputs



**Product code** 

LM-SG LZ-AKLES1 This slide-in module is suitable for the connection of 4 strain gauge based GraviDos<sup>®</sup> dosing systems or measuring sensors, load cells, torques transducers etc..

The complex amplifier and six-wire technology guarantees high measuring accuracy irrespective of the length of the wire.

The integrated adaptive digital filter technology guarantees robust measurement with a high disturbance rejection.

#### **Plug assignment**



Front view of 6-pin LEMO socket 1. DMS supply 5 V AC 2. Ref. DMS supply + 3. Signal + 4. Signal -5. Ref. DMS supply -6. DMS supply -

Toc	hnica	ЫА	<b>ata</b>
ICU	inica		αια

Signal	For a direct connection of strain gauge full bridges
Connection type	6-pin socket, type LEMO S1
Resolution (ADC)	24-bit
measuring range	Dependent on the measuring cell
Absolute measurement uncer- tainty from final value (within the maintenance interval)	±0.1 %
Absolute measurement uncertainty from final value	±0.01 %
Bridge load	330 $\Omega$ , other values on request
For the recording of	weight, force, flow, torque etc.
Description	
Slide-in module for	4 strain gauge full bridge inputs
Cover caps for LEMC	D S1 socket

**Automation Technique** 

Liquid Handling Laboratory Robots

Dosing Systems Pumps

## Slide-in modules for digital input/output

#### Digital inputs with sensor supply



The digital inputs of HiTec Zang ASs may be used for frequency measurement in addition to their use for the pure recording of binary conditions (in/out).

This slide-in module additionally provides on every socket (Pin1) 24 V DC for supply to a connected sensor (total load max. 300 mA/ module).

#### The advantages

- » Inputs with connectible NAMUR-compliant level detection system
- » Status LED for each channel, displays the binary condition or errors
- » Galvanic separation between inputs and bus
- » Activation in accordance with PELV (protected extra low voltage)

#### Plug assignment

O3Front view of M8 socket (IEC 947-5-2)1. Sensor feed 24 V DC3. Digital GND4. Signal

>	Pulse	duration	measurement
---	-------	----------	-------------

> Edge detection

> Counting input

Suitable for

Frequency measurement

> Period length measurement

#### **Technical data**

Signal	Input level 24 V (can be switched to a NAMUR-compliant level) and assignment in accordance with NAMUR NE28
Connection type	3-pin M8 socket
Digital counting function	32-bit
Frequency measurement	≤ 100 kHz
For the interrogation of	proximity sensors, switch contacts, fill level switches, pressure switches, digital status signals of devices etc.

Product code	Description
LM-DI	Slide-in module for digital input with active 24V input and sensor supply
LZ-AKM8	Cover caps for M8 sockets

#### **Digital outputs**



The digital output slide-in module is required for switching valves, reflux separators, heaters, contactors etc. directly via the LabManager®.

The pulse-width modulated output allows guasi-continuous direct control of heaters, motorized control valves, etc.. Thus, there is no necessity for expensive additional control electronics.

The pulse area modulation is an extended form of pulse frequency modulation (XPFM) which minimises the pulse amount and consequently prevents damage to the actuator (e.g. a solenoid or reflux separator).

#### The advantages

- » 4 active digital outputs
- » For direct connection of proportional solenoids
- » LED control display
- » Short-circuit-proof

#### Plug assignment



Front view of M12 socket A-coding 1. Power supply 24 V DC 2. Power supply 24 V DC 4. Switch output 24 V DC

#### chnical data

Technical uata	
Signal 4 active digital outputs 01,000 Hz, 1 A per channel, total load max. 3 A	
Connection type	5-pin M12 socket (A-coded)
For the control of	proportional solenoids etc.

Product code	Description	
LM-DO	Slide-in module digital output, 4 active outputs	
LZ-AKM12	Cover cap for M12 sockets	
Serial interfaces		

## Serial interfaces

Serial interfaces may be provided both on an AS and on an OS (see PC plug-in cards). Simple laboratory apparatus, such as dosing pumps and balances are usually connected directly to an AS so that they may be easily integrated into control loops. Laboratory apparatus with more complex functions, such as analysers or titration devices should

## be connected directly to an OS (see PC plug-in cards).

There are various forms of technologies for communication. Further details may be found under driver programs for laboratory equipment.

#### Serial RS-232 interfaces



The slide-in module provides four 9-pin serial interfaces.

- Independent SIO channels with FIFO storage, supports RTS/CTS hardware handshake.
- > Parallel processing of all channels, resulting in a reduction in delay
- > Max. transfer rate of 38,400 Baud (per channel)

The devices connected to a serial interface can communicate in various ways with the automation unit:

- > Standard drivers for "known" laboratory apparatus
- > NAMUR drivers for "unknown" laboratory apparatus

#### Plug assignment



2. Rx (input) 3. Tx (output) 5. GND 7. RTS (output) 8./CTS (input) DTE configuration

The channels are potential separated (insulation voltage 35 V) and are allocated in accordance with the DTE configuration.

**Dosing Systems** 

Laboratory Apparatus

Accessories

Pumps

Laboratory Reactor

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Systems

Product code	Description	Servic
LM-RS232	Slide-in module for 4 serial RS-232 interfaces	
LZ-AKRS9	Cover cap for RS-232 interface	

## **Automation Technique**

#### Serial RS-485 interfaces



The slide-in module provides four 9-pin serial interfaces.

- > Independent SIO channels with FIFO storage
- Parallel processing of all channels, resulting in a reduction in delay
- > Max. transfer rate of 38,400 Baud (per channel)

#### Socket assignment



Front view of RS-485 interface 1. Reference potential GND (signal and power supply) 2. 5 V power supply for optional termination 5. B/B' data + 9. A/A' data -

#### Serial RS-422 interfaces



The slide-in module provides four 9-pin serial interfaces.

- > Independent SIO channels with FIFO storage
- > Parallel processing of all channels, resulting in a reduction in delay
- Max. transfer rate of 38,400 Baud (per channel)

#### Socket assignment



Front view of RS-422 interface 1. Reference potential GND (signal and power supply)

2. 5 V power supply for optional termination 4. RxD1



9. TxD0

Product code	Description
LM-RS485	Slide-in module for 4 serial RS-485 interfaces
LM-RS422	Slide-in module for 4 serial RS-422 interfaces
LZ-AKRS9	Cover cap for RS-485/RS-422 interface

## Bus coupling modules

LabManager® can be expanded by using sub-stations in order to increase the number of racks or to distribute the inputs/outputs across various positions of an installation or racks.

Various bus coupling units are available for this purpose. If it is simply intended to expand the number of available slots, while retaining the LabManager® and sub-stations at the same location, an LM-BCUSO slide-in module in the LabManager® and an LM-BCUI slide-in module in the sub-station will be sufficient.

If it is intended to connect several sub-stations or if the length of cable between the LabManager<sup>®</sup> and sub-stations should be longer than 1 m, an LM-BCUO slide-in module should be used in the LabManager<sup>®</sup> and an LM-BCUI slide-in module in each of the sub-stations.

The HiBus<sup>™</sup> system is self-configurating, i.e. no rack addresses etc. have to be set.



LabManager<sup>®</sup> with sub-station, bus coupling via LM-BCUSO and LM-BCUI slide-in modules



LabManager<sup>®</sup> with two sub-stations, bus coupling via LM-BCUO and LM-BCUI slide-in modules

#### HiBus<sup>™</sup> bus coupler outputs for LabManager<sup>®</sup>, channels 2 to 4



This slide-in module is used for connecting the sub-stations 2 to 4 to a LabManager® AS by HiBus™. In addition, a diagnosis interface (D) is integrated.



LabManager<sup>®</sup> with two sub-stations, bus coupling via LM-BCUO1 and LM-BCUI slide-in modules

Product code	Description
LM-BCUO1	Slide-in module bus coupler outputs for LabManager®, channels 24, diagnosis output

#### HiBus<sup>™</sup> bus coupler outputs for LabManager<sup>®</sup>, channels 5 to 8



This slide-in module is used for connecting the sub-stations 5 to 8 to a LabManager<sup>®</sup> AS by HiBus<sup>™</sup>.



LM-BCUO2

#### Description

Slide-in module bus coupler outputs for LabManager®, channels 5...8



Both the LM-BCUO1 slide-in module and the LM-BCUO2 slide-in module will be required in order to connect up to 7 sub-stations.

Laboratory Reactor Systems

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LabManager®

#### HiBus<sup>™</sup> bus coupler output



Passive bus coupler for the connection of a sub-station to a LabManager® by HiBus™.

If more slide-in modules are required than a LabManager® module rack can accept, then a sub-station can be connected as an expansion using the economical LM-BCUI and LM-BCUSO bus coupler. The maximum length of cable between the bus couplers for this is 1 m.

An LM-BCUSO slide-in module is required for the LabManager® and an LM-BCUI slide-in module for the sub-station.





LabManager<sup>®</sup> with sub-station, bus coupling via BCUSO and BCUI modules

# Product codeDescriptionLM-BCUSOBus coupler slide-in module for LabManager®, 1 x HiBus™ passive output, point-to-point connection

#### HiBus<sup>™</sup> bus coupler input



Bus coupler input slide-in module for the connection of a sub-station to a LabManager<sup>®</sup> by HiBus<sup>™</sup>.

An LM-BCUO slide-in module is required for the LabManager<sup>®</sup> and an LM-BCUI slide-in module for the sub-station.

Product code LM-BCUI Description Bus coupler slide-in module for sub-station, HiBus™ input

## LabManager®-laboratory automation system

#### HiBus<sup>™</sup> bus coupler input for SoftManager<sup>™</sup>



**Product code** 

LM-BCUE

An LM-BCUE slide-in module is required when using a sub-station in conjunction with a SoftManager<sup>™</sup>. Additional sub-stations may be connected using LM-BCUO or LM-BCUSO slide-in modules and LM-BCUI slide-in modules. OS with SoftManager™



OS with SoftManager™ and sub-station, bus coupling via an LM-BCUE slide-in module

# BK ABK / CON BT Sevelo

Slide-in module CPU

CPU

The CPU module is the HiBus<sup>™</sup> master for the internal and external interface modules. The raw interface values are derived in this module by averaging, linearisation and scaling. The limit value monitoring, control, regulation and technical communications-related functions continue to be derived.

#### Characteristics

> 32-Bit-CPU, 400 MHz

Description

- > Own communications processor
- > Redundant time base
- Redundant system monitoring unit

#### Interfaces

Bus coupler slide-in module for sub-station to SoftManager™, Ethernet

- > 2 x High-speed RS-232, Modbus and special driver (option)
- > 1 x RS-232 console interface (diagnosis)
- > 1 x RS-485-RJ45, Modbus for digital measuring amplifier (option)
- > 2 x USB B connections (option)
- > 1 x USB A connection (option)
- > 1 x RJ45 Ethernet interface for communication with an OS

Product code	Description
LM-CPU	Slide-in module CPU for LabManager® basic device
LM-CPURS	Slide-in module CPU for LabManager® basic device, incl. 2 x unlocked RS-232 interfaces and 1 x unlocked RJ45 RS-485 interface
LM-CPURS232	2 x RS-232 interface drivers for LabManager® CPU
LM-CPURS485	1 x RS-485 interface driver for LabManager® CPU
LM-CPUUSB	2 x USB interface drivers for LabManager® CPU

(option) blifier (opt

sub station

#### Fan slide-in module



The fan module extends the LabManager cooling system and achieves lower temperatures through air circulation. The average lifetime of a LabManager is increased as a result and permit a higher power output.

#### The advantages

- » Redundant design for higher reliability
- Barely audible, thanks to a demand-based control system »
- » A status LED displays any fan failure
- Does not require any ventilation slots »

The fan module must be installed in the last slot on the right-hand side of the housing.



#### Slide-in cover plate

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Cover plate for unused LabManager® module slots

**Product code** LM-BLENDE

Description

Slide-in cover plate for LabManager® module rack

## Lab I/O<sup>™</sup> customer-specific laboratory automation system

The Lab I/O<sup>™</sup> devices essentially have the characteristics of the LabManager<sup>®</sup> devices, but they are do not have their modularity and flexibility. They are configured and developed to suit individual customer requirements. They do not have an integrated CPU but are controlled by a SoftManager<sup>™</sup> which is emulated on the PC.

The devices are used preferably for data logging or the automation of small laboratory units or experimental set-ups.

Lab I/O™ devices are equipped in accordance with customer specification. As engineering technology is required, its use is generally only worthwhile for large quantities.



Lab I/O™ sample configuration




# I/O modules



The HiTec Zang digital I/O modules convert analogue and digital I/O signals into RS-232 NAMUR or RS-485 ModBus AS protocols or vice-versa. They can be used where the number of measuring channels is so low that the use of a LabManager<sup>®</sup> is not cost-effective or to expand a LabManager<sup>®</sup>.

They are also suited as interfaces for small HiBuilder<sup>™</sup> or SoftManager<sup>™</sup> projects, for example, as a supplement to LabDos<sup>™</sup> or AutoSam<sup>™</sup> where additional signals need to be recorded or additional actuators controlled.

In SoftManager™/LabVision® projects they can also be used as interfaces for small projects such as for weighing stations.

- > Power Supply via interface cable or 24 V plug-in power supply unit
- > RS-232 NAMUR protocol and RS-485 Modbus AS interface
- > Durable metal casing

#### Technical data

Technical data

Interface	RS-485 with Modbus AS proto- col or RS-232 V24 NAMUR
Power supply	24 V power supply via RJ45, a plug-in power supply unit is required when operating on an interface without a power supply
<b>Dimensions</b> (L $\times$ W $\times$ H)	100 x 61 x 27 mm, with plug

## I/O module for analogue input



recifical data		
Interface	RS-485 with Modbus AS proto- col or RS-232 V24 NAMUR	
Inputs	2 x 010 V or 0/420 mA	
Absolute measurement uncertainty	$\leq \pm 0.5$ %	
Measuring rate	20/s	
<b>Dimensions</b> ( $L \times W \times H$ )	100 x 61 x 27 mm	
Scope of delivery	I/O module, manual	

### Product code IL-AINAMP2D

#### Description

Input module for analogue input 2x 0...10 V or 0/4...20 mA

# I/O module for Pt100



#### **Technical data**

Interface	RS-485 with Modbus AS proto- col or RS-232 V24 NAMUR
Inputs	1 x Pt100, four-wire technology
Absolute measurement uncertainty	± 0.2 °C
Measuring rate	20/s
<b>Dimensions</b> ( $L \times W \times H$ )	100 x 61 x 27 mm
Scope of delivery	I/O module, manual

Product code

Description Input module for 1x Pt100 sensor

## I/O module for pH/RedOx



The electrodes can be directly connected without a pH measuring amplifier

A measuring amplifier for the evaluation of a Pt100 sensor in the probe is built-in.

The sensitive electrode signal is directly digitalised and can be transferred over long distances to an AS without any errors occurring.

External I/O module for pH/RedOx measurement with temperature compensation, input voltage from -1.1 to +1.1 V, input resistance > 100 M $\Omega$ , VP8 connection.

#### The advantages

» pH value and temperature measurement

- » Space-saving
- » Cable can be extended

#### **Technical data**

Interface	RS-485 with Modbus AS proto- col or RS-232 V24 NAMUR	
Inputs	1 x pH electrode with Pt100	
Measurement uncertainty	0.1 %	
Measuring rate	20/s	
<b>Dimensions</b> ( $L \times W \times H$ )	130 x 61 x 27 mm	
Scope of delivery	I/O module, manual	

#### Description

Product code

Input module for pH and RedOx electrodes

## I/O module for load cells and GraviDos®



The digital measuring amplifier is suited to all HiTec Zang load cells (except for the types with an integrated measuring amplifier) and for all other strain gauge cells with a voltage feed.

- > Integrated calibration function
- > Integrated taring function
- > Standard balance protocol (Mettler)
- > Alternating voltage measuring bridge

#### **Technical data** RS-485 with Modbus AS proto-Interface col or RS-232 V24 NAMUR 1 x 6-pin LEMO plug, type Inputs FFA.1S.306.CLACxx 5 V AC Bridge feed voltage Measuring resolution 0.01 % Power supply Via data plug **Dimensions** $(L \times W \times H)$ 100 x 61 x 27 mm Scope of delivery I/O module, manual

Product code
IL-GRADOAMP1D

Description

Digital measuring amplifier for strain gauge measuring cells

Suitable sensors for the external I/O modules can be found in the chapter "Process Analytics & Sensors" from page 313.

## I/O modules

# I/O module for analogue output



The digital output module is used for the output of control voltages or currents.

Description

The module can be connected to any RS-485 interface.

I/O module for digital output

**Product code** 

IL-AOUT2D

Technical data	
Interface	RS-485 with Modbus AS proto- col or RS-232 V24 NAMUR
Outputs	2 x 010 V or 0/420 mA

Output module for analogue output 2 x 0...10 V or 0/4...20 mA

Outputs	2 x 010 V or 0/420 mA
Absolute uncertainty	≤ ±0.2 %
Data rate (total)	50/s
<b>Dimensions</b> (L $\times$ W $\times$ H)	100 x 61 x 27 mm
Scope of delivery	I/O module, manual

Fermentation Technique

Laboratory Reactor

Systems

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**Product code** Description

voltage signals from monitoring devices, switches, etc..

The digital input module is used for the recording of 24 V switching

IL-DIN2D

Input module for digital input, 2 x 24 V, binary and frequency

The digital output module output current exceeds 30 Technical data	e requires its own power supply if the total 00 mA.
Interface	RS-485 with Modbus AS proto- col or RS-232 V24 NAMUR
Outputs	2 x 24 V, max. 1 A per channel
Signals	Binary, PWM, PFM, XPFM

100 x 61 x 27 mm

I/O module, manual

RS-485 with Modbus AS proto-

Binary, frequency up to 5 kHz

100 x 61 x 27 mm

I/O module, manual

col or RS-232 V24 NAMUR

**Dimensions**  $(L \times W \times H)$ 

Scope of delivery

**Technical data** 

Interface

Inputs

Signals

**Dimensions**  $(L \times W \times H)$ Scope of delivery

The digital output module is used for the output of 24 V switching voltage signals for valves, protection devices etc..

The signal received via the data interface switches to 0 V or 24 V onto each of the outputs.

Product code	Description
IL-DOUT2D	Output module for digital output, 2 x 24 V, max. 1 A, binary, PWM, PFM and XPFM
IL-NGSAM2D-SN	24 V 2 A desk power supply unit for I/O module IL-DOUT2D

# I/O module for digital input



2 x 24 V

# LabManager<sup>®</sup> Classic family

The LabManager<sup>®</sup> Classic product family contains automation devices of different sizes that are built up in a modular manner. This ensures that you always obtain a device which best meets your requirements.

The connecting technology is uniformly based on panels with standardised plugs and sockets.

Extensive information can be downloaded from our web-site www.hitec-zang.com or requested from us.



# Available basic devices for individual mounting

Туре	Number of free panel spaces	Internal expansion possibilities	<b>Dimensions</b> (H × W × D)
<b>LabBox® 1</b> LB-LABBOX1B	2	2 interface cards plus HK-SER8ECB, power supply HS-NGS242SN-02, up to 4 serial interfaces (RS232/RS485) in the CPU panel	135 x 236 x 310 mm
LabBox <sup>®</sup> 2 LB-LABBOX2B	4	4 interface cards plus power supply HS-NGS245SN , HS-NGS242SN, HS- NGS153SN, up to 4 serial interfaces (RS232/RS485) in the CPU panel	135 x 342 x 310 mm
<b>LabManager®-</b> Classic 1 LB-LABMAN1B	6	7 interface cards plus power supply HS-NGS242SN, HS-NGS153SN, HS-NGS245SN, up to 6 serial interfaces (RS232/RS485) in the CPU panel	135 x 450 x 370 mm
LabManager <sup>®</sup> Classic 2 LB-LABMAN2B	13	12 interface cards plus power supply HS-NGS245SN , HS-NGS242SN, HS-NGS153SN, up to 6 serial interfaces (RS232/RS485) in the CPU panel	280 x 450 x 370 mm
Technical data			
Housing		3 HE desk housing (LabManager2 Classic 2: 6 HE)	
Basic panel		OS interface (PC), 230 V AC power supply and function LEDs	
CPU		CPU-32 card, 32-bit embedded controller, watchdog, max. 1,000 data points	
Working tempera	Vorking temperature050 °C, non-condensing		
Storage temperat	orage temperature 050 ℃		
Degree of protect	tion	IP20, meets EN61010 safety regulations for EMSR and laboratory apparatus	
Power consumpti	Depending on configuration 30240 W (without 230 V switching outputs) LabManager®-Classic 2: 301.500 W		Manager®-Classic 2:
Scope of delivery		Basic device, cable for connection to 9-pin RS-232 interface of OS, mains cable, manual	

Detailed information on available panels and interface cards may be found on our web-site.

### Order summary for LabBox® & LabManager® Classic

Product code	Description
LB-LABBOX1B	LabBox® 1 basic device for individual assembly
LB-LABBOX2B	LabBox® 2 basic device for individual assembly
LB-LABMAN1B	LabManager®-Classic 1 basic device for individual assembly
LB-LABMAN2B	LabManager®-Classic 2 basic device for individual assembly
LP-AEP8	Interface panel with 8 current/voltage inputs
LP-AEP8A	Interface panel with 8 current/voltage inputs, sensor voltage supply 24 V
LP-PTP8	Interface panel for Pt100 in two- to four-wire technology in accordance with NAMUR

I/O modules

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Product code	Description	<u> </u>
LP-PTPRP8	Interface panel for Pt100 to HK-AD24PX8 in two- to four-wire technology	eacto
LP-AE4PT4P	Interface panel with 4 Pt100 and 4 current/voltage inputs	 ory Re stems
LP-THP8	Interface panel for thermocouples	oorat Sy:
LP-DMS4DA4PT	Interface panel for 4 strain gauge full bridges and 4 active digital outputs (500 mA)	Lal
LP-DMS8	Interface panel for 8 strain gauge full bridges	_
LP-AAP8UI	Panel for analogue output, current and voltage	_
LP-AEAP8I	Multi-purpose panel 8 current inputs 0/420 mA, 8 current outputs 0/420 mA	 tation que
LP-AEAP8IA	Multi-purpose panel 8 current inputs 0/420 mA, 8 current outputs 0/420 mA sensor supply	'men' echni
LP-AEAP8U	Multi-purpose panel 8 voltage inputs $\pm 10$ V, 8 voltage outputs $\pm 10$ V	- Fe
LP-AEAP8UA	Multi-purpose panel 8 voltage inputs $\pm 10$ V, 8 voltage outputs $\pm 10$ V sensor supply	
LP-DEP8	Digital input interface panel with active 24 V inputs	
LP-DEP8A	Digital input interface panel with passive 24V input and sensor supply	thniq
LP-DAP8	Digital output interface panel, passive changeover contacts	n Tec
LP-DAP8A	Digital output interface panel, active outputs	matic
LP-DAP8T	Digital output interface panel for high switching frequencies, active outputs, $0\dots 1,000$ Hz	Auto
LP-DE4DA4P	Multi-purpose panel 4 digital inputs, 4 digital outputs	
LP-DE4DA4PA	Multi-purpose panel 4 digital inputs as DEP8, 4 digital active outputs as DAP8A	ots —
LP-DE4ADA4PA	Multi-purpose panel 4 digital inputs with supply, 4 digital active outputs	   Nobe
LP-LP-DA4HZ4PA	Multi-purpose panel 4 digital outputs 24 V 1 A, 4 low-voltage heaters 44 V DC	l lid Ha ratory
LP-SER99	Panel for 9 serial interface modules	Liqu Labo
LP-PEAP	Panel for the connection of an external power supply	_
HK-AD20N	Analogue/digital converter card with 20-bit resolution	
HK-HMUX	Semi-conductor multiplexer card with 16 channels	ems
HK-AD20NMUX8	Analogue measuring card, 8 channels, 20-bit resolution	J Syst
HK-AD20NMUX16	Analogue measuring card, 16 channels, 20-bit resolution	losing
HK-AD24PX8	Precision measuring card with 8 channels for Pt100, absolute differential measurement uncertainty 0.01 $^\circ\mathrm{C}$	
HK-AD24DMS4	Plug-in card with 4 channels for DMS bridges and 4 digital outputs (semi-conductors)	us –
HK-DA812UI	8-fold analogue output card 020 mA and $-10+10$ V, 12-bit resolution	 parat es
HK-DEA16N	Digital input/output card standard, 16 DE, 16 DA	 ry Ap essori
HK-SER8ECB	Serial input/output card, 8 channels	orato
HK-SER16ECB	Serial input/output card, 16 channels	Labo
LZ-GRIFFLU	Winged grips for LabManager <sup>®</sup> Classic	
LZ-GRIFFRO	Front grips for LabManager® Classic	vtics

Product code

Description

# MSRmanager™ family

The MSRmanager<sup>™</sup> is mainly used in installations within the processing and chemical engineering industry and research, environmental measurement and process engineering, test facility automation and the manufacturing industry. It is used instead of the LabManager<sup>®</sup> if the installation must be hard-wired.

Universal, potential-free and flexible interfaces save the need for many transducers, interface and driver circuits. Using a minimum of space, the MSRmanager™ enables the fulfilment of even the most complex of tasks which could either not be achieved at all or only at great expense using conventional equipment.



Extensive information can be downloaded from our web-site www.hitec-zang.com or requested from us.

## Available basic devices for individual mounting

Туре	Number of slots	Interface cards which are able to be used	Internal expansion possibilities	<b>Dimensions</b> (H x W x D)
<b>MSRbox™ 1</b> MG-MSRBOX1	2 (+1 CPU)	HK-AD20NMUX8, HK-AD20NMUX16, HK-DEA16N, HK-DA812UI, HK-AD24DMS4, HK-SER8ECB, HK-SER16ECB	power supply for digital blocks (con- trol voltage) via main power supply, up to 4 serial interfaces (RS232/ RS485)	145 x 236 x 318 mm
<b>MSRbox™ 2S</b> MG-MSRBOX2S	5 (+1 CPU)	HK-AD20NMUX8, HK-AD20NMUX16, HK-DEA16N, HK-DA812UI, HK-AD24DMS4, HK-SER8ECB, HK-SER16ECB	power supply for digital blocks (con- trol voltage) via main power supply, up to 4 serial interfaces (RS232/ RS485)	145 x 236 x 318 mm
MSRbox™ 2 MG-MSRBOX2	5 (+1 CPU)	HK-AD20NMUX8, HK-AD20NMUX16, HK-DEA16N, HK-DA812UI, HK-AD24DMS4, HK-SER8ECB, HK-SER16ECB	power supply for digital blocks (con- trol voltage) via main power supply, actuator /sensor power supply up to max. 2 x NGS245SN, up to 4 serial interfaces (RS232/RS485)	145 x 342 x 318 mm
<b>MSRmanager™</b> MG-MSRMAN	13	HK-AD20N, HK-HMUX, HK-DEA16N, HK-DA812UI, HK-SER8ECB, HK-SER16ECB	power supply, control voltage, digital blocks HS-NGS242SN-02, HS- NGS241SN, up to 6 serial interfaces (RS232/RS485)	145 x 450 x 370 mm

#### **Technical data**

Housing	3 HE desk housing
Basic panel	OS interface (PC), 230 V AC power supply and function LEDs
CPU	CPU-32 card, 32-bit embedded controller, watchdog, max. 1,000 data points
Working temperature	050 °C, non-condensing
Storage temperature	050 °C
Degree of protection	IP20, meets EN61010 safety regulations for EMSR and laboratory apparatus
Power consumption	Depending on configuration 30140 W
Power supply	230 V (+10 %/-20 %), option wide range 100240 V
Scope of delivery	Basic device, cable for connection to 9-pin RS-232 interface of UI, mains cable, manual

Detailed information on available terminal blocks and interface cards may be found on our web-site.

### Order summary for MSRbox<sup>™</sup> & MSRmanager<sup>™</sup>

Product code	Description	eacto
MG-MSRBOX1	MSRbox™ 1 basic device for individual mounting	ory Re
MG-MSRBOX2	MSRbox™ 2 basic device for individual mounting	Doratt
MG-MSRBOX2S	MSRbox™ 2S basic device for individual mounting	Lak
MG-MSRMAN	MSRmanager™ basic device	
MB-AEB16VP	Connection block for voltage, current, Pt100 and thermocouples	
MB-AAB8UI	Connection block for voltage and current output	ation
MB-DEB8	Connection block for digital input	ment
MB-DAB8R	Connection block for digital output, 8 relay outputs	ـــــــــــــــــــــــــــــــــــــ
MB-DAB8T_0.5A	Connection block for digital output, with 8 transistor outputs	
HE-EEXIU	Intrinsic safety unit for voltage inputs and outputs 010 V	e.
HE-EEXII	Intrinsic safety unit for current inputs and outputs 020 mA	chniqe Chniqe
HE-EEXID	Intrinsic safety unit for digital inputs and outputs 20 V	an Tec
HE-EEXIRS232	Intrinsic safety unit for serial interfaces TxD, RxD	matic
HE-EEXIPT100	Intrinsic safety unit for Pt100 inputs	Auto
HE-EEXITH	Intrinsic safety unit for thermocouples	
HK-HMUX	Semi-conductor multiplexer card with 16 channels	
HK-AD20NMUX8	Analogue measuring card, 8 channels, 20-bit resolution	illin
HK-AD20NMUX16	Analogue measuring card, 16 channels, 20-bit resolution	id Ha
HK-DA812UI	8-fold analogue output card 020 mA and -10+10 V, 12-bit	Liqu
HK-DEA16N	Digital input/output card standard, 16 DE, 16 DA	

Detailed information on available terminal blocks and interface cards may be found on our web-site.

# Measuring amplifier

# Measuring amplifier for pH/RedOx

The external buffer amplifier for pH and RedOx electrodes is built into the socket housing.

It is suited for direct connection to an analogue input and does not require its own power supply.

The electrodes can be directly connected without a pH measuring device. The cable with integrated amplifier is connected to a normal analogue input.

Temperature compensation and calibration are achieved using a special device component in an AS (the temperature must be recorded separately).

As the sensitive electrode signal is buffered directly in the plug, the cable can be extended without increasing the sensitivity.

The voltage of the integrated Lithium cell can be tested at the plug.

### The advantages

- » Space-saving
- » Cable can be extended



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Tec	hnica	l data

Input voltage	-1.1+1.1 V
Connections	HFS 13/4 socket
Input resistance	> 1,000 MΩ
Scope of delivery	Cable with integrated amplifier, manual

#### Description

Cable with integrated amplifier for pH and RedOx electrodes

# Measuring amplifier for load cells and GraviDos®



The external strain gauge measuring amplifier is built into the plug housing.

Load measurement cells or GraviDos® load cells can be directly connected. The cable with integrated amplifier is connected to a normal analogue input.

The amplifier is supplied from the interface and does not require any additional power supply.

Where there are increased demands for accuracy of measurement the digital measuring amplifier IL-GRADOMV1D or the internal four-way measuring system LM-SG should be preferably used.

#### The advantages

- » Space-saving
- » Cable can be extended

#### **Technical data**

Amplifier for	DMS full- and half-bridges
Connections	4-pin LEMO plug
Output signal	420 mA
Uncertainty	0,2 % of final value [strain gauge + amplifier]
Scope of delivery	Cable with integrated amplifier, manual

Product code	Description
IL-GRADOMV1	Cable with integrated measuring amplifier for DMS measuring cells
ZK-LAB-HI01-IA-DX-I-02	6-pin Lemo plug on a 4-pin Lemo plug for connection to IL-GRADOMV1 (tensile load)
ZK-LAB-HI01-IA-DX-I-03	6-pin Lemo plug on a 4-pin Lemo plug for connection to IL-GRADOMV1 (compressive load)

# Cable for the instrumentation

The following table presents ready-to-connect manufactured cables for various standard laboratory apparatus and instrumentation components. The range is being constantly expanded.

If your device is not listed here, we can produce cables according to your specifications.



Manufacturer, device, model	interface type	Signal, slide-in module	Product code cable		
Cable for LabManager® and Lab I/O™					
Analogue input, free cable ends					
voltage	analogue	LM-AI	ZK-LAB-HI01-IA-UP-O-01		
Voltage, with sensor supply 24 V	analogue	LM-AI	ZK-LAB-HI01-IA-UA-O-01		
0/420 mA two-wire	analogue	LM-AI	ZK-LAB-HI01-IA-IP-O-01		
0/420 mA two-wire with supply	analogue	LM-AI	ZK-LAB-HI01-IA-IA-O-01		
0/420 mA four-wire with supply	analogue	LM-AI	ZK-LAB-HI01-IA-IA-O-02		
Analogue output, free cable ends					
voltage	analogue	LM-AO	ZK-LAB-HI01-OA-UP-O-01		
0/420 mA	analogue	LM-AO	ZK-LAB-HI01-OA-IP-O-01		
Digital input, free cable ends					
2 wires for switches, monitoring devices	digital	LM-DI	ZK-LAB-HI01-ID-XX-O-51		
3 wires for switches, monitoring devices	digital	LM-DI	ZK-LAB-HI01-ID-XA-O-52		
Digital output, free cable ends					
For valves etc., 3 wires: Change-over contact	digital	LM-DO	ZK-LAB-HI01-OD-XX-O-51		

# Cable for the instrumentation

Manufacturer, device, model	interface type	Signal, slide-in module	Product code cable	
For valves etc., 2 wires: Normally open contact	digital	LM-DO	ZK-LAB-HI01-OD-XX-O-52	actor
For valves etc., 2 wires: Normally closed contact	digital	LM-DO	ZK-LAB-HI01-OD-XX-O-53	atory Re Systems
Pressure transmitters				abor
Keller pressure transmitter model series 21	analogue	current 4…20 mA, two-wire to LM-Al	ZK-SP-KL21-IA-IA-I-01	
Keller pressure transmitter model series 23	analogue	current 4…20 mA, two-wire to LM-Al	ZK-SP-KL23-IA-IA-I-01	tion
Heating/cooling thermostats				nenta
Lauda thermostat model C6CS/C12CS/C20CS/ K6KS/K12KS/ K20KS	analogue	Temperature actual value, 010 V on LM-AI Temperature set point, 010 V on LM-AO	ZK-T-LD01-BA-UP-Y-01	Ferm Teo
Lauda thermostat model C6CS/C12CS/C20CS/ K6KS/K12KS/ K20KS	analogue	Temperature actual value, 010 V on LM-AI Temperature actual val- ue channel 1 & set point, 420 mA on LM-AI	ZK-T-LD01-BA-KP-Y-01	mation Technique
Lauda thermostat model C6CS/C12CS/C20CS/ K6KS/K12KS/ K20KS	Serial	Temperature actual value, Temperature actual value, set point	ZK-T-LD01-BS-R2-I-02	Auto
Lauda thermostat model USH400	analogue	Temperature actual value, 010 V on LM-AI Temperature set point, 010 V on LM-AO	ZK-T-LD03-BA-UP-Y-01	uid Handling ratory Robots
Jucheim thermostat model 80-4 / 90-4	analogue	Temperature actual value, 020 mA on LM-AI	ZK-T-JH01-BA-IP-Y-01	Liqu Labo
Julabo thermostat model FP50MH	analogue	Temperature set point, 020 mA an LM-AO Temperature working sensor, 010 V on LM-AI, Temperature ext. sensor, 010 V on LM-AI Set point check-back signal, 010 V on LM-AI	ZK-T-JU01-BA-KP-Y-01	Dosing Systems Pumps
Julabo thermostat model FP50MH	analogue	Temperature set point, 020 mA on LM-AO Temperature working sensor, 010 V on LM-AI, Temperature ext. sensor, 010 V on LM-AI	ZK-T-JU01-BA-KP-Y-02	pparatus ries
Julabo thermostat model HP / SP / TP	analogue	Temperature set point, 020 mA on LM-AO Temperature ext sensor, 010 V on LM-AI Temperature int. sensor, 010 V on LM-AI Set point check-back signal, 020 mA on LM-AI	ZK-T-JU02-BA-KP-Y-01	  ytics Laboratory A . Accesso
Julabo thermostat model ATS3 / ATS2	analogue	Temperature set point, 020 mA on LM-AO Temperature actual value, 010 V on LM-AI 2 x 4-pin Tuchel on thermostat side	ZK-T-JU04-BA-KP-Y01	Process Anal Sensors
Julabo thermostat	RS232	Temperature set point, Temper- ature ext sensor, Temperature int. sensor, Set point check- back signal	ZK-T-JU00-BS-R2-I-01	Services Didactics

Should you not find your cable here, simply contact us.

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# **Automation Technique**

Manufacturer, device, model	interface type	Signal, slide-in module	Product code cable
Eurotherm thermostat type RD4455 model 99	analogue	Temperature set point, 010 V on LM-AO Temperature actual value, 010 V on LM-Al	ZK-T-ET99-BA-UP-Y01
Huber thermostat model Tango	analogue	Temperature set point, 010 V on LM-AO Bath temperature actual value, 010 V on LM-AI open ended cable	ZK-T-HU04-BA-UP-O-01
Huber thermostat model Tango	analogue	Temperature set point, 420 mA on LM-AO Temperature actual value, 420 mA on LM-AI open ended cable	ZK-T-HU04-BA-IP-O-01
Huber thermostat model Tango	RS232	Temperature set point, actual value via RS-232	ZK-T-HU01-BS-R2-I-01
Huber thermostat model Tango	RS485	Temperature set point, actual value via RS-485	ZK-T-HU01-BS-R4-I-51
Huber thermostat (compatible control)	RS232	Temperature set point, actual value via RS-232	ZK-T-HU02-BS-R2-I-01
Huber thermostat (compatible control)	RS485	Temperature set point, actual value via RS-485	ZK-T-HU02-BS-R4-I-51
Haake thermostat	analogue	Temperature set point, 420 mA on LM-AO Temperature actual value, 420 mA an LM-AI	ZK-T-HA01-BA-IP-Y-01
Haake thermostat	RS232	Temperature set point, Temper- ature actual value	ZK-T-HA01-BS-R2-I-01
T-Pot™ temperature control system	digital	1 x 8-pin. M12 device socket, LM-DO	ZK-T-HI26-BK-PA-Y-51
HiTec laboratory apparatus (see also Stirrer	s and solid matter dosin	ng devices)	
Hitec model Kaloheiz, control input	analogue	voltage, 6-pin Tuchel on LM-AO	ZK-KAL-HI04-OA-UP-I-01
Hitec model Kaloheiz, voltage monitor	analogue	voltage, 6-pin Tuchel on LM-Al	ZK-KAL-HI04-IA-UP-I-01
Hitec model Kaloheiz, current monitor	analogue	voltage, 6-pin Tuchel on LM-Al	ZK-KAL-HI04-IA-UP-I-02
PhaDec™-X	digital	LM-DI	ZK-LAB-HI06-OD-XX-I-51
Laboratory balance			
Kern balance model EW 3000-2M	RS232	5-pin Hoshiden plug / D-Sub9 socket on LM-RS232	ZK-W-KE01-BS-R2-I-01
Kern balance model GS	RS232	RS-232, 25-pin plug - 9-pin socket	ZK-W-KE02-BS-R2-I-01
Kern balance model EW PB 4002-2	RS232	RS-232, 9-pin plug - 9-pin socket	ZK-W-KE03-BS-R2-I-01
Sartorius balance / Scaltec model SBC	RS232	RS-232, 25-pin plug - 25-pin socket	ZK-W-SA01-BS-R2-I-01
Sartorius balance / Scaltec model SBC	RS232	RS-232, D-Sub9 plug- D-Sub9 socket	ZK-W-SA01-BS-R2-I-03
Sartorius balance / Scaltec model SBC	mixed	RS-232, D-Sub9 socket LM- RS232, tare on LM-DO	ZK-W-SA01-BK-R2P-Y-52
Sartorius balance / Scaltec model SBC	mixed	RS-232, D-Sub9 socket on LM- RS232, tare on LM-DO	ZK-W-SA01-BK-R2A-Y-52
Mettler balance model PM/AM 25-pin	RS232	25-pin, 15-pin Mettler plug	ZK-W-ME01-BS-R2-I-01
Mettler balance model PM/AM 9-pin	RS232	9-pin, 15-pin Mettler plug	ZK-W-ME01-BS-R2-I-02

# Cable for the instrumentation

Manufacturer, device, model	interface type	Signal, slide-in module	Product code cable	
Mettler balance model PG	RS232	9-pin, 9-pin	ZK-W-ME02-BS-R2-I-01	l eactor
Solenoids				 ory Re tems
Solenoids (Open/Closed), plug types 2508, DIN 43650 form A	digital	24 V, 4-pin ISO4400 socket / Tuchel socket on LM-DO	ZK-VMB-HI41-OD-XA-I-51	Laborato Sys
Solenoids (Open/Closed), plug types 2508, DIN 43650 form B	digital	24 V, 4-pin ISO4400 socket / Tuchel socket on LM-DO	ZK-VMB-HI41-OD-XA-I-51	
Solenoids (Open/Closed), plug types 2506, DIN 43650 form C	digital	24 V, 4-pin ISO4400 socket / Tuchel socket on LM-DO	ZK-VMB-HI43-OD-XA-I-51	tion –
Solenoids (proportional), plug types 2508, DIN 43650 form A	digital	24 V, 4-pin ISO4400 socket / Tuchel socket on LM-DO, PWM	ZK-VMP-HI41-OD-XA-I-51	l ermenta Techniq
Solenoids (proportional), plug types 2508, DIN 43650 form B	digital	24 V, 4-pin ISO4400 socket / Tuchel socket on LM-DO, PWM	ZK-VMP-HI42-OD-XA-I-51	_
Solenoids (proportional), plug types 2506, DIN 43650 form C	digital	24 V, 4-pin ISO4400 socket / Tuchel socket on LM-DO, PWM	ZK-VMP-HI42-OD-XA-I-51	ique
Bürkert solenoids (proportional) cable end 1054/1057 (valve 0127)	digital	24 V, 4-pin ISO4400 socket / Tuchel socket on LM-DO, PWM	ZK-VMP-BU04-OD-XA-I-51	ion Techı
Bürkert solenoids (proportional) cable end 1094	analogue	420 mA on LM-AO	ZK-VMP-BU03-OA-IA-I-01	Automat
Knauer multi-path valve model HPLC7	RS232		ZK-VMO-KN07-BS-R2-I-01	
VICI AG Valco multi-directional valve	RS232		ZK-VMO-VI01-BS-R2-I-01	<u>د</u>
Dosing pumps				Robo
HiTec Zang pump, LabDos™	mixed	Set point, 4…20 mA on LM-AO, Start/Stop on LM-DO	ZK-P-HI36-OK-IP-Y-51	quid Han
HiTec Zang pump, LabDos™	RS232	Set point and status informa- tion,9-pin/9-pin	ZK-P-HI36-BS-R2-I-01	Lic Lic
ISMATEC pump model ISM736	mixed	Set point, 4…20 mA on LM-AO, Start/Stop on LM-DO	ZK-P-IS01-OK-IP-Y-52	SU
ISMATEC pump model MC-Z / MS-Z	analogue	Set point 05,7/010 V volt- age passive LM-AO	ZK-P-IS03-OA-UP-I-01	l ng Syster umps
ISMATEC pump hose pump Reglo Digital	RS232	Set point, actual value	ZK-P-IS04-BS-R2-I-01	Dosir
Knauer pump	RS232	Set point, actual value	ZK-P-KN00-BS-R2-I-01	_
Prominent pump model gamma	analogue	number of strokes Set point 420 mA on LM-AO	ZK-P-PR01-OA-IP-I-01	itus
Telab pump model BF414	RS232	stroke frequency, stroke volume	ZK-P-TL02-BS-R2-I-01	y Appara ssories
Telab pump model BF414, before 2000	analogue	stroke frequency set point, 420 mA LM-AO stroke volume set point, 420 mA LM-AO D-Sub9 plug	ZK-P-TL02-OA-IP-Y-01	Laborator Acce
Telab pump model BF414, after 2000	analogue	stroke frequency set point, 420 mA on LM-AO, stroke volume set point, 420 mA on LM-AO, 15 -pol. HD plug	ZK-P-TL02-OA-IP-Y-02	cess Analytics Sensors
Telab pump model BF414, before 2000	analogue	stroke frequency set point, 010 V on LM-AO stroke volume set point, 010 V on LM-AO D-Sub9 plug	ZK-P-TL02-OA-UP-Y-01	Pro

# **Automation Technique**

Manufacturer, device, model	interface type	Signal, slide-in module	Product code cable
Telab pump model BF414, after 2000	analogue	stroke frequency set point, 010 V on LM-AO stroke volume set point, 010 V on LM-AO D-Sub15 plug	ZK-P-TL02-OA-UP-Y-02
Telab pump model BF414, before 2000	analogue	stroke frequency set point, 420 mA LM-AO stroke volume set point, 420 mA LM-AO release on LM-DO D-Sub9 plug	ZK-P-TL02-OK-IP-Y-01
Telab pump model BF414, after 2000	analogue	stroke frequency set point, 420 mA on LM-AO stroke volume set point,, 420 mA on LM-AO release on LM-DO 15 -pin HD plug	ZK-P-TL02-OK-IP-Y-02
Telab pump model BF414, before 2000	analogue	stroke frequency set point, 010 V on LM-AO stroke volume set point, 010 V on LM-AO release on LM-DO D-Sub9 plug	ZK-P-TL02-OK-UP-Y-01
Telab pump model BF414, after 2000	analogue	stroke frequency set point, 010 V on LM-AO, stroke volume set point, 010 V on LM-AO, re- lease on LM-DO, D-Sub15 plug	ZK-P-TL02-OK-UP-Y-02
Telab pump model BF414, before 2000	digital	Pulse on LM-DA, release on LM-DO, D-Sub9 plug	ZK-P-TL02-OD-XP-Y-51
Telab pump model BF414, after 2000	digital	Pulse on LM-DA, release on LM-DO, D-Sub15 plug	ZK-P-TL02-OD-XP-Y-52
Dosing devices			
Metrohm Dosimat 665	RS232	Set point, actual value	ZK-DL-MO01-BS-R2-I-01
Metrohm Titrino 718	RS232	Complete Titrino command tree	ZK-DL-MO02-BS-R2-I-01
Solid matter dosing devices			
SoliDos™ control device HiTec model (from firmware 2.10, March 2001)	analogue	Set point voltage 010 V on LM-AO Actual value voltage 010 V on LM-AI Actual value voltage 010 V on LM-AI	ZK-R-HI02-BA-UP-Y-03
SoliDos™ control device HiTec model (from firmware 2.10, March 2001)	analogue	Set point current 0/420 mA on LM-AO Actual value current 0/420 mA on LM-AI Actual value current 0/420 mA on LM-AI	ZK-R-HI02-BA-IP-Y-02
SoliDos™ control device HiTec model	RS232	Set point, Actual value, On, Off	ZK-R-HI02-BS-R2-I-01

#### Stirrer drives

# Cable for the instrumentation

Manufacturer, device, model	interface type	Signal, slide-in module	Product code cable	_
Heidolph stirrer model RZR 2102	analogue	Torque actual value 420 mA on LM-AI Speed actual value 420 mA on LM-AI Speed set point 420 mA on LM-AO	ZK-R-HD02-BA-IP-Y-01	Laboratory Reactor Systems
HiTec stirrer model ViscoPakt® and ViscoPak- t®-rheo (from firmware 2.10, March 2001)	analogue	Speed set point voltage 010 V on LM-AO Speed actual value voltage 010 V on LM-AI Speed actual value voltage 010 V on LM-AI	ZK-R-HI02-BA-UP-Y-03	rmentation echnique
HiTec stirrer model ViscoPakt® and ViscoPak- t®-rheo (from firmware 2.10, March 2001)	analogue	Speed set point current 020 mA/420 mA on LM-AO, Speed actual value current 020 mA/420 mA on LM-AI, Torque actual value current 020 mA/420 mA on LM-AI	ZK-R-HI02-BA-IP-Y-02	Technique
HiTec stirrer model ViscoPakt® and ViscoPak- t®-rheo	RS232	Speed set point, speed actual value, torque actual value, On, Off	ZK-R-HI02-BS-R2-I-01	Automation
IKA stirrer model Eurostar	analogue	Speed actual value voltage on LM-AI, Torque actual value voltage on LM-AI	ZK-R-IK01-BA-UP-Y-01	dling
IKA stirrer model Eurostar	mixed	Speed actual value voltage on LM-AI Torque actual value voltage on LM-AI Set point via RS-232, Serial measured on HD plug	ZK-R-IK01-BK-R2-Y-01	Liquid Han Liquid Han Laboratory F
IKA stirrer model Eurostar Visc	RS232	RS232 control D-Sub9	ZK-R-IK01-BS-R2-I-01	
IKA stirrer model Eurostar Visc	RS232	RS232 control 15-pin HD	ZK-R-IK01-BS-R2-I-02	 Syste mps
Sensors				osing Pu
Brooks flow rate sensor model 5850TR	analogue	Flow rate sensor D-Sub15 Actual value on LM-AI, set point on LM-AO	ZK-SFM-BR01-BA-UA-Y-01	
Brooks flow rate sensor model 5850TR	RS232	Flow rate sensor D-Sub15 Actual value, set point	ZK-SFM-BR01-BS-R2-I-01	pparatus ries
Bronkhorst flow rate controller model F-xxxaa-FAB/FBB/GAB/GBB-xx-a	analogue	Actual value on LM-AI, set point on LM-AO +24 V power supply	ZK-CFM-BK21-BA-UA-I-01	iboratory A
Bronkhorst flow rate controller model MFC F-xxxx-FA/FB/GA/GB-xx and F-xxxaa-FAC/FBC/GAC/GBC-xx-a	analogue	Actual value on LM-AI, set point on LM-AO ±15 V power supply	ZK-CFM-BK22-BA-UA-I-01	Ľ
Bronkhorst flow rate controller model F-xxxaa-FCB/FDB/GCB/GDB-xx-a	analogue	Actual value on LM-AI, set point on LM-AO +24 V power supply preferred model	ZK-CFM-BK23-BA-IA-I-01	 ocess Analytics Sensors
Bronkhorst flow rate controller model MFC F-xxxx-FC/FD/GC/GD-xx and F-xxxaa-FCC/FDC/GCC/GDC-xx-a	analogue	Actual value on LM-AI, set point on LM-AO ±15 V power supply	ZK-CFM-BK24-BA-IA-I-01	<u>7</u>
Laboratory gas meter model TG, impulse output	binary	5-pin plug DIN51524 3-pin device plug DIN51524 for connection to LM-DI	ZK-SFV-RI01-ID-XX-I-51	vices
Watchdog				Ser Didã

### Watchdog

# **Automation Technique**

Manufacturer device model	interface type	Signal slide in module	Product code cable
		Match des plus	
0/420 mA two-wire	analogue	watchdog plug	ZK-X-HIU5-IA-IA-U-U1
PC accessory cables			
HiTec null modem cable	RS232	RS-232, 2x D-Sub9	ZK-IT-HI10-BS-R2-I-01
HiTec RS-232 extension	RS232	RS-232 D-Sub9	ZK-IT-HI11-BS-R2-I-01
HiTec ABK <> Com1	RS232	25-pin, on 25-pin, RS-232	ZK-IT-HI01-BS-R2-I-01
HiTec ABK <> Com1	RS232	9-pin, on 9-pin, RS-232	ZK-IT-HI01-BS-R2-I-02
HiTec ABK <> Com1	RS232	25-pin, on 9-pin, RS-232	ZK-IT-HI01-BS-R2-I-03
Miscellaneous, periphery items			
LabCom cable			ZK-LAB-HI07-BS-R2A-I-01
HiTec model B230V16H, B230V16R	digital	LM-DO	ZK-LAB-HI06-OD-XX-I-51
Jeti spectrometer	RS232	RS232 9-pin	ZK-X-JE01-BS-R2-I-01
Pt100 extension	analogue	Lemo socket/plug 4-pin	ZK-XX-HI11-BA-PX-I-01
Edwards model Active Gauge Display (AGD) for Active Pirani Gauge (APG)	analogue	Analogue voltage on LM-Al	ZK-X-EW01-IA-UP-I-01
Reflux separator 24 V DC, plug form A, 4 pin ISO4400 socket DIN 43650 form A	digital	LM-DO	ZK-RT-HI41-OD-XA-I-51

# Driver programs for laboratory equipment interfaces

Laboratory and process device drivers enable data communication to take place between a LabVision®/LabManager® automation system and an external laboratory or process device via a data interface such as RS-232, RS-485 or Ethernet.

Devices connected to an AS can be linked into control loops as a sensor or actuating element. Devices connected to an OS can also be integrated into control loops as a sensor or actuating element; however, values needed for automated control must be permanently exchanged through the OS-AS interface

Depending on the complexity of the protocol, different kinds of drivers may be useful. Some drivers can be parameterised by the user, but others must be parameterised by a programmer.

Laboratory apparatus with more complex protocols, in particular binary protocols, can be connected to an interface of an OS using special AS drivers. Many items of laboratory apparatus can be operated using an AS driver for OPC or an AS driver for Modbus.

In doing this, the following classes of laboratory and process device drivers are distinguished from each other:

a) Drivers for HiTec Zang laboratory and process devices

The drivers for HiTec Zang laboratory and process devices are part of the basic configuration of the LabManager®/LabVision® system.

b) LabVision® standard laboratory and process device drivers (SF-PDLABPDx optional, ready-to-use)

The standard laboratory and process device driver library for other manufacturers includes common devices, such as thermostats, balances, pumps or stirrer drives. The drivers are given as options in in 4 types of granularity. Ready-to-use drivers cannot be edited by the user.

b) Special LabVision<sup>®</sup> laboratory and process device drivers (SF-PDLABPDx optional, ready-to-use)

The special laboratory and process device drivers include Cetoni, Braun Perfusor, Metrohm, Lasentec. Further device drivers are available on request

The drivers are given as options in single types of granularity. Readyto-use drivers cannot be edited by the user.

d) User-defined device drivers (NAMUR, Modbus, RK512, DDE, OPC and others on request, as options)

For all other device drivers the user determines the number and functions of the component contacts.

The user-defined protocol drivers also require an interface point (SF-IFPTSx) for each information channel in addition to each of the drivers.

### Interface points

All interface end points (external connections and information channels of connected devices and systems) require an interface point.

The exception: HiTec Zang interface end points, i.e.inputs/outputs to HiTec Zang AS slide-in modules or data point connections to HiTec

Zang software modules (e.g. a HiTec OPC server) do not require any interface points.

Example: A laboratory balance, which is not contained in the LabVision® standard laboratory and process device driver library with information channels for tare, actual value and status therefore requires SF-PDNAMUR and 3 interface points (SF-IFPTSx).

More complex devices such as thermostats require appropriately more interface points.

On rough estimation, 5 interface points may be needed for one laboratory device.

A valve terminal with 8 valves with a checkback signal requires 16 interface points.

### HiText<sup>™</sup> drivers

Laboratory apparatus with complex protocols, in particular binary protocols, can be connected to a serial interface of an OS using special drivers written in HiText<sup>™</sup> (option SL-HITXTCOM). The HiText<sup>™</sup> driver can be programmed by the user himself or by our programming department.

### NAMUR drivers

A freely parameterisable NAMUR driver for serial interfaces enables any desired amount of laboratory and analytic apparatus to be connected using serial interfaces of an AS as long as the interface protocols of these devices essentially keep to the NAMUR recommendation NE28.

Within this, a serial interface may be logically divided into several channels. Each of the channels are addressed via their own data points. In addition, there is a limited possibility to connect bus-capable devices.

A freely configurable NAMUR device component can be simply created within the LabVision<sup>®</sup> device component definition. The specific interface parameters are transferred to this from the relevant device manual.

Example: An interface configured for a dosing pump enables

- > Setting of the set point speed
- Interrogation of the actual speed
- Monitoring of fault conditions

An editable "general NAMUR device", for which appropriate input and output data points can be added, can be used as a template. The completed device may then in turn be filed in the device component library to be used as a template for other devices of the same type. Modbus, DDE and OPC drivers work similarly but are not described in detail here.

### Special drivers

A driver can be programmed by our programming department for laboratory apparatus with binary protocols.

Process Analytics Sensors The following table contains the available driver programs for various standard laboratory apparatus and instrumentation components. The range is being constantly expanded.

Should you not find your device here, please send us an enquiry.

Manufacturer, device, model	Driver
Heating/cooling thermostats	
Huber var. models *	Standard laboratory apparatus
Julabo var. models *	Standard laboratory apparatus
Haake var. models *	Standard laboratory apparatus
Lauda var. models *	Standard laboratory apparatus
Stirrers	
ViscoPakt® **	already integrated
Heidolph *	Standard laboratory apparatus
IKA Powervisc *	Standard laboratory apparatus
Dosing pumps	
LabDos™ var. models **	already integrated
SyrDos™ var. models **	already integrated
Knauer var. models *	some are standard laboratory apparatus
Vacuubrand var. models *	some are standard laboratory apparatus
Fink Ritmo *	some are standard laboratory apparatus
Ilmvac LVS Ecoflex *	some are standard laboratory apparatus
Ismatec var. models *	some are standard laboratory apparatus
Multi-path valves	
Knauer model HPLC7	on request
Besta MW1 / MW2 multi-directional valves	on request
MultiValve™	already integrated
Mass flow meters and controllers	
Bronkhorst set point A and actual value E	on request
Brooks set point A and actual value E	on request
Miscellaneous devices	
SoliDos™ **	already integrated
KaloHeiz **	already integrated
BoDrive™ (bottom outlet valve) **	already integrated
AutoSam <sup>™</sup> **	already integrated
Metrohm Liquino, Titrino, Dosino	Special laboratory apparatus
Cetoni pumps	Special laboratory apparatus
B. Braun perfusor	Special laboratory apparatus
Lasentec FBRM particle analyser	Special laboratory apparatus

Explanation:

\* Most of the devices of this manufacturer are already implemented as device components.
\*\* HiTec Zang devices do not require any additional order options

Note: Additional SF-IFPTSx interface points required

Manufacturer, device, model	Driver	
User-defined device drivers		actor
Laboratory apparatus with ASCII protocol in accordance with the NAMUR NE28 recommendation	SF-PDNAMUR	boratory Re. Systems
Devices with OPC server control	SF-PDOPC	La
ModBus devices	SF-PDMODBUS	
PLC devices with RK512 protocol	SF-PDRK512	
Devices and systems with DDE access	SF-PDDDE	ation
Explanation: * Most of the devices of this manufacturer are alre	eady implemented as device components.	Ferment

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\* Most of the devices of this manufacturer are already implemented as device components.
 \*\* HiTec Zang devices do not require any additional order options
 Note: Additional SF-IFPTSx interface points required

Product code	Description	
SF-PDLABPD2	Laboratory and process device driver library for 2 devices	
SF-PDLABPD4	Laboratory and process device driver library for 4 devices	
SF-PDSLABPD1	Special OS laboratory and process device drivers for 1 device	
SF-PDNAMUR	Protocol drivers for the NAMUR protocol	
SF-PDMODBUS	Modbus combined drivers for Modbus on the PC (serial or TCP/IP) and/or LabManager®	
SF-PDOPC	Protocol drivers for OPC-DA (version 1+2), OPC client	D
SF-PDRK512	Protocol drivers for Siemens PLC	ndlin
SF-PDDDE	Protocol drivers for DDE data exchange	 id Ha
SF-IFPTSz	Interface points for external data interfaces	 ici

z: Quantity = 10, 20, 30, 60, 100, 180, 300, 560, 1000, 1800, 3000, 10000

Dosing Systems Pumps

Laboratory Apparatus Accessories

# AS auxiliary devices external

The external AS auxiliary devices are used for the expansion of an AS functions.

# Switching box 2 x 230 V

External connection box with two single-pin (version H) or two twopin (version R) switched earthed sockets. Control inputs for connection to an LM-DO slide-in module.

The control can be carried out using a control voltage up to a max. of 24 V DC. Pulse width or pulse frequency modulated control is also possible.

The version HP-B230V16R is suited for switching frequencies of up to 1 Hz.



Technical data	HP-B230V16H/R	HP-B400V16A	HP-B230V10H/R- CH	HP-B230V16H/R- CH	HP-B230V13H/R- GB
Switching voltage signal	2 x 230 V AC	3 x 230 V AC/400 V AC	2 x 230 V AC		
Total load (A)	16	10 per phase (per- manent), 16 per phase (im- pulse)	10	16	13
	Version HP-B230V1 B230V16R: two-pin	6H: single-pin switch, l switch, 16A back-up fi	eakage current 5 mA, N use required!	Minimum load 100 mA	; version HP-
Connection type	Earthed sockets	16 A CEE plug	Swiss standard T13	Swiss standard T23	British standard BS 1363
Control signal	Max. 24 V DC				
Can be used with	Slide-in module LN panel LP-DAP8T, LP	1-DO requires 2 x cable -DAP8A requires 2x ca	2K-LAB-HI06-OD-XX-I- ble ZK-LAB-HI06-OD-X	-51 X-I-01	
For the switching of	pumps, heating ba	nds, heating domes, et	tc.		
Scope of delivery	Switching box with	permanently connect	ted power cable		
Product code	Description				
HP-B230V16H	Socket switching box 2 x 230 V total load 16 A, single-pin switching, semi-conductor switch				
HP-B230V16R	Socket switching box 2 x 230 V total load 16 A, 2-pin switching, power relay				
HP-B400V16A	Socket switching box 3-phase switched, nominal voltage 400 V, 16 A per phase.				
HP-B230V10H-CH	Socket switching box 2 x 230 V total load 10 A, single-pin switching, semi-conductor switch, Swiss standard (T13)				
HP-B230V10R-CH	Socket switching box	< 2 x 230 V total load 10	) A, 2-pin switching, pc	ower relay, Swiss standa	ard (T13)
HP-B230V16H-CH	Socket switching box 2 x 230 V total load 16 A, single-pin switching, semi-conductor switch, Swiss standard (T23)				
HP-B230V16R-CH	Socket switching box	x 2 x 230 V total load 16	6 A, 2-pin switching, pc	ower relay, Swiss standa	ard (T23)
HP-B230V13H-GB	Socket switching box 2 x 230 V total load 13 A, single-pin switching, semi-conductor switch, British standard (BS 1363)			tch, British standard	
HP-B230V13R-GB	Socket switching box	× 2 x 230 V total load 13	3 A, 2-pin switching, pc	ower relay, British stanc	lard (BS 1363)
ZK-LAB-HI06-OD-XX-I-51	Cable for connection	to LabManager®			
ZK-LAB-HI06-OD-XX-I-01	Cable for connection	to LabManager® Class	sic		



Other socket types, e.g. USA or China, are available on request

# Display & operating components

An operator station (OS) for a HiTec Zang system consists of a special PC with a Windows 7 or higher operating system and LabVision® OS software.

The OS must meet particular requirements as a part of an automation system

- > An uninterrupted power supply (UPS) with a shut-down interface
- LabVision<sup>®</sup>-compatible UPS management
- > EMC robust
- > Run-in system test

These requirements cannot generally be met by standard office PCs! HiTec OSs are devices with tried and tested hardware. The entire system of the devices is extensively tested before delivery using ready-to-use installed software.

The OS software, LabVision<sup>®</sup>, is based on a database system which places increased demands on the hardware.

As the database and the Windows operating system can possibly be damaged by a power cut, a HiTec OS is essentially fitted with an unin-

# Housing types

Our operating components may be obtained in three different housing types on request.

### Housing type "Mini desk-top"

DimensionsDepth204 mmWidth350 mmHeight99 mm

### Housing type "Midi tower"



Dimensions	
Depth	500 mm
Width	210 mm
Height	450 mm

All pictures are similar!



Other housing types are available on request!

terrupted power supply and UPS management software.

In the case of a power cut the system continues running, buffered by its battery. Before the battery capacity is exhausted, the system is shut down in a controlled manner. This is important, as otherwise it could result in a partial or total loss of the stored data.

The standard UPS is part of the basic equipment. This may not be fully discharged as occurs through a global switching off of a system using a main switch. If it is planned to disconnected the UPS from the mains supply for a longer period of time, it must be switched off in a charged condition on the operating panel. If this cannot be guaranteed, the online USV CP-USV7O must be used, as this is equipped with discharge protection.

PC hardware experiences a rapid rate of innovation. For this reason, HiTec Zang adjusts its models at regular intervals to meet the latest technology. Therefore, it makes no sense to present here current devices which will probably in a short time be outdated. Instead,, we offer a choice between a device with standard equipment and performance in line with the current state-of-the art and a device with more sophisticated equipment and performance. Should you require information on the current technical characteristics, please send us an enquiry.

For rough use an industrial PC, with protected drives and the possibility to be built into 19" system cabinets, is recommended.

## Housing type "19" industrial PC"

No.	

Dimensions		
Depth	500 mm	
Width	482.6 mm (19")	
Height	177 mm (4 HE)	

**Dosing Systems** 

Pumps

Laboratory Reactor

Fermentation

Technique

**Automation Technique** 

Liquid Handling Laboratory Robots

Systems

## HiTec-OS1

The HiTec-OS1 is used for small-scale and medium-sized applications, i.e. in conjunction with a LabManager® 1.

#### **Basic configuration\***

- > Efficient processor
- > High-quality server main board
- > Min. 8 GB RAM
- > Two LAN connections for AS and network
- > Fast SATA hard disk (> 500 GB) for permanent operation (24/7)
- > Sound card for acoustic messages
- > UPS and UPS management software
- > Windows keyboard, wheel mouse
- > Windows 7 Professional© pre-installed

\*Status 11/2015. The equipment is regularly adapted to the current standard.



The UPS management software monitors the charge level of the battery in the case of a power cut and shuts the operating system down in a defined state before the battery charge is exhausted. This is essential for the secure operation of a database.

code	Description
couc	Description

Product co CG-ABK1S

HiTec operator station 1 in a mini desk-top housing, with UPS system

# HiTec-OS2

The HiTec-OS2 is used for medium-sized to large-scale applications, i.e. in conjunction with a LabManager® 2 or several ASs with several LabVision® units.

You have the choice between three different housing types. The device is supplied as standard as a midi tower.

### **Basic configuration\***

- > Efficient processor
- > High-quality server main board
- > Min. 8 GB ECC-RAM
- > Two LAN connections for AS and network
- > Fast SATA hard disk (> 1,000 GB) for permanent operation (24/7)
- > Multi-format DVD burner
- > Sound card for acoustic messages
- > UPS and UPS management software
- > Windows keyboard, wheel mouse
- > Windows 7 Professional© pre-installed

\*Status 11/2015. The equipment is regularly adapted to the current standard.



For added security the ABK2 can be upgraded with an RAID system.

The ABK2 enables a second monitor to be connected. Thus, such elements as the manual operation level and the batch control can each be allocated to a separate monitor.

As an automation unit an OS requires a high level of reliability. This is achieved, among other methods, through error correction memory (ECC-RAM).

The UPS management software monitors the charge level of the battery in the case of a power cut and runs the operating system down in a defined state before the battery charge is exhausted. This is essential for the secure operation of a database.

Product code	Description
CG-ABK2M	HiTec operator station 2 in a midi tower housing, with UPS system
CG-ABK2I	HiTec operator station 2 in a 19" industrial housing, with UPS system
CK-RAID1	Mirror disk system RAID 1 (with intelligent controller card)

## AS auxiliary devices external

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# ABKTouch™

The ABKTouch OS is a touch monitor with an integrated Windows PC. It is a space-saving alternative to a monitor with a keyboard and mouse.

#### **Basic configuration\***

- > Min. 2 GB working memory
- > Fast 60 GB SSD

**Product code** CG-ABKTOUCH-10 CG-ABKTOUCH-15 CG-ABKTOUCH-21

- > 2 x Ethernet
- > 2 x RS-232
- > Windows® 7 Professional pre-installed

\*Status 08/2014. The equipment is regularly adapted to the current standard.



Description	
ABKTouch™ operator station with 10" touchscreen	
ABKTouch™ operator station with 15" touchscreen	
ABKTouch™ operator station with 21.5" touchscreen	

# Former industrial PCs

This computer is suitable for use in a	directly explosive environment.	d Handling tory Robots
Product code	Description	iquid bora
CG-ABKEX	HiTec operator station in a former protective housing, with UPS system	L L
CZ-EXMAUS	Wireless mouse for the former industrial area	



OS extensions and possibilities for upgrading are available on request

# Uninterruptible power supplies (UPSs)

If it is intended that the control system continues operating in the case of a power cut, it is necessary to have an uninterruptible power supply for file servers, OSs, ASs and, where necessary, the most important devices in the primary instrumentation.

### Uninterruptible power supply (UPS) standard

The standard UPS may not be fully discharged as occurs through a global switching off of a system using a main switch.

If it is planned to disconnect the UPS from the mains supply for a longer period of time, it must be switched off on the operating panel. If this cannot be guaranteed, the online USV CP-USV7O must be used. In addition, appropriate UPS management software is required so that the computer may be "shut down" in a controlled manner.

### Characteristics

- > Monitoring output for OS
- > Power 700 VA
- > Back-up time approx. 15 minutes

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### Description

CP-USV7

**Product code** 

700 VA emergency power supply for HiTec OS, including software

Note: CP-USV7 is already included in the scope of delivery of all HiTec Zang OSs.

### Emergency power supply (UPS) online

The online UPS delivers a consistently even voltage quality and is secure against being fully discharged

It should be used if it cannot be guaranteed that the UPS can be switched off after a power cut which continues for a period longer than the maximum back-up time.

#### Characteristics

- > Secure against being fully discharged
- Sinusoidal voltage
- Controlled voltage
- > Monitoring output for OS
- > Power 700 VA
- > Back-up time approx. 15 minutes

Product code	Description
CP-USV7O	Online 700 VA emergency power supply with discharge protection for HiTec OS, including software

We also supply online UPSs with higher power, e.g. with 1,000 or 2,000 VA, on request.

## Monitors

Our monitors meet all the currently applicable ergonomic rules.

### Standard monitors

#### Wide-screen TFT colour monitor

We offer both 22" and 24" TFT monitors for our operator station. Depending on the equipment on an OS, up to two TFT monitors can be connected.

- > Resolution 1,920 x 1,080
- > Low radiation level to TCO '03
- > 36-month manufacturer's guarantee
- > Height-adjustable with pivoting base



Product code	Description
CP-M22TFTWS	22" wide-screen TFT colour monitor
CP-M24TFTWS	24" wide-screen TFT colour monitor

### Industrial monitor

The metal case contains a 19" TFT monitor and protects it under rough environmental conditions. It is ready for installation into a 19" control cabinet. Installation into a housing is recommended for free-standing arrangement or for enabling systems to be transportable.

Description

Dimensions for installation (W x D x H) 483 x 116 x 399 mm



Product code CP-INMON

19" industrial monitor for installation into a control cabinet

### LabTouch<sup>™</sup> touchscreen



LabTouch<sup>™</sup> is an on site mini terminal for LabManager®, LabBox®, Lab I/O™ and MSRmanager<sup>™</sup> systems. Thus, you have immediate access on the installation to the most important processes. LabTouch<sup>™</sup> is mainly used if the operating PC is not located in the immediate vicinity of the installation.

#### The advantages

- » On site display of the most important process values
- » Freely defined dialogues for operator guidance
- » On site possibility of the entry of values and parameters
- » On site alarm signalling
- » Horizontal or vertical installation possible
- » Connection via a standard VGA

Product code	Description	
CP-MLABTOUCH7	7"-TFT colour monitor with touchscreen, resolution 800 x 600	
CP-MLABTOUCH10	10"-TFT colour monitor with touchscreen, resolution 800 x 600	
CP-MLABTOUCH12	12"-TFT colour monitor with touchscreen, resolution 1,024 x 768	

# Serial interfaces for OSs

The following serial interfaces are used both for the connection of several ASs to an OS and for the connection of devices.

The interfaces may be addressed via a HiText<sup>™</sup> program or using HiTec OS device drivers.

Product code	Description
CS-RS2322-PCI	PCI plug-in card, 2 x RS-232 interfaces, plug&play, only 1 IRQ per card
CS-RS2324-PCI	PCI plug-in card, 4 x RS-232 interfaces, plug&play, only 1 IRQ per card
CS-RS4852-PCI	PCI plug-in card, 2 x RS422/485 interfaces, plug&play, only 1 IRQ per card
CS-RS4854-PCI	PCI plug-in card, 4 x RS422/485 interfaces, plug&play, only 1 IRQ per card
CS-RS4852-PCI-O	PCI plug-in card, 2 x RS422/485 interfaces, opto-isolated plug&play
CS-RS4854-PCI-O	PCI plug-in card, 4 x RS422/485 interfaces, opto-isolated plug&play

## Network components

For the connection of devices with an Ethernet interface via the Ethernet interface on the LabManager® or an OS

Product code	Description	App sorie
CP-ETHERSWI8	Managed Ethernet switch, 8 port, including configuration	atory
CP-ETHERSWI24	Managed Ethernet switch, 24 port, including configuration	_abor
CP-ETHERSWI48	Managed Ethernet switch, 48 port, including configuration	_
CZ-ETHERCAB1	Ethernet cable, 1 m	10
CZ-ETHERCAB2	Ethernet cable, 2 m	alytics s
CZ-ETHERCAB3	Ethernet cable, 3 m	is Ana ensor
CZ-ETHERCAB5	Ethernet cable, 5 m	roces
CZ-ETHERCAB10	Ethernet cable, 10 m	<b>C</b>

Laboratory Reactor

Systems

### Interface converter

Interfaces which are essentially incompatible may be connected to each other with the aid of the interface converter.

A typical application is the connection of devices with a serial interface to a PC which only has USB interfaces.

Product code	Description
HA-COMSERV232	Com server RJ45 Ethernet 10/100 MBits on RS-232
HC-USB232	Converter for the connection of 1 device with an RS-232 interface to a USB interface on an OS
HC-USB232-2	Converter for the connection of 2 devices with an RS-232 interface to a USB interface on an OS
HC-USB232-4	Converter for the connection of 4 devices with an RS-232 interface to a USB interface on an OS
HC-USB232-8	Converter for the connection of 8 devices with an RS-232 interface to a USB interface on an OS
HC-MODTCPRTU232	Converter for the connection of devices with a Modbus AS RS-232 interface to a Modbus/TCP interface on an OS or AS
HC-MODTCPRTU485	Converter for the connection of devices with a Modbus AS RS-485 interface to a Modbus/TCP interface on an OS or AS
HC-RS232-TCPTUNNEL	RS232 TCP tunnel unit, enables the tunnelling of RS-232 signals via an Ethernet network
HC-USBETH	Ethernet USB converter for the connection of devices with an Ethernet interface to a USB interface on the CPU slide-in module

further peripherals and special solutions on request

Services Didactics

# LabVision<sup>®</sup> process visualisation

A maximum of automation with a minimum of engineering



LabVision<sup>®</sup> is the trend-setting, modular visualisation and automation software system for automation devices from HiTec Zang and other manufacturers. A process is monitored, controlled and regulated using LabVision<sup>®</sup> and all procedures are recorded and archived.

The processing system is shown on the display as a dynamic flow diagram for monitoring and operating. The online evaluation provides important information on your process at run time. The process data chain ranges from the definition of the experiment up to the laboratory information management system.

LabVision<sup>®</sup> is, in the opinion of many users, currently the most powerful and most prestigious research process control system (RPCS) software. It is particularly suited for the visualisation and automation of flow and batch processes in laboratory, pilot plant, mini-plant and production areas in the chemical, pharmaceutical, biotechnology and foodstuffs technology industries. Thanks to its flexibility, it is also used in other sectors, such as landfill, solar and environmental technology.

The particular strength of LabVision<sup>®</sup> is in its flexible use. The program meets the requirements of the NAMUR working party - AK 2.4 for research process control systems (RPCS) and is thus equipped for frequently changing or modified tasks.

LabVision<sup>®</sup> may be used at different levels of complexity. If you wish to benefit from LabVision<sup>®</sup> as a pure user, one day of instruction is usually sufficient in order to learn everything which is necessary.

But even if you wish to create automation projects for varying systems yourself, you can learn how to do this in one day with a suitably equipped workplace.

This is enabled through the project module library which contains predefined project modules for all important basic functions, such as temperature controlling, dosing, regulation of the pH value or vacuum, distillation etc.

A familiarisation period of only about one week is required for specialists who wish to learn about all of the possibilities of parameterisation and programming in place of the month-long training courses required for conventional distributed control systems.

#### The advantages

- » Complete documentation of the entire process
- » More efficient use of your resources
- » Consistent presentation of values, events and process phases
- » Release from routine activities
- » Savings during the instrumentation thanks to virtual devices
- » Realisation of a processing data chain without interruption from the job order to the laboratory information management system

#### Characteristics which you will appreciate

- > Easy to handle, a minimum amount of learning required
- > Able to be configured and paramterised online as an RPCS to the NAMUR standard
- > Project modules for very fast and simple creation of applications
- > Historical database for the consistent storage of values, text and results
- Support of the NAMUR NE 33 basic operation concept for batch processes
- Support of GLP and TQM through resource administration and automatic project documentation
- Can be scaled from a simple data logging system up to a networked process control system with a distributed online database
- > Multi-language version, able to be consistently switched between English and German
- > Customizable user interface

LabVision<sup>®</sup> increases the efficiency of the laboratory personnel by releasing them from routine work. Processes which have been run once can at any time, even after years, be repeated with best possible reproducibility, because all steps are carried out at the correct time, all materials given in the correct quantity and parameters automatically correctly set.

The ensuring of reproducibility and the optimal documentation of all parameters, values and events each make a proven contribution to an improvement in quality.

#### The user interface has the following properties

- > Consistently object-oriented and context-sensitive
- > Self-explanatory control icons with pop-up windows (tool-tips)
- > Customizable (storable and loadable desktop)
- > A high level of protection against unauthorised access (own user administration independent of the operating system)
- Can be remotely operated and maintained using WebVision<sup>™</sup>, the network and the internet

### Demands on the user

LabVision<sup>®</sup> can be used at different levels of complexity and detail and requires appropriate levels of knowledge from the user (See also training programme).

#### 1. Operation by shift personnel

Operating and monitoring the current system by changing shift personnel requires instruction lasting about half a day, depending on the complexity of the application.

#### 2. Operation by personnel with little training

With a training course of one to two days, the operating personnel is in a position to parameterise, start and operate prefabricated applications. With the help of the unit operation library for batch running, a user with little training is also capable of creating, parameterising and operating complex recipe operational sequences in a short amount of time.

- **3. Project engineering and operation by little-trained personnel** After a training course of about two to three days, even personnel inexperienced in automation techniques can create an application with typical ALR basic functions, such as temperature controlling, dosing, vacuum regulation, distillation etc. with the aid of pre-defined project modules.
- 4. Project engineering and operation by well-trained personnel Well trained users (approx. one week) have knowledge of the essential functions of the system and is capable of using them in accordance with their demands. They can independently create display and control screens, as well as control programs and online evaluations of any desired complexity.
- 5. Project engineering and operation by trained El&C personnel Well trained automation systems specialists (at least one week) can use the functions of this open system down to a detailed level. They can create display and control screens, as well as control programs and online evaluations of any desired complexity make use of the possibilities of an automation system (AS) for increased safety standards e. g. by use of the PLC functionality of the LabManager.

### Libraries

Prefabricataed libraries suited for the common use cases help the user to save time and costs when creating his projects (see "Unit operation library" on page 160 and "Laboratory component library" on page 147). The libraries can also expanded at any time by the user himself.

### Data objects

Data objects are referred to in LabVision® as data points.

LabVision® recognises the following types of data point

- > Input
- > Output
- > Variable
- > Field
- Text
- > Monitoring
- > Device component

Data points can be used for values and parameters. Thus, this enables in a simple way, for example, to dynamically change controller parameters by a program. Data points can be defined for the different automation units (e.g. LabManager<sup>®</sup> (AS) and a user interface (OS).

Referring numerical data points a choice of default values for the graphic scaling and the format of numeric displays can be made.

These defaults are accepted by the visualisation objects as a default.

Device components provide higher functions in an AS, such as

- > Application oriented controllers
- > Integrators
- Differentiators
- Programmers
- > Communication components etc.

All data points are administered in the online database.

#### Particular characteristics of the online database are

- » Fastest currently known access mechanism
- » High throughput

Values, events and text objects are stored in the historical database. For data reduction only values are stored which have significantly changed. The stored quantity of data is reduced to a minimum through this so-called delta-x, delta-t process.

### Safety

LabVision® places a special emphasis on safety. The Application Manager constantly checks all modules and generates an alarm in the case of a module failure while the remaining system generally remains stable.

Numeric and other non-critical errors only cause error messages which can be treated by programming, thus not hindering the further operational sequence. HiText<sup>™</sup> programs with formal errors cannot be started at all.

LabVision<sup>®</sup> protects, to a large extent, against errors during configuration and parametering and from faulty operation and incorrect input at run time. This is ensured, amongst other things, by a bottom-up technique during the creation of the application, an extensive use of prefabricated objects, as well as an examination of the input values.

User, Super	rvisor	
Password:		Change passwor

The access control with user administration prevents unintentional and unauthorised interventions. In the case of a power cut, the system is shut down in a defined state after expiry of an emergency operation phase. The resource administration ensures that, when defining new data points, only available, i.e. existing, not already allocated interfaces can be used. Deletion procedures are only effective at critical positions after confirmation of at least one security prompt.

AS control programs are stored against interference in the non-volatile flash memory. Even the historical values can be buffered in an AS in order to bridge temporary failures of an OS (e.g. during maintenance and care work) and to guarantee complete documentation of the test data. Once an OS is available once more, the data are automatically re-entered into the database.

### Particular properties

LabVision® varies from conventional process control system (PCS) software in essential points. Especially significant in this regard are the capacity of the system, simple handling and transparency.

### Online changeability

One important feature is the capability of LabVision<sup>®</sup> for online configuration and online parameterisation. It does not differentiate between the preparation phase and run time. This means for the user that, for example in case of an unplanned necessary intervention into the process or in the event of a malfunction, the plant does nor need to be shut down and re-started. This is the reason for its special suitability as an RPCS for R & D applications in laboratories and pilot plants. Conventional systems do not possess this capability, but it is indispensable for flexible and efficient working in laboratories and pilot plants.

### Visually configurable

The visual configuration of interfaces of a LabManager® AS is especially simple and comfortable. The interface type, e.g. Pt 100, can be selected in a combo box from a display of the available slide-in modules of the individually equipped LabManager®. The appropriately suited free plug connections are marked. The program gives a proposal for the first free plug connection via a flashing mark. You simply select this or another free connection by clicking onto it. The current and the historic values of the connected sensor are immediately available for visualisation and further processing.

Even the connection of any desired laboratory or analysis apparatus via serial interfaces can be simply achieved using the freely parameterisable NAMUR device component.

Only the interface parameters contained in the respective device manual are required to be entered into the input masks.

## System requirements

### LabVision® places the following requirements on an OS

- > Intel®/AMD® processor with 1 GHz (32 or 64 bit)
- > 2 GB RAM (32 bit)/4 GB RAM (64 bit)
- > At least 1 GB free hard disk space
- > Windows® 7/Windows® 8/Windows® 10 Professional
- > DirectX 9 graphics card (min. resolution 1,024 x 768)
- > Keyboard and mouse
- > 2 free USB 2.0 connections
- > CD-ROM drive

LabVision<sup>®</sup> is tested only on HiTec Zang OSs. Faultless functioning on other manufacturers' equipment cannot, therefore, be ensured. The essential requirement for a safe shut-down of the database in the case of a power cut can only be guaranteed for HiTec Zang OSs with UPSs (for HiTec Zang OSs see page 134).

Further interfaces (e.g. RS-232, RS-485, Ethernet and/or additional USB connections) may be required under certain circumstances for the operation of HiTec ASs or automation devices.

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# LabVision<sup>®</sup> modules

LabVision<sup>®</sup> constructed in a modular manner. The functions of the LabVision<sup>®</sup> basic module can be upgraded using the modules described below.

The number of data points can be appropriately adjusted to suit the size of the project. The graduation is 30, 100, 180, 300, 560, 1,000, 3,000 and 10,000 data points.

Modules and data points can be retrofitted at any time. This is done after approval via a download from our web server or by submitting a data medium.

# LabVision<sup>®</sup> basic module

The LabVision® basic module is the minimum software configuration of the LabVision® program system. It is sufficient for systems with a small quantity structure and a low level of automation. It can be upgraded to the full or light versions using the expansion modules. The number of data points can also be expanded.

A LabVision<sup>®</sup> license contains a free-of-charge update authorisation for three months. Small changes (bug-fixes) within a main version can also be downloaded from our web server after expiry of this time period.

Minimum or demonstration versions of some modules are contained in the basic module. The basic module contains 30 data points.



Pre-defined and discounted LabVision<sup>®</sup> standard packages may be found from page 185

A LabVision<sup>®</sup> license contains a free-of-charge update authorisation for three months after purchase. Current software versions which are adjusted to the respective client system can be requested via download from our web server. When you are entered in our e-mail list, you will automatically be informed of any new software updates and bug-fixes for your system as they become available.

An overview of all modules can be found from page 189

#### Functions

- > Configuring and parameterising
- > Monitoring and reporting of alarms, without any reactions and full text messages with three pre-defined message classes
- > Designer limited to one worksheet and 30 visualisation objects
- > RI-CAD<sup>™</sup> limited to 50 graphic objects
- > Online charts limited to 8 curves and one page
- > Analogue plotter limited to 8 curves and one page
- > Process report basic features
- > HiText<sup>™</sup> limited to one program and 30 lines
- > Device components for HiTec ASs
- > Demonstration project module templates
- > Data export into text or spreadsheet files, limited to a manual start
- > User interface in German and English

#### Product code SL-LABVIS

### Description

Description

LabVision<sup>®</sup> basic module with 30 data points

## LabVision<sup>®</sup> process report



In the progress report all events, values or parameters are recorded, the presentation of which as a curve would not be useful or not possible. These include comments from the operator, process and monitoring messages including their respective text information or pictures and LabCam<sup>™</sup> videos.

With the help of the many filter possibilities, the specifically most interesting information can be selected fast and safely even from many thousands of entries. When in batch running, the progress report also provides a batch report.

The report can be printed and exported to Microsoft® Excel® or to HTML.

Note: The basic program contains a process report which only has simple search, export and filter possibilities.

## Product code

SL-BERICHT

Process report with batch-oriented, extended search possibility

Laboratory Reactor

Fermentation Technique

**Automation Technigue** 

Liquid Handling Laboratory Robots

**Dosing Systems** 

Pumps

Systems

# LabVision<sup>®</sup> multi-plotter system

The multi-plotter is an innovative, holistic plotting system.. It displays to you the current and historical process conditions in the form of values (analogue plotters), events (event plotters) and process phases (phase plotters) clarity and consistency not seen until now

A diagram can be printed out directly, or can be inserted into documents using the clipboard.

The presented period can be changed manually, via a worksheet or a program.

The presented values can be directly exported to spreadsheet programs.



### Analogue plotter

The analogue plotter presents analogue values as curves. It can plot up to 40 pages, each with eight curves on up to eight axes. The display can be spread and zoomed as desired.

When reading off values, the read-off cursor provides support in the form of a vertical line.

The position to be read off can be set using a mouse-click. The values can be read directly from the cursor or in the allocated table column below the diagram window.

The trend display interval can be set using the trend cursor (Delta-t). The trend for each curve can then be read off either directly on the cursor or in the table column "Trend". The analysis cursor provides

supports during graphic evaluation with min, max, average and gradient etc.. Significant curve sections can be highlighted with a text comment after clicking onto them.

The plotter can be configured online, i.e. new curves can be created and all settings modified at any time. The curves can optionally also be displayed either linearly or logarithmically, un-smoothed or smoothed.

Time domains which are of interest can be retrieved in many ways. In conjunction with the export module, the displayed plotter page can be passed via a mouse click.for numeric value export to the export module (e.g. for Microsoft® Excel®)

oparatus ies
 Laboratory Ap Accessor

SL-SCHANAL	Analogue plotter, single window, limited to 2 recorder pages, each with 8 graphs

Description

### Phase plotter

**Product code** 

**SL-SCHANA** 

The phase plotter provides a visualisation of temporal operational sequences, e.g. the process phases or the sequence of recipe steps.

It enables the direct allocation of the value curves and events to the phases which are defined in clear text.

If the mouse cursor is directed at a phase bar, a pop-up window will appear with information on the event. Through a mouse-click onto a phase bar, the appropriate period in the process record will be opened.

		VAKUDEST (LD5/A24-8855-AZO)	
FILLING	TEMPERING	AMOUNT_DOSER1 TICH	GAS_FEEDING
	INERTING	AMOUNT_DOSER2 AIR3	

Analogue plotter, capable of several MDI child windows, 40 pages, each with 8 graphs

Product code	Description
SL-SCHPHA	Phase plotter
SL-SCHPHAL	Phase plotter, light version, limits the display to 3 phases

### **Event plotter**

The event plotter provides a symbolic explanation of monitored events, operational messages, comments etc. Each event which occurs is displayed with its own symbol. The event plotter is displayed above the analogue plotter.



If the mouse cursor is moved over an event symbol, a pop-up window will appear with all information relating to the event.

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The process report is opened by clicking on an event symbol and the relevant clear text message is displayed with a note on its source.

Product code	Description
SL-SCHERE	Event plotter with clear text pop-up window and additional function.
SL-SCHEREL	Event plotter, light version, without clear text pop-up window and additional function.

## LabVision<sup>®</sup> online chart



The Online chart displays diagrams of values against time. The time axis can be optionally labelled with absolute time or time relative to the time of commencement, i.e. starting with zero.

A displayable read-off cursor simplifies the reading of the values on the cursor or in the stored value table.

In contrast to the analogue plotter, online and offline curves can be compared with each other.

For online or offline comparisons, historical values or calculated set points can be displayed as curves. These reference curves can be preset from recorded LabVision<sup>®</sup> data values or from Microsoft<sup>®</sup> Excel<sup>®</sup> files.

A diagram can be printed out directly, or can be inserted into documents using the clipboard. Additionally, the event and phase plotters can be displayed. The diagram can be marked with a title. A memo field can also be displayed for additional information. The starting time, period displayed, heading and additional text as well as phase texts can be set manually or by a HiText<sup>™</sup> program.

The online charts module offers 40 pages, each with up to eight curves.

One axis can be placed to each of the right or left side of the diagram.

Product code	Description
SL-ONLGRA	Full version of online chart with reference curve display, capable of several MDI child windows
SL-ONLGRAL	Online chart, light version, limited to 2 diagrams, each with 8 curves, no reference curves

## LabVision<sup>®</sup> designer

Dynamic display and control graphics!



#### **Display and control graphics**

The system may be driven completely using display and control graphics in manual operation. Therefore, external display and control units are unnecessary.

Even operators who are not trained in detail on the system are immediately able to find the essential and can intuitively arrange the displayed values.

Operation is to a large extent self-explanatory thanks to the clear presentation. The operating possibilities can be limited for specific users. Therefore, even less qualified shift personnel can be familiarised with the operation in a short period of time.

The scope for design is virtually limitless. Its functions are extraordinarily versatile. For example, each of the display and control objects is explained through a freely produced text message if the mouse cursor is moved over the object.

Even the operating philosophy can be set. The choice is available between control objects which can be operated directly, for instance by clicking onto them with the mouse, or control objects which must first be opened by clicking on a (hand) symbol, to exclude accidental operation.

Critical operating processes can be additionally provided with confirmation dialogues. By storing user-defined RTF-formatted text and images, complex operating instructions or maintenance instructions can be displayed as an additional help for operating and display elements.

#### The Designer

The designer is a tool for creating display and control graphics (pro-

cess images), report forms, operating panels for devices etc..

No special knowledge or programming skills are needed for this. Larger system images can be distributed across several pages which can be called up using a linking switch from the currently displayed image.

In order to make your system flow chart "dynamic" it is only necessary to drag the desired display and control objects onto the worksheet and link them with the appropriate data points. In the library which is provided everything can be found, from an actuation switch to a pointer instrument. The visualisation objects indicate not only the value of the connected data point, but also visualise any violation of threshold and warning values by flashing symbols.



**Dosing Systems** 

Pumps

Data point names and physical units are automatically displayed and the settings of the display range etc. are automatically transferred from the associated data points.

Even complex dialogue elements like e.g. forms for the input of experimental parameters with save and load functions or control panels which can be minimised to a symbol can be simply created without any programming. Freely expandable libraries of prefabricated display and control panels are optionally included in the scope of delivery.



In conjunction with prefabricated project modules (see project modules), you receive ready-to-use operating and visualisation objects which are already linked to the appropriate inputs/outputs and device components. Complete sub-projects and system basis functions can be thus set up and visualised with one mouse-click.

The used basic operating and display elements are constantly being expanded and adjusted to the most current Windows<sup>®</sup> operating system technology.

In addition to the standard display and control objects, the Designer offers complex elements, such as

- > Registers for organising and grouping of extensive visualisations
- > Panels for saving and loading of all values in a group of elements
- > Dynamic assignment of the screen position
- > Dynamic displaying and hiding, flashing or operation lock for objects

You can create your own reusable combined display and visualisation objects and collect them to own libraries.

The Designer contains a library for the visualisation of application oriented device components such as

- > Dosing
- Vacuum regulation
- > Control of the reactor interior temperature

Thus, such as a dosing unit can be achieved using a dosing device component, a balance and a pump, all connected to a LabManager<sup>®</sup>. A GraviDos<sup>®</sup> weighing cell can be used in place of the balance and a valve in place of the pump.

Up to now this functionality could only be achieved using PID controllers in conjunction with a program or a ramping device component. However, this demanded more technical knowledge of measurement and control equipment for the realisation and parameterisation of the controller.

The application oriented dosing device components, on the other hand, contain the complete control function including the possibility of refilling the receiver tank without interrupting the dosing. Parameterising of controllers is also no longer necessary and thus, one of the greatest and most time-consuming problems in practice is eliminated. The project modules are based on these application oriented device components.

Product code	Description
SL-DESIGN	Designer
SL-DESIGNL	Designer, light version, limited to 1 worksheet and 400 visualisation objects

### RI-CAD<sup>™</sup> for process flow charts

The RI-CAD<sup>™</sup> software module for LabVision<sup>®</sup> is to a great extent identically with the stand-alone version, RI-CAD<sup>™</sup> (see page 194).

The RI-CAD<sup>™</sup> software module which is linked with the Designer was especially developed for the drawing of RI flow charts and contains a library in accordance with EN ISO 10628. It is used for the drawing of static background images of display and control graphics. In addition, dynamic image elements (changing images) can be created for the Designer.

However, it can also be reasonably used at the planning stage for a standardised drawing of the system.

Attached to the library elements is additional information which can be extended as desired to include such as supplier or maintenance information.

### Laboratory component library

The SL-BIBRILK library for RI-CAD<sup>m</sup> contains displays of the components of a laboratory process plant which are more detailed and more realistic than in the EN ISO 10628 library.

Here you will find glass reactors of various designs and sizes and glass appliances, such as reflux separators, coolers, vessels etc. as well as clear representations of other laboratory apparatus.

Fermentation Technique

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Dosing Systems Pumps

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Laboratory Apparatus Accessories

Process Analytics Sensors

Services Didactics

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Product code	Description
SL-RIEDIT	RI-CAD™ for LabVision®
SL-RIEDITL	RI-CAD™, light version, for LabVision®, limited to a worksheet with 120 graphic objects
SL-BIBRILK	Glass and laboratory device library for RI-CAD™

0

# LabVision<sup>®</sup> project modules

### Create automation projects in record time!

The technology of the LabVision® project modules marks a new generation of automation software with a user-friendliness and functionality not seen until now.

Instantiated project modules enable the visual creation of projects using prefabricated, ready-to-use modules using a drag and drop technology, i.e. a project is established by moving the required project module elements necessary for the demanded functions from a Designer library onto the worksheet.

Project modules are combined using different LabVision® objects, including

- > Data points
- > Device components
- > Operating objects
- Visualisation objects
- Monitoring objects
- > HiText<sup>™</sup> programs
- > Plotters, export configurations etc.

Completed project modules with the most common configurations are available as a library. These only require to be adjusted to the hardware equipment in the course of importing. This significantly shortens the development period for projects.

Thanks to a library administration of the generated project modules, it is possible to simply secure and easily transfer various work statuses of personally created modules to other systems in a similar way to the LabVision<sup>®</sup> project administration.

A gravimetric dosing module consists, for example, of a dosing regulator, the data points for the balance, pump and cut-off valve, the relevant monitoring elements and the graphic display and operating objects. Thanks to the new technology, the project establishment



### **Automation Software**

time has shrunk in comparison to conventional work procedures from a few days to a few minutes, which especially reduces the time required for frequently changing laboratory equipment to a negligible level. Even users with limited experience of automation equipment can securely create a demanding automation project.

The project modules contain the required process measurement and control functions and visualisation elements. This means that the data points for the inputs and outputs, the control components and the user interface are automatically set up and can be immediately used.

#### Example of use

A 1 litre plant with a stirred reactor, gravimetric dosing, vacuum control, rectification and distillate weighing is intended to be automated.

In the Designer the required modules are merely dragged onto the previously empty work sheet.

A display for operating and monitoring, combined from a small number of individual project modules, then looks as follows:



After the parameters on the regulating modules for temperature, dosing and vacuum have been set with the aid of the auto-parameterisation function, the system can be run via the control screen as a flow diagram.

The performance of the project modules is clarified by the following example. The project shown was able to be created and ready to run in less than 30 minutes.



The ALR (automatic laboratory reactor) project module library contains the modules required for the creation of an automation project for a flexible laboratory reactor system:

- > Temperature regulation cascade with thermostat
- > Gravimetric or volumetric dosing
- > Solid matter dosing
- > Vacuum regulation
- > pH control
- > Distillation
- > Rectification
- > Temperature control
- Phase separation
- > Sample collector
- > Stirring etc.

A project established on the basis of the project module library is EasyBatch<sup>™</sup> and HiBatch<sup>™</sup> compatible. This means that it can be used as a basis for the recipe control system and the unit operation library. Modules which have been previously used are marked in colour in the Designer library.

The modules can be re-used so that, for example, expansion with further dosing circuits can be easily achieved.

The data points for the connection of the required balances, pumps, and valves are set up automatically.

The technical documentation can be created automatically at the push of a button.

Access is achieved, via the context menus of the individual modules, which can be reached by a right-hand click on the mouse, to a graphic display of the LabManager® slide-in modules which then displays to which slots the required instrumenting components, such as balances, stirrer drive, thermostat, valves etc. need to be connected. The module library is designed for HiTec Zang instruments and laboratory apparatus, but it can be easily adapted to other components.

The user interface is extraordinarily versatile. The parameterising dialogues are opened by clicking onto the symbols of the operating objects . This prevents unintended operation actions being triggered by accidental mouse clicks.

As the objects used in personally developed project modules are based on the standard design objects, they can be changed or extended/ by the user as desired.



Project work was never more simple!

Laboratory Reactor Systems

Fermentation Technique

**Automation Technique** 

Liquid Handling Laboratory Robots

Pumps

Project module libraries	
Product code	Description
SL-MODBIBALRL	<ul> <li>ALR project module library, light version for Designer</li> <li>Pumps with LabDos<sup>™</sup> and SyrDos<sup>™</sup></li> <li>pH control (for alkaline and/or acid dosing)</li> <li>Inerting (generation of an inert atmosphere through repeated drawing/inerting of a vacuum)</li> <li>Volumetric dosing with LabDos<sup>™</sup> and SyrDos<sup>™</sup></li> <li>Gravimetric surge dosing with GraviDos<sup>®</sup> (demand: amount)</li> <li>Gravimetric rolume dosing with GraviDos<sup>®</sup> (demand: amount and time)</li> <li>Gravimetric flow rate dosing with GraviDos<sup>®</sup> (demand: dosing rate and time)</li> <li>Gravimetric conti dosing with GraviDos<sup>®</sup> (demand: dosing rate)</li> <li>Temperature regulation with thermostat and temperature cascade regulation</li> <li>SoliDos<sup>™</sup> (solid matter dosing with SoliDos<sup>™</sup>)</li> <li>Stirring with ViscoPakt<sup>®</sup> (output of a set point speed to the stirrer and torque indication)</li> <li>Inerting (introduction of inert gas)</li> <li>Vacuum regulation</li> <li>Reflux distillation</li> <li>Automatic phase separation with PhaSep<sup>™</sup> and LabDos<sup>™</sup> or SyrDos<sup>™</sup></li> </ul>
SL-MODBIBALR	ALR project module library, full version for Designer Contains additional Designer objects for touch panels with a low resolution (640x480) All project modules additional to the light library - Stirring using various stirrer drives (output of a set point speed to the stirrer and torque display) - Volumetric dosing with an analogue controlled pump - Gravimetric surge dosing with a pump and balance (demand: amount) - Gravimetric volume dosing with a pump and balance (demand: amount and time) - Gravimetric flow rate dosing with a pump and balance (demand: dosing rate and time) - Gravimetric conti dosing with a pump and balance (demand: dosing rate and time) - Gravimetric conti dosing with a pump and balance (demand: dosing rate) - Distillation with sheath temperature control - Rectification (multi-level separation by distillation) - Crystallising - Gassing with MFC - Flow meter/integrator for gas meter and flow meter - Titration

- Re-filling

Description	
Project module generator (creation of new project modules)	
ALR project module library, full version for Designer	
ALR project module library, light version for Designer	
	Description         Project module generator (creation of new project modules)         ALR project module library, full version for Designer         ALR project module library, light version for Designer

# Multiple projects

Any desired number of projects on any desired number of ASs can be driven with an OS.

independent user interface.

The option "multiple projects" enables a single LabVision<sup>®</sup> unit to be started on an OS for several projects. Each project then has its own

For licensing the data points of all simultaneously active applications are added together.

Product code

SL-MULTIPROJ

Multiple projects with LabVision®

Description

# MicroLab<sup>™</sup> designer library

The MicroLab  $^{\rm M}$  designer library is used for the creation of projects for micro-reaction systems in LabVision  $^{\rm O}.$ 

It contains prefabricated elements for micro-reactions devices from Ehrfeld Mikrotechnik BTS GmbH.

The parameterisation of LabVision® is thus greatly simplified.

Description MicroLab™ designer library for LabVision®

### Data export

The data export server supports the manual and automatic exporting of value and report files in the file formats

- > Microsoft® SYLK (.slk)
- > Text format (.csv)
- > Microsoft® Excel® direct export (.xls)
- > HTML format (.htm)

Several export jobs can be defined and manually or automatically executed at given times.



In addition, the possibility exists to manage the export using a HiText<sup>™</sup> program in order, for instance, to export the data automatically at the end of a test.

A data export can also be started directly from the analogue plotter. The data to be exported may be individually selected. The number of digits before and after the decimal point can be set in advance.

Numeric data exported are subject to a data reduction on export. The reduction is optionally conducted by forming the

- > Average value
- Maximum value
- Minimum value
- > Without an average value

The reduction interval may be freely defined. One data point can be entered several times in order, for instance, to export average, minimum and maximum values at the same time.

The time can be issued optionally either absolutely or relative to a freely selectable start time. An export which can be started manually is already contained in the basic version.

The process report may also be exported at the same time for some file formats.

### Product code

SL-EXPORT

Description

LabVision® export module, option for automatic or HiText<sup>™</sup>-controlled exports

## Selectors and display filters

The display filters help to handle large amounts of data which occur in some systems by, for instance, limiting the time domain.

Selectors act as user-specific classification criteria, for instance when searching or sorting data points and in the reports. Selectors can be freely defined by the user in a separate form.

Examples: System1, system2, waiting, to be calibrated, no operation

The selectors offer the possibility to choose a group of data points during selection, in reports etc. The selectors can be linked by the



operators

- > Plus
- > Without
- > )With(

Example: (Reactor1 plus cooling unit) with (All without set points)

Through this selection all data points except the set points of Reactor1 and the cooling unit will be selected.

This option also extends the filter possibilities in

- Process reports
- > Project modules
- > Monitoring reports
- > Data point selection
- > Data point tables

Product code	Description
SL-SELFIL	Selectors and filters for LabVision®
Laboratory Reactor

Systems

Technique

**Automation Technigue** 

Liquid Handling Laboratory Robots

Dosing Systems Pumps

Depending on requirements, the user administration may be set by the administrator to the strict FDA regulations (GLP, GMP and FDA 21 CFR Part 11), or to quick ability to react to faults and to restrictions against operating errors.

All log-in procedures and changes to user accounts are recorded in extensive reports. This is carried out both in the log file of the application manager and in the historical database of an active project.

Rights can be individually allocated to each user. At first a user has to log in using his name and password before he can work with the system. The access control is active in:

- > Modules, for example, project administration, control program editor etc.
- > Windows with possibilities for critical data point parameterisation
- Objects created by a user, such as programs, flow diagrams and recipes and individual control objects

The user administration can, after an adjustable period of inactivity, automatically lock the system.

The access control is a sensible addition for WebVision™ connections of other computers.



**Product code** 

Description

**SL-BENRECH** 

Access and user administration for LabVision®

## WebVision™



WebVision<sup>™</sup> enables LabVision<sup>®</sup> to be operated and monitored from an external computer (client) via a network connection (TCP/IP). Access can be achieved to the current LabVision® projects from one or several computers connected via a network without the necessity of having to install a LabVision® system at these locations.

The WebVision<sup>™</sup> user interface is generally identical with that of LabVision®. WebVision™ supports the same modules (worksheets, multi-chart and online plotters, process report, monitoring report, data point tables and LabCam™) in line with the optional equipment of the currently connected LabVision®-System.

The LabVision<sup>®</sup> user administration is supported. Work sheet control operations can be permitted or prohibited by the LabVision® computer, depending on the custom setting. WebVision<sup>™</sup> control actions are recorded in the process report.

Several WebVision<sup>™</sup> installations can each (simultaneously) access one or more LabVision® systems in the network. The LabVision® or HiText™ user interface does not have to be active for this purpose. Worksheets can both be displayed and operated in WebVision™.

A "chat function" enables the communication between a user of the LabVision<sup>®</sup> system and WebVision<sup>™</sup> users.

Die WebVision™ light version is limited to the display of the multi-plotter.

WebVision<sup>™</sup> Plus contains the complete functionality of WebVision<sup>™</sup>. In addition, it offers the possibility of starting as many units of the WebVision<sup>™</sup> client as are desired on one PC and of connecting them in parallel with various projects on one or various servers. Thus, for example, several systems can be clearly and simultaneously monitored from one multi-monitor system.

Product code	Description
SI -WEBVIS	WebVision™ full version, access to active LabVision® projects via a TCP/IP connection
SL-WEBVISL	WebVision'''' light version, LabVision'' multi-plotter visualisation via a TCP/IP connection
SL-WEBVISPLUS	WebVision™ Plus, WebVision™ with multiple start possibility, simultaneous access to several projects via a TCP/IP connection

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When an existing WebVision™ module is upgraded, the cost of the previously purchased module is included in the calculation so that only a small additional price has to be paid

Services Didactics

Laboratory Apparatus

Accessories

## Monitoring and reporting

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	Class	Monitoring data point	Sp	Ac	Condition	Time	Message		
	🛕 Alert message	T_RM_X:MAX	×	18	T_RM_X>=88	05.04.2013 08:17	[Quilt>] Maximale reactor jacket tempera	ature is exceeded!	
	△ Warning mes	VP_RFC_XOA	1	1	VP_RFC_X<-25	05.04.2013 08:08	Warning Coolant flow was acknowledge	dl	
D	🛕 Alert message	VP_RFC_XUA	1	1	VP_RFC_X<=5	05.04.2013 08:08:	ALERT: Coolant flow was acknowledged	1	
÷.	Alert message	T_RI_X.UA	1	1	T_RI_X <t_ri_ua< td=""><td>05.04.2013 08:08:</td><td>Alert message : Reactor inside temperatur</td><td>re acknowledgedl</td><td></td></t_ri_ua<>	05.04.2013 08:08:	Alert message : Reactor inside temperatur	re acknowledgedl	
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	Alert message     Warning mes     Alert message     Alert message     Alert message	T_RM_XMAX VP_RFC_X0A VP_RFC_X0A T_RL_X0A	× !!	* * < &	T_RM_X0=88 VP_RFC_X<=25 VP_RFC_X<=5 T_RL_X <t_rl_ua< td=""><td>05 04 2013 08:17: 05 04 2013 08:08: 05 04 2013 08:08: 05 04 2013 08:08:</td><td>[Quilt -&gt;] Maximale reactor jacket tempera Warning Coolant: Bow was acknowledge ALERT: Coolant Bow was acknowledged Alert message : Reactor inside temperatu</td><td>sture is exceeded d 1 re acknowledged</td><td></td></t_rl_ua<>	05 04 2013 08:17: 05 04 2013 08:08: 05 04 2013 08:08: 05 04 2013 08:08:	[Quilt ->] Maximale reactor jacket tempera Warning Coolant: Bow was acknowledge ALERT: Coolant Bow was acknowledged Alert message : Reactor inside temperatu	sture is exceeded d 1 re acknowledged	
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Monitoring conditions and various message options may be defined in the register "Monitoring/reporting" of the data point definition.

ame: T_RI_	x		Label: R	loactor inside	lomporal	ture		
Identification, Av	eas PNK settin	gs Nontoing	Relevence list	Values				
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Identification	-				-			New
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Where one of the specified monitoring conditions is met, it is recorded in the monitoring report (extended alarm journal) and in the process report, as is the finishing and acknowledgement of the monitoring event.

## Extended monitoring and reporting module

Complex systems require sophisticated, flexible alarm strategies. The extended alarm module was developed for this reason. In this way, various reactions to threshold and warning value violations can be set up by the user.

Dynamic comparisons between data points or fault conditions, such as a conductor breakage, can be set as monitoring conditions, over and above the usual static comparisons of threshold and warning values. Both the message and the confirmation are recorded. In the case of important alarms a horn, for example, can be switched on or a control program can be started for the selective processing of the incident. Certain alarm messages can alternatively be shown with a delay. The current messages are always shown in the lower table window. The upper table is used for acknowledgement. It can be filtered and scrolled according to requirements in order to gain access to historic messages outside the area shown.

Class properties Class	Symbol	Must be acknowl.	Process	Mon Printer	Signal	Visual- objects	Display blinking	Voice
Alert message		100	12	(R)	10	1	X	
Warning message	-		1	13		13		
Work message				10				
User class-3						0		
User class-4								
User class-5			10	13	•			10
User class-6				13				
User class-7		•		13		13		10
User class 8			12	•	10			13
Signal data points				-	Printer	options	Symbo	i defaul
Signal Signal acknowledge					1	ок	×	Cancel

Projectable monitoring classes enable the monitoring procedure for the classes, danger warning, warning message, operating report and optionally user-defined monitoring classes to be centrally determined. The standard configuration is included in the LabVision<sup>®</sup> basic module.

A differentiation is made between alarms and operating reports, as well as messages which do and do not require acknowledgement.

#### Characteristics

- > User-defined monitoring classes
- > Full text reports
- > Complex alarm handling by a control program

Alerting by telephone, text messaging and e-mail will be provided as an extension to this module.

### Product code SL-UEBMEL

Description

Extended monitoring and reporting module

## Voice output LabVoice™

The LabVoice<sup>™</sup> option enables synthesised voice output in German and English (several speakers may be selected) and may be used with the following LabVision® modules

- > In HiText<sup>™</sup> via the command "Alarm text", e.g. Alarm text "The reactor interior temperature is too high! Please activate cooling"
- > In the monitoring and messaging system (SL-UEBMELD): Message classes can be parameterised in such a way that the message text can be read out via the audio system of the computer
- > In conjunction with the alarm call module (SL-ALRRUF): Alarm call messages are read out in a synthesised manner on the telephone where a LabVoice option is present. Without LabVoice<sup>™</sup> only pre-configured voice files are played or the alarm call text is read out letter for letter.

#### Description

**Product code SL-LABVOICE** 

LabVoice™, Synthesised voice output for message, HiText™ and alarm call modules for LabVision®

## Multi-LabCam system

Certain process conditions and events can be best documented photographically. Examples are the recording of turbidity, colour change, precipitation, etc. Modern server system architecture permits the integration of several different image sources, such as LabCams, video streams etc.

The Multi-LabCam system offers the possibility to document visual procedures automatically, either event-controlled or at programmed intervals and by manual triggering as a digital picture or a video. The digital pictures are inserted, reduced in size, into the process report. A photo may be displayed in full size or a recorded video played in the integrated media player by clicking with the mouse.

The current live pictures may be integrated into worksheets.

The Multi-LabCam system supports the use of the full resolution of HD cameras

Individual cameras purely with a photo function and without a video recording function, as well as without programmable image trigger and without the possibility for the selection of higher resolutions such as 640 x 480 pixels can also be connected directly to the LabVision® computer without an auxiliary module.

### The advantages

- » Documentation of visual conditions and events
- » Monitoring of the system from the office workplace
- » Visual remote monitoring



From version 2.12 onwards the Multi-LabCam system also supports the use of IP cameras with an integrated webstream capability (MJpeg streams). Alternatively, simple USB cameras can also provide live pictures from any desired computer in the network with the aid of additionally supplied software. These pictures are then available for both LabVision<sup>®</sup> and all connected WebVision<sup>™</sup> clients in the same quality.

Product code	Description
SL-LABCAM	Multi-LabCam system for LabVision®, event-controlled photo and video documentation
CP-DIGICAMUSB	Digital camera, Still image resolution: 1,920 x 1,080, Video resolution: 1,280 x 720, USB connection
CP-DIGICAMIP	Digital IP-camera, RJ45 Ethernet connection

We recommend the use of driverless USB webcams (with UVC - Universal Video Class) for the Multi-LabCam system.

E-mail alarm call module for LabVision®

## E-mail alarm call

**Product code** 

SL-EMLRUF

E-mail messages with prepared event-related text may be sent to various e-mail addresses by a control program as a reaction to certain events.

Description



Laboratory Reactor

Fermentation Technique

**Automation Technique** 

-aboratory Robots Liquid Handling

**Dosing Systems** 

Laboratory Apparatus Accessories

Pumps

Systems

## Telephone alarm call

Telephone calls can be automatically triggered for defined events with the aid of the telephone alarm call module. Depending on the event, one or more text messages can be read out. In addition, the announcement of current measured values is possible.

A library of letters, numbers and standard words is included in the scope of delivery. Optionally, further words and complete sentences can be recorded for specific customers.

In a control program one or more telephone numbers can be called, for instance of staff on call during a system malfunction or operating personnel after completion of a batch, as a reaction to a certain event and the appropriate message announced in clear text.

In addition, it is possible, depending on date and time, to activate dif-

ferent telephone numbers so that an on-call service can be arranged in advance, even over several days. If unexpected deviations arise, such as a result of illness, the settings can also be changed by remote maintenance.

The confirmation of the received call by a key code is entered into the process report.



Product code	Description
SL-ALRRUF	Telephone alarm call module for LabVision®, telephone alarm call with voice output

## SMS message alarm call

SMS messages with prepared event-related text may be sent to various mobile telephone numbers as a SMS message by a control program as a reaction to certain events.

In a control program one or more mobile telephone numbers can be called, for instance of staff on call during a system malfunction or operating personnel after completion of a batch, as a reaction to a certain event and informed. In addition, it is possible, depending on date and time, to activate different telephone numbers so that an on-call service can be arranged in advance, even over several days. If unexpected deviations arise, such as a result of illness, the settings can also be changed by remote maintenance.



Condition: SL-HITEXT(L) and CP-MODEM-GSM

Product code	Description
SL-SMSRUF	Text message alarm call module for LabVision®, alarm call by text message
CP-MODEM-GSM	HiTec GSM modem without SIM card

# Control and online evaluation

LabVision® is in a class of its own in the area of control and online evaluation. The graphical recipe procedure control system HiBatch™, the clear text language HiText™, instruction List according to EN 61131, and AWLplus™ with structured text in HiText™-oriented syntax (see AS firmware modules) as well as the device components (see LabManager® system, system construction) are available. Depending on the problem definition, the relevant type of program must be selected which is especially suited for the problem in question.

### Programming of algorithms

Algorithms are best programmed in HiText<sup>™</sup> with English key words such as: calculations, programmed relationships (If..., then...).

In the German version, German language elements are used (the German syntax can be used even in an English language environment).

### Programming of processes/recipes

Processes/recipes can be programmed, in text form in HiText<sup>™</sup>, in table form in EasyBatch<sup>™</sup>, or graphically as HiBatch<sup>™</sup> sequences in accordance with NAMUR and IEC/EN.

# HiText<sup>™</sup> control, monitoring and evaluation in clear text

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HiText<sup>™</sup> is a clear text language for control, online evaluation and communication. HiText<sup>™</sup> was developed in cooperation with users from the chemical industry with the aim of achieving a self-explanatory and self-documenting language which can be used by everyone. As HiText<sup>™</sup> can be learned even by users with no programming experience in the shortest time, the language enjoys high acceptance, in particular with R&D users in laboratories and pilot plants.

The module contains a comfortable editor with many help functions, a multitasking-capable interpreter and a visualisation of the sequence of operation with a debugging assistant.

The syntax check takes place directly during the input. Errors are underlined and are clearly marked. Only formal, error-free programs can be started.

All important mathematical functions are available for the calculation of mathematical expressions apart from the basic arithmetic operations. Set point defaults for controllers can be created with any desired progression (profile).

The common control types

- > Logic control
- > Sequence control
- > Time scheduled control

can be implemented, even in a combined form.

HiText<sup>™</sup> is multitasking-capable, i. e. several programs can run simultaneously. Thus, you can clearly separate different tasks such as sequence control, monitoring, the execution of required reactions, on-line evaluation etc. and retain an overview, even of complex projects.

For example, specifications of temperature ramps do not have to be laboriously interwoven into a single sequential program while simultaneously monitoring a pH and a temperature window. Rather, each individual task is formulated as its own program, thus, in particular, ensuring the re-usability of modules and their long-term maintainability.

A HiText<sup>™</sup> program is self-explanatory and self-documenting so that it can be directly attached as documentation of the process sequence to GMP or GLP documents. The program can be progressed, interrupted, continued at any desired point and ended online in the editor window. Values can even be changed at runtime. In addition, the option is available to use variables instead of numbers, the values of which are allocated using dialogue forms or files.

A HiText<sup>™</sup> program may, according to requirements, work together with a stored PLC, an IL-AS control program or device components and assume within this the function of a higher-level group control level. Common data points (variables) enable an uncomplicated data exchange with an AS.

In addition, the modules of the HiBatch<sup>™</sup> unit operation library are written in HiText<sup>™</sup>. The users can thus program new unit operations themselves and extend the library.

### HiText<sup>™</sup> language elements

The tab card language elements contains the available commands.

A HiText<sup>™</sup> program can be created by simply dragging the language elements or instructions with the mouse into the word processor window or by entering them directly using the keyboard.

In the Functions tab card you will find functions of the areas of: arithmetic, trigonometry, text and time/date.

	Exertise	Description						
	* Arithmetic	Arithmetric functions						
-	Trigonometry	Triponometric functions						
	konstante Pt = 3.14159265	Relation of perimeter to diameter.						
	funktion Sin(X: Gletkomma): Gletkomma	Returns the sine value of argument X (radian measure).						
	funktion Cos(X: Gletkomma): Gletkomma	Return the cosine value of argument X (radian measure).						
	funktion Tan(X: Gletkomma): Gletkomma	Returns the tangent of argument X (radian measure).						
	funktion Cot(X: Gletkomna): Gletkomna	Returns the cotangent of argument X (radian measure).						
	funktion ArtSin(X: Gletkomma): Gletkomma	Returns the arcus sine of argument X (radian measure).						
	funktion ArcCos(X: Gletkomma): Gletkomma	Returns the arcus cosine of argument X (radian measure).						
	Buckling AurTan/V (Saltanna) (Saltanna	Returns the action tennest of any most V (redisc discussion)						

These functions support the realisation of online evaluation programs and time scheduled control.

The sample program in the following screen shots shows how simply HiText<sup>™</sup> can be understood and applied.

C Programm	a Masken
+n. 01 ·	Pipe.Name = RezepturName + ".LaborJournal"
+CI 02 *	Abtastintervall_Laborjournal(SchrittPhase.Zeile) = ATI_Laborjournal
03	
01	sausgabe "\\\ InstansName @ 2005 Hiles Lang GmbH ///" an Bericht, Pipe
\$ 05	
06 Anfang	(Initialisierungsdaten in Ablaufbericht schreiben)
- 07 •	Adsgabe SDE("Ablasselt ") +
2 08	<pre>\$EN("Drain time ") +Ablasszeit An Bericht, Pipe</pre>
<u> </u>	
10 •	Starten Zeiten
11 •	Starten Dyn_Ausgabe
C 12 •	Warte Bis Dyn_Ausgabe.Durchlaufl = Ja
13 .	Warte 1 Sec
14	
15	(Warten Bis Zeit abelaufen ist)
16 .	Warte Bis Restzeit <= 00:00:00
17	
	Beandan Jaitan
Hauptprogra	mm (Dyn_Ausgabe (Anhaten / Fortsetzen / init / Online) (Zeiten /
Cibersetzun	g/Laufzet/Meldungen/Hatepunkte/Suchergebnisse/Referenzen/Programme=2/Überwachungen/Lesezeichen/
1.1	

The command lines "OUTPUT"...."TO REPORT" store the following entries in the process report which are automatically given a time stamp.

CABOEMO (User wanager i	DEE - Process report)			CO D MAR
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<ul> <li>3 第331 ····</li> <li>9 股段段 ···</li> </ul>	kt ▲ k≥ %	۱۸۵۰۷	/ision®	LebVision® 2.11 -Vesor 211 18 Hite: Zeg Geer 200 Hite: Zang
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05.04.2013/03/01/16	Hoove schore	PEACTORUPLAN		Walatest stated
05.04.2013/08/58/19	Mobile actions	PROJHOD_READY		Wolksheet Invinced
05.04.2012/08/56/51	Module actions	PROMOD_READY		Workshoot starked
05.04.2013/08/55:47	Module actions	CEND		Workshoot torminated
05.04.2012085421	Module actions	CEND		Workshadt started
05.04.2013 08:54:30	Huble active	CEND		Worksheet territinated
05.04.2013 08:54:30	Defenitions	DEMO		Watchest changed

This brief example is only able to give an initial first impression of the user-friendliness and to show a small extract of the power of HiText<sup>™</sup> and LabVision<sup>®</sup>.

Product code	Description
SL-HITEXT	HiText <sup>™</sup> full version
SL-HITEXTL	HiText™ light version, a maximum of 4 programs each of 100 lines
SL-HITXTDLL	DLL interface for HiText™
SL-HITXTCOM	COM interface driver for HiText™

## Dialogue and report forms

Dialogue and report forms with display and input objects, diagrams, graphics, switches etc. can be created using the graphical editor, without even having to program a single line. These forms can not only be used for an online-presentation of the data, but also for the generation of printed documents.

In conjunction with HiText<sup>™</sup> experiments can be automatically evaluated online and presented in a suitable form.

For every diagram there is a value table which contains all the presented values and which can be edited using the HiText<sup>™</sup> program or manually. The form of the diagrams can be varied in many ways:



The dialogue and report forms are also used in the electronic laboratory notebook.

### Characteristics

- » Multi-axis, x-t, x-y
- » Multi-curves
- » Multi-diagram
- » Curve attributes
- » Lines, plot symbols
- » Fill areas
- » Auxiliary lines
- » Linear or logarithmic scaling
- » Auto-scaling



## Product code Description

SL-DIAPROT

Dialogue and report forms with diagrams and tables for HiText™

# HiBatch<sup>™</sup> recipe control and administration



Reproducibility and clear documentation of a test procedure are the conditions for an increase in quality and a shortening of development times. The basis for this is formed by the automation of the process in the development laboratory.

The recipe module is thus the ideal tool for automating frequently changing applications with a minimum of effort. HiBatch<sup>™</sup> enables the creation of recipe flow diagrams by linking unit operations with the help of a graphical recipe editor. HiBatch<sup>™</sup> is even simpler to handle than HiText<sup>™</sup>. Even complex recipe flow diagrams can be created in conformity with IEC/EN and NAMUR standards in a clear form in a minimum of time. By clicking an operation in the flow diagram you open the appropriate dialogue form in order to input parameters and values, such as quantities and times.

A unit operation can be used several times, also parallel respectively at the same time. The relevant parameters, such as quantity, times, temperatures etc. are simply entered into the initialisation forms which are opened by clicking on a step.

The flow chart is checked and automatically executed. The active steps are colour indicated and freely selectable control values are displayed directly in the flow chart.



Whole series of tests can be processed automatically, either serial on one reactor or parallel on several reactors.

You are able to gain a whole series of advantages through the use of the batch control system program HiBatch<sup>™</sup> with a unit operation library to NAMUR standard.

### The advantages

- » Recipe creation without programming knowledge and in a minimum of time
- » More time for skilled core tasks due to more efficient working.
- » Automatic test control, also during the night and at weekends
- » Modification of the program parameters and the procedure, even during the actual run
- » Ideal documentation due to complete recording of measurement data, processes, events and manual Interventions
- » Simplified and secure transfer of the EI&C technology knowledge from the laboratory into a pilot plant and into production
- » Supports the GLP and GMP-compliant mode of operation

The input parameters are checked with freely definable plausibility criteria and corrected where necessary, . The parameter sets can be saved for further future re-use.

Even when the recipe procedure control system is running the parameters can still be changed and the process temporarily interrupted at any time, for instance for manual actions.

Thanks to the open programming in HiText<sup>™</sup> the system can be expanded without any problem using preloaded and saved functions, for example by a scaling function for the basis recipe, automatic parameterisation of whole series of tests, automated evaluation, or the administration of the parameters and results.

## **Automation Software**



The unit operations can be personally created using HiText<sup>™</sup> or the unit operation library (SL-GOPBIB) can be referred to. Our services can be used for the creation of special unit operations.

Events, values and process phases are consistently displayed in the multi-plotter.

A batch report with all events, operator interventions, value changes etc. is automatically established. This guarantees an optimal reproducibility of the process, even after manual interventions.

The electronic laboratory notebook eJournal<sup>™</sup> and the laboratory information management system HiLIMS<sup>™</sup> ideally complement HiBatch<sup>™</sup>. An uninterrupted process chain is thus achieved, from the issuing of the order via the control of and involvement in the complete R&D process to the final report.

For simpler applications  $\mathsf{EasyBatch}^{\mathsf{m}}$  may be considered as an alternative.



Product code	Description
SL-HIBATCH	HiBatch™ full version, batch control module with graphic editor
SL-HIBATCHL	HiBatch™ light version, batch control module with graphic editor, 20 steps and 4 recipe flow diagrams
SL-HIBATCHAP	HiBatch $^{\mathrm{m}}$ , batch control module with graphic editor for a closed unit operation library
SL-HIBATCHRT	HiBatch™, batch control module run time, limited to the execution and parameterisation of recipe flow diagrams

#### Additionally recommended modules:

Product code	Description
SL-GOPBIB	HiTec unit operation library for HiBatch™, full version
SL-GOPBIBL	HiTec unit operation library for HiBatch™, light version
SL-SCHERE	Event plotter for LabVision®
SL-SCHPHA	Phase plotter for LabVision®
SL-BERICHT	Extended process report with batch/recipe filter for LabVision®
SL-JOURNAL	eJournal™, programmable electronic laboratory notebook
SL-HILIMSL	Single user license HiLIMS <sup>™</sup> and SQL Express, no external SQL server access)
SL-HILIMS	HiLIMS™, laboratory information management system with external SQL server database access
SL-EXPORT	Export module for LabVision®, option for automatic or HiText™-controlled exports

## Multi-reactor cloner

The cloner is a useful tool for the reproduction of control technical structures. The creation of a project for a parallel reactor system is immensely simplified with the cloner. After the project has been created for one reactor, it can be cloned for the other reactors. The user decides which objects should be cloned.

The channel number is initially assigned automatically and can be changed later.



Fermentation Technique

Product code

### Description

Clone tool for LabVision® (parallel reactor system)

## MultiBatch™



MultiLab™ parallel reactor system

The definition of parallel experiments is made as simple as it can be by the HiBatch<sup>™</sup> extension MultiBatch<sup>™</sup>. A recipe created as a template can be applied to any desired number of reactors using MultiBatch<sup>™</sup>. The recipes can be individually parameterised and the process individually modified.

All parallel experiments are defined by allocating the recipe created as a template to the reactors intended for use with the help of the reactor allocation chart.

Product code SL-MULTIBATCH

### Description

MultiBatch™ option for HiBatch™

MultiBatch<sup>™</sup> then generates a copy of the recipe for each reactor. The names of the recipes are indexed with the attached reactor number so that they can be differentiated.



Allocation of the reactors to a recipe

The units can be started, interrupted and ended independently of each other and have their own data sets.

The recipe operational sequences are initially the same for each of the parallel experiments. However, single sequences can be individually modified.

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	÷

Display of the allocated reactors

## Unit operation library

With the HiTec Zang unit operation library you have a tool with which you can respond quickly and flexibly to continuous new demands. The progress program for a process is made up of standard components. Thus, even a synthesis of high complexity can be programmed in a minimum of time.

The elements of the unit operation library are written in the self-documenting language HiText<sup>™</sup>. Therefore, any individual adjustments at will can be made by modifying the control program. Similarly, the dialogue forms can be edited using a comfortable Designer where necessary. If required, our application developers can create further basic operations, according to your specifications.

The unit operations are available individually or as a library.

Product code	Description
SL-GOPBIB	<ul> <li>HiTec unit operation library for HiBatch™</li> <li>Pressure (control of a pressure regulation unit with a set point ramp)</li> <li>Pressure_keeping (simple pressure control)</li> <li>Vacuum_keeping (vacuum control)</li> <li>Control_program (Starting or execution of a control program)</li> <li>SoliDos™ (solid matter dosing with SoliDos™)</li> <li>pH_control (pH control for alkaline and/or acid dosing)</li> <li>Inert_produce (generation of an inert atmosphere through repeated drawing of vacuum/inerting)</li> <li>Filling (metered addition without regulator)</li> <li>Distillation with sheath temperature control</li> <li>Weigh_out (manual weighing with output in a report)</li> <li>Inerting (introduction of inert gas)</li> <li>Reflux_dist (waiting for set point temperature and initialised time)</li> <li>Boiling_point (detection of boiling points for subsequent distillation)</li> <li>Vacuum (program for the running of vacuum ramps)</li> <li>Repetition (determines the number of runs of a recipe cycle)</li> <li>Wait_condition (wait until a freely defined condition is met)</li> <li>Wait_user (wait for operator acknowledgement)</li> <li>as well as all unit operation of the options SL-GOPBIBL</li> </ul>
SL-GOPBIBL	<ul> <li>HiTec unit operation library, light version, for HiBatch™</li> <li>Surge_doser (fastest possible gravimetric dosing of a given amount)</li> <li>Amount_doser (gravimetric dosing of a given amount in a given time)</li> <li>Rate_doser (gravimetric dosing at a given rate during a given time)</li> <li>Conti_doser (continuous gravimetric dosing at a constant dosing rate)</li> <li>Temperature_keeping (temperature control)</li> <li>Dosing_gravi (gravimetric dosing from a load cell, without refilling)</li> <li>Endoperation (final step in recipes with a possibility for export)</li> <li>Stirring (output of a set point speed to the stirrer and torque display)</li> <li>Startoperation (starting step of recipe)</li> <li>Tare_Gravi (taring of a load cell)</li> <li>Tare_scale (taring of a balance)</li> <li>Value_output (output of a new value to a data point)</li> <li>Waiting (wait for a set waiting time)</li> <li>Wait_until (wait until a set time)</li> </ul>

## Unit operation library individual modules

Product code	Unit operation	Description
SL-GOPBEFUEL	Filling	Metered addition without regulator. The pump power is automatically shut down at the end of the dosing in order to arrive as closely as possible to the desired quantity.
SL-GOPDEST	Distillation	Distillation using jacket temperature control The set point for the jacket temperature is given by the current reactor interior temperature plus the set point difference between the interior and jacket temperature. The set point difference between the interior and jacket temperature is given by the operator. A small set point difference means a saving on distillation! The reflux separator ratio can be controlled, depending on the head temperature.
SL-GOPDOSI	Dosing	Gravimetric dosing of one set of balance with a set point ramp and controller
SL-GOPDOSIGRAVI1	Dosing_gravi	Gravimetric dosing from a load cell (e.g. HiTec Zang GraviDos®) with a set point ramp and controller, Without refilling of the tank.
SL-GOPDPWERT	Value_output	Output of a new value to a data point.
SL-GOPDRUCK	Pressure	The program controls a pressure regulation unit. The set point is led via a ramp to the final value.
SL-GOPDRUCKHALTEN	Pressure_keeping	The program controls a pressure regulation unit. The given set point is directly output to a regulator. Stepping up is possible depending on time or through structural transition (e.g. if a parallel path is completed).
SL-GOPEINWIEG	Weigh_out	A substance is weighed "manually". The weighed quantity is recorded in the process report.
SL-GOPEND	Endoperation	This operation is used as the final step in recipes. The possibility exists to automatically start an arranged export proce- dure from this recipe step. As time period for the export the time from the start of the recipe to the start of the recipe to the start of the export has to be set. A condition for the functioning of the export is the utilisation of the ini- tial operation out of the unit operation library as well as the full version of the data export module (L_EXPORE)
SL-GOPGRAVITARI	Tare Gravi	Program for taring a load cell (z. B. HiTec Zang GraviDos <sup>®</sup> ).
SL-GOPINERT	Inerting	The program is used to open a binary and proportional inerting valve It can optionally be opened for a defined time or as long as a parallel path is running
SL-GOPINERTHERST	Inert_produce	Generation of an inert atmosphere by n-fold turning vacuum drawing / inerting to normal pressure using a vacuum control unit
SL-GOPKONTIDOS	Conti_doser	Continuous gravimetric dosing at a constant dosing rate.
SL-GOPMENGENDOS	Amount_doser	Gravimetric dosing of a given amount in a given time.
SL-GOPPHREGELUNG	pH_control	The program achieves pH value control for alkaline and/or acidic dosing via a pH value regulator. Stepping up is possible after reaching a pH value tolerance limit or through structural transition (e.g. if a parallel path is completed).
SL-GOPPROGRAMM	Control program	Starting or execution of a control program.
SL-GOPRATENDOS	Rate_doser	Gravimetric dosing at a given rate during a given time.
SL-GOPRUECKDEST	Reflux_dist	The program initially waits until the initialised set point temperature is reached during distillation and then waits for any desired time
SL-GOPRUEHR	Stirring	The program is used for the output of a set point speed to a stirrer. Stirring can be optionally carried for a given time or as long as a parallel path is running
SL-GOPSIEDEP	Boiling_point	Detection of boiling points based on the minimum increase in the interior temperature given by the operator.
SL-GOPSOLIDOS	Dosing	solid matter dosing with SoliDos™.

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### Continuation of unit operation library individual modules

Product code	Unit operation	Description
SL-GOPSTART	Startoperation	Starting step for a recipe with the possibility of undertaking initialisa- tion and settings.
SL-GOPSTOSSDOS	Surge_doser	Fastest possible gravimetric dosing of a given amount
SL-GOPTEMP	Tempering	Program for driving heating and cooling ramps
SL-GOPTEMPHALTEN	Temp_keeping	The program controls a temperature regulation unit. The predeter- mined set point is output directly to the thermostat for inside tempera- ture control at the controller and jacket temperature control. Stepping up is possible depending on time or through structural transition (e.g. if a parallel path is completed).
SL-GOPVAKHALTEN	Vacuum_keeping	The program controls a vacuum regulation unit. The given set point is directly output to a regulator. Stepping up is possible depending on time or through structural transition (e.g. if a parallel path is completed).
SL-GOPVAKU	Vacuum	The program controls a vacuum regulation unit. The set point is led via a ramp to the desired final value.
SL-GOPWAAGETARI	Tare_scale	Program for taring a scale
SL-GOPWARTET	Wait_until	The program waits until a time given by the user is reached.
SL-GOPWARTEZ	Waiting	Program for determining a freely selectable waiting time.
SL-GOPWBEDIENER	Wait_user	The program waits until the operator presses "OK".
SL-GOPWBEDINGUNG	Wait_condition	The program waits until a condition given by the user is met.
SL-GOPWIEDERH	Repetition	Determines the number of runs of a recipe cycle: As long as the "counter" is smaller than the number of repetitions, the right output of the element is used, otherwise the lower output is used.

### The controller modules (SF-PIDx see page 172) are required for the complete functionality of the following unit operations

- > SL-GOPDOSI
- > SL-GOPDOSIGRAVI1
- > SL-GOPDRUCK
- > SL-GOPDRUCKHALTEN
- > SL-GOPKONTIDOS
- > SL-GOPMENGENDOS
- > SL-GOPPHREGELUNG

- > SL-GOPRATENDOS
- > SL-GOPREKTIF
- > SL-GOPSTOSSDOS
- > SL-GOPTEMPHALTEN
- > SL-GOPVAKHALTEN
- > SL-GOPVAKU

### The controller modules (SF-PIDx see page 172) are recommended for the complete functionality of the following unit operations

- > SL-GOPDEST
- > SL-GOPSIEDEP
- > SL-GOPTEMP

151201

# EasyBatch<sup>™</sup> & ActionTracker<sup>™</sup>- table-based batch control

Batch control was never more simple!

0 CP ~~ B .	• • • • • • • • •	H	C HBM			156 9	1					
Command	Parameter	Row	(VISCOPAKT.O	VISCOPAKT.S Stimer setpoint [[/min] 0	IT_R_CTRL Temp-Cascade cor Off	IT_R_CTRL.W T-Setpoint [*C] 0.0	DOS1_CTRL Doser 1 on/off	DOS1_CTR Dosing amou	LM IDOS1_CTRL.TI t Dosing time 5.0 [4]	ME IVB_BOUT_X Botom drain 55 [01] (	Phase	Comment
Execute	BEFÜLL		On	1							Betüllen	Reaktor befüllen
Set				250	On	30,0					Anfangstemperatur	Anfangstemperatur vorgeben + Rühren einschalte
Wait for	IT_RI_X>29 (*C)										Warte T-Start	Warten bis Anfangstemperatur erreicht
Ramp	00:01:00					80,0					T-Rampe	Rampe auf 80°C
Vait for	IT_RI_X>79 ("C)										Warte T-End	Warten auf Endtemperatur
	MISCOPAKT.TOR>100 (Ncm)	11										Fails Md zu hoch, vorzeitig beenden
et								On	2,0	10		20g in 10sec dosieren
/ait for	IDOS1_CTRL.EI=1											Warte bis Dosierer fertig
ot						20,0					Abkühlen	Abkühlen
Vait for	IT_RI_X<30 ("C)		100									Warten bis abgekühlt
et			01		Off			Off		1	1	Reaktor ablassen + Rühren ausschalten
the other state reserves	and call coans command satection dialog.											

## EasyBatch™

Command

Wait

Reproducibility and clear documentation of a test procedure are the conditions for an increase in quality and a shortening of development times. This can be achieved at an early stage and with a reasonable amount of effort simply through automation of the procedure in the development laboratory. Up to now, only the text-based language HiText<sup>™</sup> or the graphical sequential function chart HiBatch<sup>™</sup> were available for programming.

EasyBatch<sup>™</sup> is now available as a new option with unrivalled simplicity. EasyBatch<sup>™</sup> enables uncomplicated table-based and self-documenting programming. It can be intuitively operated. EasyBatch<sup>™</sup> can also be used in conjunction with manual operation and easily ensures reproducibility.

EasyBatch<sup>™</sup> is even simpler to handle than HiText<sup>™</sup> and HiBatch<sup>™</sup> and is especially suited to the programming of processes with a simple to medium amount of complexity.

EasyBatch<sup>™</sup> is also ideally suited for the control of fermenters, micro-reaction plants and robots.

Description

### The advantages

The program waits until the time set in the parameter column (hh:mm:ss) has expired before executing next line

- » More time for skilled core tasks due to more efficient working.
- » Automatic test control, also during the night and at weekends
- » Modification of the program parameters and the procedure, even during the actual run
- » Ideal documentation due to complete recording of measurement data, processes, events and manual Interventions
- » Supports the GLP and GMP-compliant mode of operation

Its own table column is provided for all variable parameters and values, such as times and amounts. The first column contains the command to be performed. In the simplest case, a program only consists of set and wait commands Recipe creation is thus achieved without programming knowledge and in a minimum of time

_	Dosing Systems
_	
_	Apparatus
_	≥
-	Laborato

Laboratory Reactor

Fermentation Technique

**Automation Technique** 

Liquid Handling Laboratory Robots

Pumps

Accessories

Systems

Wait for	The program waits for the fulfilment of the condition in the the parameter column before executing next line
Wait until	The program waits until the stated date or time before executing next line
Set	Assigns each of the values given in the current line to the data points given in the column heading
Ramp	Creates ramps for all set point values in the time given in the parameter column to the given final values
Start	Starts the HiText™ program given in the parameter column, does not wait for the program to be called up to continue
Terminate	Terminates the HiText™ program given in the parameter column
Pause	Interrupts the HiText™ program given in the parameter column
lf	Branches out to the given program line if the condition in the parameter column is met
Goto	Branches out without condition to the program line given in the column "Line"
Confirmation	Opens a window containing the message stated in the parameter column and interrupts the program until the operator acknowledges (by clicking on "OK")
ADD	Adds the given value to the current value
SUB	Subtracts the given value from the current value
MUL	Multiplies the current value by the given value
DIV	Divides the current value by the given value
Execute	Starts the HiText™ program given in the parameter column, waits for the program to be called up to continue

## **Automation Software**

The command parameters, such as time interval and conditions e.g. "pH > 6,5" or a HiText<sup>M</sup> program name, are entered into the parameter column. The final column is a commend column into which the operator can, where required, enter relevant information which cannot be automatically recorded. This is transferred into the report of the electronic laboratory notebook as comments.



Events, values and process phases are consistently displayed in the multi-plotter during the procedure.

A batch report with all events, operator interventions, value changes etc. is automatically established and archived in HiLIMS<sup>™</sup>. This ensures an optimal data protection of test results and the reproducibility at any time.

	Zeit	°C °C	π_K_X °C	IP_RL_X mbar	น_RLX mi	PH_R_X	IVISCOPAKT. TOR Ncm	IW_DIST1.X	Kommentar	
1	00:00:01	20,00	20,00	1013,00	0,00	7,00	0,00	0,00	Medium Heptan Menge 500,00 g	
2	00:00:02	20,00	20,00	1013,00	0,00	7,00	0,00	0,00	Startgewicht 0,00 g	
3	00:00:02	20,00	20,00	1013,00	0,00	7,00	0,00	0,00	Absperrventil !VB_DOS3_Y geöffnet	
4	00:00:12	20,00	20,00	1013,00	340,00	7,00	0,00	0,00		
5	00:00:14	20,00	20,00	1013,00	400,00	7,00	0,00	0,00	Pumpe IFV_PU3_Y auf 10,00 gesetzt	
6	00:00:15	20,00	20,00	1013,00	480,00	7,00	0,00	0,00	Pumpe !FV_PU3_Y auf 1,25 gesetzt	
7	00:00:17	20,00	20,00	1013,00	501,25	7,00	0,00	0,00	Absperrventil IVB_DOS3_Y geschlossen	
8	00:00:17	20,00	20,00	1013,00	501,25	7,00	0,00	0,00	Pumpe IFV_PU3_Y ausgeschaltet	
9	00:00:19	20,00	20,00	1013,00	503,75	7,00	0,00	0,00	Es wurden 503,75 g Heptan eingefüllt	
10	00:00:20	20,00	20,00	1013,00	503,75	7,00	0,00	0,00	Innentemperaturregelung: Endwert (IT_RLx) 80,00 °C Rampenzeit 00:01:00 Toleranz 1,00 °C	
11	00:00:20	20,00	20,00	1013,00	503,75	7,00	0,00	0,00	Verhalten beim Weiterschalten: Temperatur halten	
12	00:00:20	20,00	20,00	1013,00	503,75	7,00	0,00	0,00	Innentemperaturregler eingeschaltet	
13	00:00:20	20,00	20,00	1013,00	503,75	7,00	0,00	0,00	Inertisierungsventil !VB_INERT_Y geöffnet	
14	00:00:21	20,00	20,00	1013,00	503,75	7,00	0,00	0,00	Rührer eingeschaltet	
15	00:00:31	22,18	20,15	1013,00	503,75	7,00	5,44	0,00		

The LabVision® project modules form the ideal basis for EasyBatch™. The modules used are automatically reflected in the EasyBatch™ program table so that the laboratory work can immediately be commenced after a project has been created.

The EasyBatch  $^{\rm M}$  module is thus the ideal tool for automating frequently changing applications with minimal effort.

## ActionTracker<sup>™</sup> action recorder

	-
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The ActionTracker<sup>™</sup> module enables EasyBatch<sup>™</sup> teach-in programming. The operator runs the system manually with the aid of the control screen. All set point modifications are recorded automatically in the table. All value changes are added as a line in the table by the action recorder so that at the end of a process a clear, reproducible description of the actual procedure is available in tabular form. In other words: An executable program is created from the operating activities of the operator without the necessity of any further action on his part.

The chain of activities recorded in tabular form can now be automatically repeated without any further effort. Intervals, set points, comments, conditions etc. may be inserted at run-time or before a re- start of the table.

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If value changes are undertaken by the operator during the execution, the table is automatically updated. Thus it may be ensured that the procedure is always documented in an uninterrupted manner and is reproducible.

Product code	Description
SL-EASYBATCH	EasyBatch™, table-based batch control
SL-ACTIONTRACK	ActionTracker <sup>™</sup> for the recording of operation activities as an EasyBatch <sup>™</sup> program

# eJournal<sup>™</sup> electronic laboratory notebook

## Test documentation as it should be!

The electronic laboratory notebook eJournal<sup>™</sup> is more than an adequate substitute for a paper-based laboratory notebook. eJournal<sup>™</sup> automatically records all information gathered in the course of a test. In addition, it is also possible to consistently display and archive test regulations, material properties of the reactants and products, laboratory analyses and other information. This significantly increases productivity and prevents a loss of knowledge through employee turnover.

The trend towards electronic documents is becoming more and more evident. The American FDA (Food and Drug Administration) is pushing the deployment of electronic media within documentation. Digitally signed electronic documents in compliance with FDA 21 CFR Part 11 are legally equivalent to hand-signed paper documents. The increase of productivity in the research industry due to the change to an electronic system is estimated to be over 50%.

A computer-aided laboratory notebook offers significant advantages: read and write errors are eliminated, a search function enables a fast search for experiments and results. Tamper-proof filing with an electronic signature has been made possible. Test parameters, measurement data and evaluated results are presented in clear report sheets.

The laboratory personnel receives support through additional functions (e.g. automated evaluation) and is relieved of particularly bothersome routine activities such as the noting of measurement values.

An electronic laboratory notebook is particularly a "must-have" if the laboratory process (synthesis laboratory, fermentation laboratory) has to run compliant with GLP (Good Laboratory Practice) standards or where a validated mode of operation is required.

The following diagram illustrates the information flow between the individual modules of the LabVision<sup>®</sup> system.



### The advantages

- » A standardised way of working
- » Release of the lab personnel from routine activities
- » Avoidance of read and write errors
- » Filing free of manipulation
- » Easier retrieval of experiments
- » Promotes the paper-free laboratory
- » Individually configurable
- » Online evaluation and spreadsheets
- » Full-text search in individual or all PDF documents
- » Export of the test report as a PDF or RTF file

### Recording

The relevant values, parameters and events and any possible text to be written and comments on a test are recorded and stored in the electronic laboratory notebook. It is also possible to automatically insert digital photographs which have been taken on an event-driven basis or according to schedule with the Multi-LabCam system during the test.

The recorded data are shown on freely configurable report pages with tables, diagrams and value and text fields. As a result, this guarantees an optimal documentation of the test events at all times. Manual processing of the data is no longer required, thus eliminating one major source of errors. Unattended operation is now possible and night time and weekends are now available as times for experimenting. A multitude of tests can now be processed in a minimum of time.

### Recording

A batch report with all values, events, operator interventions, value changes etc. is automatically established. Digital photographs, chemical formulas, laboratory analysis data, links to data files or websites, comments etc. can be easily inserted. eJournal<sup>™</sup> is thus a major step in the direction of a paper-free laboratory. Authenticity and integrity of the information are ensured.



## **Automation Software**

The report can be adjusted to meet the special demands of your laboratory. It contains, among other things, a cover page with general information, a page with information on the reactants, products and system properties, a page with analysis values and report pages with the recorded measurement values, events, and comments. The layout of the report pages can be freely designed using the form generator.

The recorded values are also graphically presented to enable a better overview. The laboratory notebook can be exported as a PDF or RTF file for further processing.

### Evaluation

Evaluation and documentation of the experimental data are supported or fully automated. The recorded data can be automatically evaluated online using HiText<sup>™</sup> and presented in tables or various diagrams in various forms, such as a set of curves, average values with minimum and maximum bars or standard deviations. Self-calculating tables are also possible.

### Data import and export

There are various possibilities for a data exchange to third party software, such as

- > CSV files
- > Text files
- > Named pipe
- > Data interfaces

### **Comprehensive documentation**

A set of comprehensive synthesis recipes is essential for the clear execution of a reaction. It contains and respectively links all information required to make the reaction comprehensible. This includes information on the test construction, the recipe flow diagram, the data of the reactants and solvents and test parameters such as periods, quantities, temperatures and pressures. The material data and other parameters of the reactants and products can be called off from the LIMS database.

The storage of the synthesis recipes ensures the availability of all

information required for a later repetition of a test.

Organisational, procedural and chemical information are also recorded in the eJournal<sup>™</sup> to enable the remaining data to be precisely allocated.



eJournal<sup>™</sup> structures the data in such a way that they can easily be retrieved with the help of the HiLIMS™ laboratory information management system and are available for further use. This ensures that new and proven synthesis recipes, including the knowledge of the synthesised substances, are not lost and available at all times.

A single user license is also available for the modification of laboratory notebooks on an additional stand-alone workplace. The single user license does not require a LabVision® installation (see eJournal™ offline viewer).

Information about LIMS can be found under the HiLIMS<sup>™</sup> laboratory information management system on page 167.

We will be happy to create a laboratory notebook system to suit your specifications.

Condition: SL-HITEXT(L) and SL-DIAPROT

# Product code

Description

**SL-JOURNAL** 

eJournal<sup>™</sup>, parameterisable electronic laboratory notebook

## eJournal<sup>™</sup> offline viewer

The eJournal<sup>™</sup> offline viewer enables laboratory notebooks to be opened and edited outside the LabVision® environment.

The software can be installed on a PC with the Windows® 7 operating system upwards.

The offline viewer thus expands the possibilities of the eJournal, as it enables the user to also edit the notebooks on a computer on which LabVision<sup>®</sup> is not installed.



#### **Product code** Description SL-JOURNAL-SA eJournal<sup>™</sup> offline viewer single user license for a stand-alone workplace (with dongle)

# HiLIMS<sup>™</sup> laboratory information management system

*Finally the sure way to retrieval!* 



A general development towards electronic documentation is becoming more and more evident. The FDA 21 Part 11 makes electronic documents with a digital signature legally equivalent to hand-signed paper documents. The FDA (Food and Drug Administration) is pushing the use of electronic media. Laboratory Information Management Systems (LIMS) are coming into laboratories where they are replacing paper-based laboratory notebooks or books.

Even one single test which is unable to be retrieved can be more costly than the investment in a LIMS, as patent claims cannot be defended, claims for compensation cannot be rejected or tests must be repeated.

The term LIMS covers a wide range. Laboratory Information Management Systems are just as varied as the laboratories in which they are applied in, for instance in a laboratory for medical diagnostics, a laboratory for production-related testing or a chemical development laboratory.

HiLIMS<sup>™</sup> is the special LIMS for an R&D laboratory. There, in addition to the increase of efficiency and shortening of the "time to market", the LIMS acts as protection of the intellectual property rights and as safeguard against liability claims through electronic documentation and archiving. The latter functions also enable the fast retrieval of information gathered in the tests (batch and continuous operation mode) by searching the electronic laboratory notebook.

The data of test series, parallel experiments or freely arranged tests can be visually compared in various graphical forms and can be condensed in freely configurable reports. The data do not have to be "handled manually" any more as usual in the conventional way of workin. As a result of that, many error sources are excluded right from the beginning and the rework time is reduced drastically. According to a study (CENSA 2004), the increase in productivity in the research industry due to the change to an electronic system is estimated to be over 50%.

### The advantages

- » Support of internal laboratory procedures
- » Secure retrieval of test results
- » Increase in productivity
- » Prevention of errors
- » Making knowledge available internally
- » Protection of knowledge from outside
- » Protection of information from manipulation
- » Securing of information for re-use
- » Securing of own claims and prevention of liability claims

A LIMS should be able to achieve an uninterrupted process chain, from the issuing of the order via the control of and involvement in the complete R&D process to the final report.

A LIMS consists of at least the basic data logging and measurement value evaluation modules. Additional modules provide an integration of the hardware to the measurement process, an integration of the ERP systems, controlling software, data protection infrastructure etc..

A LIMS can also be achieved as a distributed system so that data can be entered and called up from different workplaces. HiLIMS<sup>™</sup> can depict all essential parts of a laboratory and supports either the administration of static (e.g. material data) or dynamic data (e.g. temperature patterns or spectra).



Modern laboratory automation and analysis devices produce huge amounts of raw data, e.g. a recipe control system with online analysis and chemometrics, which would remain more or less worthless without efficient data administration and subsequent data evaluation.

For the automatic data transfer a data connection is required to automated laboratory reactors, chromatography data systems, instruments etc. The question of whether to "make or buy" no longer arises, as HiLIMS<sup>™</sup> can be so flexibly adapted to various tasks that individual is not cost-effective. Laboratory Reactor

Systems

Fermentation Technique

**Automation Technique** 

Liquid Handling Laboratory Robots

**Dosing Systems** 

Laboratory Apparatus

Accessories

Pumps

## **Automation Software**

Particular properties of HiLIMS™

- » Fast relational SQL database
- » Self-explanatory user interface
- » Network and multi-user capability
- » Smooth integration into LabVision<sup>®</sup>/HiBatch™
- » Very versatile
- » Integrated forms and form designer
- » Integrated data mining, evaluation and reporting
- » Various import and export possibilities

There are virtually no limits to the possibilities for the integration of measuring devices, sensors and analytic instruments into the measuring chain. The control process can also be extended as desired by mathematical processing and evaluation of the measurement values, sample management, calculations etc.

HiLIMS<sup>™</sup> is seamlessly integrated, as the last but highly important link in the processing chain, into the LabVision<sup>®</sup>-/HiBatch<sup>™</sup> program system. It attaches itself directly onto the data tables of the electronic laboratory notebook and the LabVision<sup>®</sup> database. It can, however, also be adjusted to other systems as an independent program.

### Planning and organising

The processing chain begins with the order. This contains the organisational data such as the customer, the order number, completion date and the test specifications.

The order form is freely configurable using the form editor. Information stored in the database, such as the customer, laboratory or product, can be chosen via selection lists. In addition, text fields for freely editable text, tables, and graphics can be inserted.

#### Administration and documentation

All relevant information, such as the order, recipe, test parameters, measurement values, events, laboratory data or the laboratory notebook are stored in the LIMS data base in such a way that they can be retrieved as quickly as possible using freely configurable search queries. In addition to better internal organisation, this provides a means of securing property rights and liability issues.

The archived recipes and parameter sets can be transferred back to the HiBatch<sup>™</sup> recipe control system in order to, if necessary, repeat a batch run or test program.

Any adjustment to special requirements, including the connection of laboratory and analysis devices, can be conducted by HiTec Zang, an external service provider or the user himself.

#### Administration of

- Recipe data
- > Batch data
- > Reactant and product data
- Sample data
- Documents

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#### Searching and retrieval

The generated research knowledge is made easily accessible and its transparency is increased through the deployment of HiLIMS<sup>™</sup> as a knowledge base.

A query can be created by the user either based on forms or scripts. This may contain various criteria such as organisational data, material data, measurement values, laboratory data etc. The freely configurable search forms are self-explanatory and support standardised operation modes. Individually configured search forms can be used as predefined search dialogues after they have been saved.

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#### The elements of a search dialogue

- > Organisational data
- > Dates, times, time domains
- > Values, value ranges of measurement values, analysis data etc.
- > Keywords, terms

The search dialogue forms may contain any desired combination of search elements.

The search dialogue forms can also be created by the user using the form designer. For this, the required search elements are merely integrated into the form via drag and drop.



Once a search is completed, all data sets matching a query are presented as a list.

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The user can remove single tests from the list before starting the evaluation and insert single tests, such as a reference test, using the "Attach single test" button.

A possible alternative is a script-based search (expert search). Search terms which are more complex than those created using the And and Or links may be generated using the setting of brackets.

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Any errors in the search script are detected and displayed.

Different search scripts can be stored for later re-use.

### Evaluation

The data of the tests retrieved using the search function can be evaluated in many different ways. The simplest case is a direct comparison of selected variables in a diagrammatic form. Various diagrams with different types of display, such as a series of curves, average values with min./max. bars, are available for this.



The report of the evaluation may consist of a cover page with general information, possibly a copy of the order and subsequent report pages.

The layout of the report pages is designed using the form designer.

### Possibilities for evaluation

- > Evaluation of test series and parallel tests
- A comparative display
- > A statistical evaluation
- > A freely programmable evaluation

The information stored, such as the order, recipe, laboratory notebook, report data table and raw data, may be displayed or exported as a file for further processing.

#### Setting up

The master data is created using the table-based master data editor. The user can also himself create new database fields and tables such as warehouse number or materials with material data. The created database fields and tables can be accessed immediately via a selection list as soon as an order has been created, within a laboratory notebook, by means of queries or during the report design.

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Services Didactics

### User administration

The users are assigned to different groups, such as administrator or user, in the user administration. The user must log in and the data saved by him are assigned to his ID.

### Device coupling

Various interfaces and reports are available for the coupling of analysis devices, spectrometers, etc..

- > OPC
- Modbus
- Text files
- > CSV files
- > Microsoft® Excel® tables
- > Device DLLs etc.

Individual programming is provided for coupling with other software, such as ERP and chemometrics programs.

Fechnical data	
Database systems	Microsoft® SQL-Server® version 2005 up- wards basic version is supplied with a free- of-charge SQL Server Express, limited to 4 GB
Number of users	1 to unlimited (depending on the database server and client licenses)
Client licenses	1 to unlimited
	> Basic version (single user license)
	> Multi-user extension
	> SQL database server
	User administration
Modules	> Electronic signature
	> Device driver
	<ul> <li>Customer-specific adjustments to ERP programs</li> </ul>
	<ul> <li>Customer-specific adjustments to chemo- metrics programs</li> </ul>

 $\rm HiLIMS^{m}$  is available as a LabVision\* module (SL-HILIMS-C) and as stand-alone software (SL-HILIMSSA-C).

Product code	Description	Impact on data point
SL-HILIMSL	HiLIMS <sup>™</sup> single user license, light option, for LabVision® and SQL Express, no external SQL server access	yes
SL-HILIMSLSA	HiLIMS <sup>™</sup> single user license, light client an additional stand-alone workplace with access to HiLIMS <sup>™</sup> light system	no
SL-HILIMSSQL	HiLIMS™ server license for multiple-user version Note: Requires additional SQL server license	no
SL-HILIMS	HiLIMS <sup>™</sup> option LabVision <sup>®</sup> Note: Assumes HiLIMS <sup>™</sup> server and requires an additional SQL client license. A license is required for each workplace which is logged in at the same time. A license increases the maximum number of HiLIMS <sup>™</sup> users which are able to be set up by two.	yes
SL-HILIMSSA	Stand-alone workplace client (HiBuilder <sup>™</sup> version, able to be run without LabVision®) Note: Assumes HiLIMS <sup>™</sup> server and requires and additional SQL client license. A license is required for each workplace which is logged in at the same time. A license increases the maximum number of HiLIMS <sup>™</sup> users which are able to be set up by two.	no
SL-SQLSERV	SQL server license without client licenses	no
SL-SQLCLNT	SQL client license per workplace	no

Condition: SL-JOURNAL and SL-DIAPROT

Laboratory Reactor

Fermentation Technique

**Automation Technique** 

Liquid Handling -aboratory Robots

Systems

# Further LabVision<sup>®</sup> modules

# LabVision<sup>®</sup> Switcher

The LabVision<sup>®</sup> Switcher software is an auxiliary module which enables by switching an alternate operation between different main versions of the LabVision<sup>®</sup> software (from version 2.5) on a computer without a previous de-installation and (re-)installation in Windows<sup>®</sup>. This module is only intended for service personnel (administrators) who operate offline project development for each of their systems at locations with several system versions of the LabVision<sup>®</sup> software. Previous training at our company is obligatory for the operation of this module.

Product code

SL-SWITCHER

**Product code** 

Programming interface

programmers is obligatory.

SL-SIGNA

Description

Switcher software for the administration of various LabVision® versions on a PC

## Calibration data module

By means of the calibration module the calibration data of MSRmanager<sup>™</sup> or LabManager<sup>®</sup> AS data points can be saved, loaded and administered independently from the status of the referring project.

The loaded project status should frequently remain unchanged if it is only intended to modify the calibration of the relevant data points.

This enables LabVision<sup>®</sup> projects which are created on a neutral development system to be distributed across several independent systems.

There, after a new project status has been loaded, the calibration data of each of the stations can be then loaded in order to avoid the re-calibration to the sensors and actuators which would otherwise be necessary.

Product code	Description
SL-CALIBR	Calibration data module for the administration of AS calibration data independently of the status of the project

## Digital signature of export and report data

The validation of production and research systems (in accordance with FDA 21 CFR Part 11) makes the signature of export data, laboratory notebooks and result reports increasingly necessary.

The relevant LabVision<sup>®</sup> modules now create documents which are given an electronic signature which may be regarded as a signature on paper documents.

Signatures are checked when these documents are displayed in LabVision® and are thus protected against modification.

We especially recommend a use together with the LabVision® internal user administration (SL-BENRECH see page 151) so that allocations of created documents to personal identities may be stored.

The module ANWINT makes it possible to access from other programs (Visual Basic, C++, Delphi etc.) the current values of the data points being written and read. A period instruction of at least one day by our

Description

### Supported formats

- > CSV exports
- > HiText<sup>™</sup> laboratory notebooks
- > Application manager log file
- > Calibration data files

**Dosing Systems** 

Pumps

Product code	Description	
SL-ANWINT	Programming interface for LabVision®	
DS-LVPROG	Instruction in "SL-ANWINT" programming for LabVision®	

Electronically signed file store for LabVision<sup>®</sup> and HiText<sup>™</sup>

## Process and AS simulation

By using the module PNKSIM an AS (LabManager® etc.) and the technical process can be completely simulated. This enables a system to be virtually operated on a PC. Typical applications are

- > Instruction and training of users
- > Education
- > Testing of automation projects
- > Simulation of procedural processes

The syntax of HiSim<sup>™</sup> simulation programs is HiText<sup>™</sup>-compatible. It essentially varies from HiText<sup>™</sup> in the following point:

 $\mathsf{HiText}^{\mathsf{m}}$  can read in values from inputs and write out values to outputs.

In contrast, HiSim<sup>™</sup> can write out values to (virtual) inputs and read in values from outputs, e.g. write a temperature value to a virtual temperature measurement input or read the control value of a dosing pump.

The reaction of the simulated system to control variables can be simu-

lated using suitable programs.

A project developed using HiSim<sup>™</sup> can be transferred without change to a real system.

A period of instruction of at least one day by our programmers is obligatory.

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Product code	Description
SL-PNKSIM	Emulator fir HiTec ASs, including HiSim™
DS-LVPROG	Instruction in the programming for HiSim™

# AS firmware modules

The AS firmware auxiliary modules can be used to extend the functionalities of an AS for fulfilling special tasks, which are in excess of the basic configuration.

## Controller modules

HiTec Zang ASs can be fitted with up to 32 controller modules. In addition to the standard PID controllers, so-called application-oriented controllers are available for the typical technical process controlling tasks.

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Example of a PID controller panel for parameterisation

All control parameters are passed over data points and can be dynamically re-parameterised. Thus, special algorithms for difficult non-linear lines can be realised without any problems.

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You can choose between standard PID controllers and application-oriented controllers.

## Standard PID controllers

The smallest version of the MSRmanager controller module consists of 4 controllers.

The PID controllers can be individually parameterised. The type can be individually selected

- > |
- **>** P
- > PI
- > PD
- > PDtz (tz = shortened D share)
- > PID
- > PIDtz
- > PH (support for pH control)

The controllers have the characteristics of industrial controllers, such as a manipulated variable limitation, auxiliary manipulated variable intrusion switch, tolerance band, bounce-free transfer and an antiwind-up function.

Set point and actual value, auxiliary manipulated variables and manipulated variables are allocated via a configuration menu using the relevant data points (inputs/outputs). The sampling interval is adjustable to a resolution of 1/10s.

The manipulated variable limitation works optionally either before or after the cutting in of the auxiliary manipulated variable and allows the specification of a maximum and a minimum for the manipulated variable.

A starting-up of the I portion in the case of long-lasting control deviations is prevented (anti-wind-up). The specification of a tolerance band is useful for heating/cooling or pH value control.

Since all controlled variables are linked with data points, cascaded or guided controller systems and special functions, such as dynamic limitation, mapping controllers, split outputs etc., can be easily realised.

## Application oriented controllers

	DO S2	CTRL	6	DO	S2 CTRL	
	Bedienung Par	rameter		Bedienung	Parameter	
	Zustand:	Aus		Zustand:	Aus	
	Ein/Start	Aus		Ermittlung der max. Förderrate,		
n-Dosierei	Pause	Standby	iere	AutoKal	Stop	
	Dosiermenge	Dosiert	Dos	Autoical	J Stop	
	50,0 g	0,0 g	÷.	Max. Förde	rrate 1.87 g/s	
ğ I	Dosierzeit Laufzeit		1ge	Nachfülltyp:		
- Me	00:01:20	00:00:00	ate 4	Kein Nachfi	illen 👻	
ΞI	Waage	Förderrate		Min, Füllstan	d Max Füllstand	
ă I	0,09		ğ	0.0 9	0.0 9	
<b>"</b>	Akt. Rate		-	End-Toleran	z Alarm Toleranz	
	0,0 g/s	Hand-Y		0.50	2.0	
	Man. Förderrat	e La La Car				
	0,0	Nachfullen		Speiche	Laden	

Application-oriented controllers are optimised controllers for special tasks, such as

- Batch dosing control
- Conti dosing control
- Vacuum regulation
- > pH control
- > Temperature cascade regulation

Application-oriented controllers are self-parameterising or are automatically set by a controller optimization program. They thus save much time in the creation of an application. The achieved control qualities can only be reached with PID controllers with a great deal of effort and expertise.

With the help of application-oriented controllers the laboratory personnel is able to solve problems which would otherwise require the presence of a control engineer.

Product code	Description
SF-PID4	4 controller modules PID controllers type P to PIDTz and application oriented controllers
SF-PID8	8 controller modules PID controllers type P to PIDTz and application oriented controllers
SF-PID16	16 controller modules PID controllers type P to PIDTz and application oriented controllers
SF-PID24	24 controller modules PID controllers type P to PIDTz and application oriented controllers
SF-PID32	32 controller modules PID controllers type P to PIDTz and application oriented controllers
SF-PID48	48 controller modules PID controllers type P to PIDTz and application oriented controllers
SF-PID64	64 controller modules PID controllers type P to PIDTz and application oriented controllers

## HiTune<sup>™</sup> Auto-tuning for temperature cascade controllers



A temperature cascade controller can be automatically parameterised using the  $\operatorname{HiTune}^{\operatorname{m}}$  module.

Using conventional ways of carrying out a process requires much experience and generally takes up several hours or often days.

Using HiTune<sup>™</sup> parameterisation of a controller can be automatically carried out in a minimum of time during the run-up to a set point value. The following diagram shows the excellent controller behaviour

for different set point steps.

The controlled system consists of a 2-litre glass reactor with an interior temperature sensor, a temperature control jacket and a standard thermostat.

The control run-up pattern can be modified without any re-optimisation.



### Product code Description

SF-HITUNE

Automatic parameterisation for SF-PIDxx temperature cascade controller

## IL PLC functions for ASs

The IL module brings extended PLC functions to all HiTec ASs.

The programming of control processes in an instruction list (IL) has been internationally standardised via EN 61131 and has proven itself in practical use. The HiTec ASs, MSRmanager<sup>™</sup>, MSRbox<sup>™</sup>, LabManager<sup>®</sup> and LabBox<sup>®</sup>, are thus able to independently carry out control functions, i.e. without any participation of the OS (user PC). The IL control language and dynamic device components are provided for this purpose and can be active even when the PC is switched off. Thus, the HiTec laboratory and MSR systems meet the safety-related NAMUR category 3.

The IL control rounds off the LabManager<sup>®</sup>/MSRmanager<sup>™</sup> system and at the same time expands its area of application towards larger projects.

As it is implemented on an AS, it significantly increases its security and enables the programming of even more complex security and running routines which can be achieved without any involvement of an OS.

The measurement and control technology oriented language IL and the device components are an ideal supplement to the application technology oriented HiText<sup>™</sup> control and evaluation language. It is recommended that they are used if the control functions need to be particularly secure, i.e. they must be run even in the case of an OS failure, or increased demands are placed on the level of performance.

### The advantages

- » EN 61131 compatible
- » Indirect addressing
- » Sub-program technology
- » Cyclic and continuous execution
- » Can be combined with device components
- » Binary and analogue value processing
- » Online download capability
- » Simple data exchange with an OS
- » Extended alarm processing in an AS

It must be emphasised that the IL and device components are "online capable", i.e., during the running of a program, a modified program can be loaded into an AS which then takes over the control at the start of the next cycle.

The programs are permanently and securely stored in the AS FLASH memory.

IL has access to all AS data points. An interesting feature is also the possibility to implement any desired number of complex alarm reactions directly in an AS, ranging up to the controlled shutting down of the system, such as in the case of an OS malfunction.

## AS firmware modules

An IL program is started automatically immediately after the switching on of an AS and can execute several thousand operations per second.

Support is provided during program development by the use of debugging functions, such as break points, single sequence and monitored printouts.

Symbolic variables and array variables are supported.

Permanent (the value remains after a reset and power-off) and non-permanent variables are supported.

#### The language elements

IL control supports, among others, the following IEC 61131 commands

Operator	Meaning
LD	Load operand
ST	Save operand
S R	Set, re-set, depending on operand
AND OR XOR	Boolean AND Boolean OR Boolean exclusive OR
ADD SUB MUL DIV	Addition Subtraction Multiplication Division
GT GE EQ NE LE LT	Greater than comparison Greater or equal to comparison Equal to comparison Unequal to comparison Smaller or equal to comparison Smaller than comparison
JMP	Jump to a given line
NOP	No operation

#### Data types

Description	Туре
AS data points	All types of AS data points
Word memory	Analogue, digital 32 bit
Bit memory	Bool
Digital inputs directly ad- dressed	Bool
Digital outputs directly addressed	Bool
Constants	Integer and floating point values



#### **Function blocks**

Name	Description
TP timer	Timer Pulse
TON timer	Timer on-delay
TOF timer	Timer off-delay
CTU counter	Counter up
CTD counter	Counter down
CTUD counter	Counter up/down
F_TRIG	Negative edge triggered flip-flop
R_TRIG	Positive edge triggered flip-flop
SR	RS flip-flop with overriding set
RS	RS flip-flop with overriding reset

The number of existing system function blocks amounts to:

- > 30 timers
- > 10 counters
- > 100 RS flip-flops

The optional direct addressing of the digital inputs and outputs enables quick access to these inputs and outputs. Additionally, this direct access is protected from faulty parameterisation or manipulation via the user interface.

Data points which are used are easily available in all other modules of an OS and an AS; i.e. they can be connected with visualisation objects or can be used in HiText<sup>™</sup> programs.

#### The program editor

The comfortable editor (like the HiText<sup>™</sup> editor) offers many debugging functions such as Breakpoint, Step-Over, Trace-Into, CPU-Window, and Watch Window with a value modification function.

Online help functions are integrated. The reserved language elements are marked and comment areas are highlighted in colour (syntax highlighting).

## **Automation Software**



Entered programs are checked regarding the correct use of the programming language before performing the download into the AS and its activation.

#### **Test support**

The monitoring of terms supports troubleshooting, particularly during the development phase. The current values of freely selectable data points and flags are displayed and constantly updated here.

### AWLplus<sup>™</sup> structured text

AWL ER	ner (PARC I UNEMAND)	Bauten I AWLDI	INCERTAIN - Inc	0				08	- 21
Qatel Bea	rbeiten Ansicht A	WI Stat	the second second second						
Editiviter	PMK (Sulley)								
061 yar	iable					(a)	Operator Mode	Operand	1
062	n s integer						LD		
068	c : Loleger					2	FUNCTION .		
001	a t latager					2	1.0	384-039	
005	b r binary = 0	× .				4	HEC	1	
the end	variable.					5	LD	1	
REF						5	51	134-299	
WE STA	25.1					7	LD		
- 4 199	0					10.0	sr	100.00	
KIN MILL	to true repeat					2	END_FUNCT	- Protocord	
411						12	PROPARY	-	
012	a = 0					11	04.	2	
411	while a c 10 a	Z.com				12	10		
034	b = (0 = a)					13	51	10102	
445	If h then					14	LU FOLL	160,8	
416						12	- In-CH	144.10	
417	soto sta	and the second sec				15	E SH	- and	
616	and if					18	10		
441						13	470	845	
-	and shirts a					33	MODER	4	
	addition .					24	12	984./2	
	who he					22	10	6	
						* 29	M	2354/2	
4						18	an .	1944-19	
daitungen	aut Spochebele	are Demante	Autista						
Name	Type	LATE	Spe	frat					_
	INTERE	VAR		10	Sale .				_
С	INTERER	VM	1.1	1	Sale				
A	INTEGER	VAR	1	2	Sale				
8	1003	YWE		2.0	Sele				

By using AWLplus<sup>™</sup> an IL program can be written as structured text in HiText<sup>™</sup> oriented syntax. The program is translated into the IL syntax before being executed.

A simple exchange of program parts is possible using the HiText<sup>™</sup> editor via the clipboard.

A thorough syntax and error check is carried out before the actual transfer of the completed program into the LabManager<sup>®</sup>/ MSRmanager<sup>™</sup>.

Product code	Description
SF-AWL	IL control module for an AS
SF-AWLPLUS	AWLplus™ control module for an AS, IL and structured text

## Linearisation tables

In addition to the standard linearisation tables for thermoelements which are firmly implemented in the MSRmanager<sup>™</sup>/MSRbox<sup>™</sup> and LabManager<sup>®</sup> ASs, further personal linearisation tables and characteristic curves can be defined by the user. These are called user tables.

Any desired function can be discretely described via sampling points with the help of a user table. A function is described by entering into a table up to 64 sampling points between the smallest and largest value of the input variable (graphically or automated).

A selection can be made between a general characteristic curve, a

thermoelement and a resistance sensor.

In this way special sensors can be easily linked even if their characteristic curves are only available as non-linear tables.

Completed user tables can later easily be used as an interface type during the definition of data points.

Product code	Description
SF-ANWTAB	User-defined linearisation tables for HiTec Zang ASs

512 kB memory, page administration of up to 64 kB per page as ring

# Data logger functions for an AS

The data logger module for LabManager®/MSRmanager™ and LabBox<sup>®</sup>/MSRbox<sup>™</sup> ASs saves the data which occurs in the case of an OS failure. The data are automatically transferred to an OS as soon as an OS is available again.

**Technical data** 

buffer, storage of up to 32,000 events.

### **Product code** SF-DATLOG

Data logger module for HiTec Zang ASs



Prefabricated parameterisation for laboratory apparatus see "Driver programs for laboratory equipment interfaces" on page 129.

Description

# Computer networking in the laboratory

A number of computers exist in a modern laboratory which are used for very different purposes. This increasingly includes operator stations (OSs) for the automation systems. A computer must be connected to a computer network in order to be able to make use of central services, such as printers, LIMS, intranet and internet. In many companies only certain devices which have been validated by the IT department (PCs or similar devices) may be connected to the company network. Also, only software which has been validated by the IT department may be installed on these devices. Virus scanners are obligatory.



Systems

### The integration of a laboratory computer in the company network is associated with serious disadvantages

- > Care by the IT department is very expensive
- > The automatic installation of patches/updates may cause operational malfunctions and involve high consequential costs (functions of existing software may be affected by the patch/update)
- An obligatory virus scanner and other software running in the company network may seriously disturb time-critical operations in the automation software
- > The flexible working methods required in an R&D environment are greatly hindered. New software must always be first validated
- The general replacement of PCS every two years causes consequential costs, because, for instance, proven software no longer runs or proven hardware components no longer work

This brings about the idea of installing an internal laboratory network in which proven workplace computers are not changed and are available for operation in the laboratory without any malfunctions.

# An internal laboratory network, separated from the company network, offers the following advantages

- > Significantly lower maintenance costs
- > Best possible data security
- > Greatest possible flexibility
- > No operational malfunctions as a result of the installation of patches and software updates
- > No disruptive virus scanner

#### Unfortunately, significant restrictions also arise as a result

- > Remote access from an office PC to an OS is not possible
- > Remote maintenance is not possible
- Storage of test data on a secure company file server is only possible using an external data storage medium, normally a USB stick

These problems may be theoretically solved by the linking of the laboratory and company networks via a router with a firewall. However, for security reasons IT departments reject the linking up of networks which are not maintained by them to a company network.

Laboratory operators therefore have a real problem.

HiTec Zang offers an elegant way out of this dilemma with the Lab-Net<sup>™</sup> concept without having to accept any significant restrictions.

LabNet<sup>™</sup> is based on a level II network which is fully separated from the company network (or via a router/firewall). The level II laboratory network may be operated with or without LabNetManager<sup>™</sup>, depending on requirements. A key element in the LabNet<sup>™</sup> concepts is the RoBox<sup>™</sup> (remote operation box). Despite the completely physical separation of the laboratory and company networks, the RoBox<sup>™</sup> enables an alternative operation of the office computer and an OS at the office workplace with only one bundle of monitor and keyboard/ mouse. Access to a LabVision<sup>®</sup> project on an OS is achieved by remote desktop (exclusively) or with the aid of WebVision<sup>™</sup>/WebVision<sup>™</sup> Plus without placing any restrictions on the operation of an OS.

The RoBox<sup>™</sup> contains a special dual-port data memory unit which can be switched between the laboratory and company networks, thus enabling a data transfer between the two networks. This form of data transfer provides the best possible security and is significantly more safe than the current practice using portable data storage media. Thus, a big problem is simply solved.

The demands on an optimal IT infrastructure for networked workplaces vary between laboratories. It is important to identify a suitable structure for a rational and comfortable mode of operation.

The following questions, in particular, need to be clarified:

# Is it necessary for laboratory technicians to have to administer other workplaces for a certain period of time?

The LabNet<sup>™</sup> concept permits, for example, a member of staff to take over control where necessary in all the structures shown below (e.g. during a break or shift change).

Without the use of WebVision<sup>™</sup>/WebVision<sup>™</sup> Plus it is necessary to know the Windows<sup>®</sup> login data of the workplace of which temporary charge is to be taken in order to take over control of the Windows<sup>®</sup> system by remote access. This is not necessary when using WebVision<sup>™</sup>.

WebVision<sup>™</sup>/WebVision<sup>™</sup> Plus enables access to the operational and monitoring functions of LabVision<sup>®</sup> on an OS, however only limited to the HiText<sup>™</sup>, HiBatch<sup>™</sup> and EasyBatch<sup>™</sup> functionalities. In contrast to remote desk-top access, WebVision<sup>™</sup> enables parallel access to a LabVision<sup>®</sup> project from an office PC without any mutual restrictions or hindrances occurring. Several users can also be given access to a project using WebVision<sup>™</sup> Plus.

The access to the individual WebVision<sup>™</sup> operating functions is administered through the LabVision<sup>®</sup> user administration.

#### Should data be exchanged between workplaces?

The OSs permit access to test and result data controlled via user rights.

#### Should recipes be centrally administered?

The HiTec Zang LabNetManager<sup>™</sup> enables central administration and distribution of recipe data to the workplaces.

#### Should the test data be centrally stored and protected?

The HiTec Zang LabNetManager<sup>™</sup> supports the storage and administration of test data and provides operation resources for data protection.

# The following structures of the workplace organisation are possible

- 1. A user works at one workplace (e.g. a flue) and uses an OS (operator station = operating PC).
- 2. One user administers several workplaces with an OS.
- 3. Several users share one workplace with an OS.
- 4. Several users work at several workplaces and use a central OS.
- 5. Several users work at several workplaces and use several OSs.

For remote maintenance a GSM modem is used which is only connected with the relevant OS or the LabNetManager<sup>™</sup> as required. The connection to the maintenance company may only be made under the control of a member of the laboratory staff and is thus secure.





In a LabVision® system one project for a user (a Windows® account) can be loaded into the LabVision® system in a user session. The system can also be sequentially used by several users. Each user then has access under his personal account to his projects and data.

### Operation

- > Keyboard, mouse and monitor of an OS
- > Alternative operation via RoBox™/remote desktop from the office workplaces. Keyboard, mouse and monitor of the affected OS are deactivated during this mode of operation
- > Parallel independent access to a LabVision® project using WebVision<sup>™</sup> (WebVision<sup>™</sup> option required)

Process Analytics Sensors

Laboratory Apparatus

Accessories

Each user controls several laboratory workplaces via one OS



In a LabVision<sup>®</sup> system one or more projects (MultiProject option) for a user (a Windows<sup>®</sup> account) can be loaded into the LabVision<sup>®</sup> system in a user session. The system can also be sequentially used by several users. Each user has access under his account to his projects and data.

### Operation

- > Keyboard, mouse and monitor of each OS
- > Alternative operation via RoBox™/remote desktop from the office workplaces. Keyboard, mouse and monitor of the affected OSs are deactivated during this mode of operation
- Parallel independent access to a LabVision<sup>®</sup> project using WebVision<sup>™</sup> (WebVision<sup>™</sup> option required) per project (per workplace)

### Several users operate one or more laboratory workplaces via a common OS



This configuration is essentially an emergency solution where there is insufficient space. It can only be achieved with the agreement and involvement of the IT department.

### Operation

- > Preferably with the aid of a space-saving ABKTouch<sup>™</sup> OS
- > Alternative operation via RoBox™/remote desktop from the office workplaces. Keyboard, mouse and monitor of the affected OS are deactivated during this mode of operation
- > Parallel independent access to a LabVision® project using WebVision™ (WebVision™ option required) per project (per workplace)
- > The project development takes place via remote desktop operation using the MultiRD<sup>™</sup> tool which, in contrast to a Windows® remote desk-top, enables multi-user parallel access to an OS

Laboratory Apparatus

Accessories

Several users control several workplaces via several OSs



Particularly in multi-user operation, the operators should also plan the central administration of projects and information/data.

A LabNetManager<sup>™</sup> for archiving and for data back-up simplifies handling and increases the reliability of the whole system.

The use of a LabNetManager<sup>™</sup> is especially recommended if several users work with several OSs. Access for the management of the Lab-NetManager<sup>™</sup> is carried out via an OSs or office workplaces.

The scenarios shown are only examples which were tested under practical conditions. In individual cases divergent or new scenarios could appear. The setting up of a laboratory network with remote access always requires agreement with the specialist departments in addition to taking the operational procedures into account.



Any other questions?

Please call us. Our project engineers will be happy to take your call

### Operation

- > Preferably with the aid of several OSs in the immediate vicinity of the flues
- > Alternative operation via RoBox™/remote desktop from the office workplaces. Keyboard, mouse and monitor of the affected OSs are deactivated during this mode of operation
- Parallel independent access to a LabVision<sup>®</sup> project using WebVision<sup>™</sup> (WebVision<sup>™</sup> option required) per project (per workplace)
- The project development takes place via remote desktop operation using the MultiRD<sup>™</sup> tool which, in contrast to a Windows<sup>®</sup> remote desk-top, enables multi-user parallel access to an OS

## LabNetManager™

The LabNetManager<sup>™</sup> is a module within the LabNet<sup>™</sup> concept and provides the following functions

- > Central administration and distribution of automation projects
- > Central administration and distribution of recipes
- > Archiving of the data gathered in tests
- > Central data protection
- > Central administration of user rights
- > Central clock, optionally based on a radio-controlled clock (Europe)

# MultiRD<sup>™</sup> tool

The MultiRD<sup>m</sup> tool (multi remote desktop) is used for the provision of multi-user and multi-session functions for an OS. Thus, the LabVision<sup>®</sup> applications are provided for the use of several users at the same time. With the MultiRD<sup>m</sup> tool each user can continue to be granted certain access rights to the installed applications (user administration). Within this access can be made to the system via an office PC or on a wireless basis via a smartphone or tablet PC (from HTML5 onwards).

# RoBox™

The RoBox<sup>™</sup> (remote operation box) is a key element of the Lab-Net<sup>™</sup> concept. The easy-to-handle box is connected to the monitor, keyboard, mouse and the relevant connections of an office PC and with the laboratory and company networks. Despite the completely physical separation of the laboratory and company networks, the RoBox<sup>™</sup> enables by means of a changeover switch an alternative operation of the office computer and an OS at the office workplace with only one bundle of monitor and keyboard/mouse. Access to a LabVision<sup>®</sup> project on an OS is achieved by remote desktop (exclusively) or with the aid of WebVision<sup>™</sup> without placing any restrictions on the operation of an OS.

The RoBox<sup>™</sup> also contains a special dual-port data memory unit which can be manually switched between the laboratory and company networks, thus enabling a data transfer between the two networks. This form of data transfer provides the best possible security and is significantly more safe than the current practice using portable data storage media.

Thus, many current problems in laboratory networking are simply solved.

## Remote maintenance/remote service

HiTec Zang GmbH places an emphasis on certified secure remote access software in the provision of support for the correction of errors or for remote maintenance purposes.

#### **Connection via**

- > Internet > Modem
- > Network (LAN) > ISDN

#### Applications

- > Remote maintenance
- Remote operation
- Remote service
- Remote diagnostics
- File transfer
- Software maintenance

The OS can be operated from a remotely located user PC with the aid of a remote access software.

This computer virtually provides a second keyboard and a second monitor so that all functions may be carried out as from an OS itself. Both monitors therefore always show the same image. In addition,

### The advantages

- » Support and bug fixing without travelling time
- » Short service reaction times, particularly in critical situations
- » Savings in service costs
- » Security of support session
- » Flexible and simple rights administration
- » Certified secure remote access software

a file transfer is possible in both directions. All keyboard and mouse movements and all monitor displays are transferred via the telephone network, internet or a LAN. Though, you can decide at any time what our support department is allowed to do and what not.

Thus, troubleshooting and bug fixing, network maintenance, file transfer, the installation of updates etc. can be carried out speedily and inexpensively.

Product code	Description
SL-TELES	Remote service, remote connection to an OS for remote maintenance
CP-MODEM2	External modem for the analogue telephone network
CP-MODEM4	External modem for leased lines
CP-ISDNAD	External ISDN adapter for the digital network

# LabVision<sup>®</sup> price structure

The selling price is determined by the number of data points and the selected options. This ensures that you only have to purchase what you really need.

The number of data points to be licensed in LabVision® is calculated as follows:

All used

- > LabManager® inputs and outputs
- > External inputs and outputs and information channels (SF-IFPTSx)
- > Text data points
- Inputs and outputs of device components (including controllers and the device component itself)

- > Monitoring points
- Global variables
- Control data points in LabVision<sup>®</sup> modules such as plotters, worksheets, HiText<sup>™</sup>, export etc.

Flags in HiText<sup>™</sup> and IL do not counts as data points. The required number of data points can be generally estimated as follows:

Number of data points = Number of the inputs and outputs \* automation factor

Level of automation	Tasks	Automation factor
Minimum	Only data logging	1
Low	Data logging with limit value monitoring, simple control	2
Average	Data logging, limit value monitoring, control, regulation	4
High	Data logging, limit value monitoring, control, regulation, complex operator guidance	8

You have a choice in the number of data points between 30, 100, 180, 300, 560, 1,000, 3,000 and 10,000.

Our application consultants will be happy to discuss your automation plans with you and to put together a suitable package for you. The packages can at any time be expanded by adding program options and data points.

Laboratory Reactor

Fermentation Technique

Systems

# LabVision<sup>®</sup> software packages

The following discounted LabVision® software packages have been bundled for the most frequently occurring use cases. They save you the laborious arranging of the individual modules and are, in addition, lower-priced than the sum of the individual modules

Individual packages are provided for continuous and batch processes. The packages can also be individually extended later.

The packages already contain the minimum amount of 30 data points and must be extended to the number required for the application.

## Overview of LabVision® software packages

LabVision <sup>®</sup> module	Product code package	ABVIPKONL	ABVIPKON	ABVIPKONP	ABVIPEASY	LABVIPBATL	LABVIPBATE	ABVIPBAT	ABVIPBATP	Fermeni Techni
		SL-I	SL-I	SL-I	SL-I	SL-I	SL-I	SL-I	SL-I	ne
SL-LABVIS (LabVision® basic package 30 c	lata points)	Х	Х	х	х	Х	х	Х	Х	chniq
<b>SL-HITEXT</b> (HiText <sup>™</sup> multitasking control s	ystem & online evaluation)	X <sup>2</sup>	Х	х	х	Х	х	х	Х	on Teo
<b>SL-HIBATCH</b> (HiBatch <sup>™</sup> batch control mod	dule)					X <sup>8</sup>	Х	Х	Х	matic
SL-EASYBATCH (Table-based recipe and s	equence control)				Х					Auto
<b>SL-ACTIONTRACK</b> (For the recording of o EasyBatch™)	perating activities for				х					
<b>SL-GOPBIB</b> (HiTec unit operation library fo	or HiBatch™)					X <sup>9</sup>	Х	х	Х	dling obot
SL-DIAPROT (Dialogue and report forms,	tables and diagrams)	Х	Х	х	х			х	Х	Hand Ory R
SL-ONLGRA (Online chart with reference curve display)				Х					Х	iquid
SL-SCHANA (Analogue plotter, MDI-capable)		X <sup>5</sup>	Х	Х	X <sup>5</sup>	X <sup>5</sup>	X <sup>5</sup>	х	Х	L L
SL-SCHERE (Event plotter)		X <sup>6</sup>	х	Х	X <sub>6</sub>	X <sub>6</sub>	X <sub>6</sub>	Х	Х	
SL-SCHPHA (Phase plotter)					X <sup>7</sup>	X <sup>7</sup>	х	х	Х	
SL-UEBMEL (Monitoring and messaging)			Х	Х					Х	ysten ps
SL-DESIGN (Designer)		X <sup>1</sup>	Х	Х	X <sup>1</sup>	X <sup>1</sup>	Х	х	Х	Pum S
SL-MODBIBALR (Project module library for Designer)		X <sup>3</sup>	Х	Х	X <sup>3</sup>	X <sup>3</sup>	х	Х	Х	Dos
SL-PROJMOD (Project module generator and editor for LabVision®)				Х					X <sup>10</sup>	
SL-RIEDIT (RI-CAD <sup>™</sup> in accordance with EN ISO 10628)		X <sup>4</sup>	Х	х	X <sup>4</sup>	X <sup>4</sup>	х	х	Х	SN
<b>SL-BIBRILK</b> (RI-CAD <sup>™</sup> glass library for laboratory systems)								х	Х	parati es
SL-EXPORT (Data export: automatic and externally controlled)				х			Х	х	Х	ry Ap
SL-SELFIL (Selectors and filters)			Х	Х					Х	Drato
SL-BENRECH (Access control with user administration)				х					Х	Labo
SF-AWLPLUS (AWLplus <sup>™</sup> module, IL and structured text)			Х	х				х	Х	
SL-BERICHT (Extended process report with batch/recipe filter)								Х	Х	S
SL-JOURNAL (Parameterisable electronic laboratory notebook)								Х	Х	nalyti ors
SL-WEBVIS (Access to LabVision® via a TCP/IP connection)				Х					Х	ess Ai Sensc
<sup>1</sup> Light- version: one spreadsheet with max. 400	visualisation objects	<sup>6</sup> Light- ve	rsion: Resu	ults are on	ly displaye	d as brief i	note			Proc

<sup>2</sup> Light version: 4 Programs each with 100 lines

<sup>3</sup> Light version: Limited library see SL-MODBIBALR on page 149

<sup>4</sup>Light version: max. 120 visualisation objects

<sup>5</sup> Light- version: 2 plotter pages each with 8 curves

<sup>7</sup> Light- version: max. 3 phases

<sup>8</sup>Light- version: max. 20 steps, maximum 4 recipe flow diagrams

<sup>9</sup> Light version: Limited library see SL-GOPBIBL on page 160

<sup>10</sup> From LabVision<sup>®</sup> version 2.12 onwards

## LabVision<sup>®</sup> software package Conti-light

This software package is customised for LabManager® 1 and LabManager® 2 or LabBox® 1 and LabBox® 2 ASs and is suited for the automation of small continuous processes.

You can find the contained LabVision® modules in the synoptic table on page 185.

Product code	Description
SL-LABVIPKONL	LabVision® software package Conti-light for the running of small continuous processes

### **Recommended AS modules**

Product code	Description
SF-PID4	Controller module with 4 PID and application-oriented controllers
SF-PDNAMUR	NAMUR protocol drivers
SF-ANWTAB	User-defined linearisation tables
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure

## LabVision® software package Conti-standard

This software package is customised for LabManager® 3 and LabManager® Classic 1 for the automation of medium-sized continuous processes.

You can find the contained LabVision® modules in the synoptic table on page 185.

Product code	Description
SL-LABVIPKON	LabVision® software package Conti-standard for the running of medium-sized continuous processes

### **Recommended AS modules**

Product code	Description
SF-PID8	Controller module with 8 PID and application oriented controllers
SF-PDNAMUR	NAMUR protocol drivers
SF-ANWTAB	User-defined linearisation tables
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure

## LabVision<sup>®</sup> software package Conti-plus

This software package is customised for LabManager® 3 or LabManger® Classic 1 and LabManger® Classic 2 for the automation of large continuous processes. You can find the contained LabVision<sup>®</sup> modules in the synoptic table on page 185.

Product code	Description
SL-LABVIPKONP	LabVision® software package Conti-plus for the running of large continuous processes

### **Recommended AS modules**

Product code	Description
SF-PID16	Controller module with 16 PID and application oriented controllers
SF-PDNAMUR	NAMUR protocol drivers
SF-ANWTAB	User-defined linearisation tables
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure
## LabVision<sup>®</sup> software package EasyBatch<sup>™</sup>

This software package is suited to all ASs for the automation of small batch or continuous processes.

You can find the contained LabVision® modules in the synoptic table on page 185.

# Product codeDescriptionSL-LABVIPEASYLabVision® software package EasyBatch™ for the running of small batch or continuous processes

### **Recommended AS modules**

Product code	Description	
SF-PID4	Controller module with 4 PID and application oriented controllers	
SF-PDNAMUR	NAMUR protocol drivers	
SF-ANWTAB	User-defined linearisation tables	
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure	

### LabVision<sup>®</sup> software package Batch-light

This software package is customised for LabManager® 1 and LabManger® 2 or LabBox® 1 and LabBox® 2 for the automation of small batch processes. You can find the contained LabVision® modules in the synoptic table on page 185.

Product code	Description	
SL-LABVIPBATL	LabVision® software package Batch-light for the running of small batch processes	cil po

### **Recommended AS modules**

Product code	Description
SF-PID4	Controller module with 4 PID and application oriented controllers
SF-PDNAMUR	NAMUR protocol drivers
SF-ANWTAB	User-defined linearisation tables
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure

### LabVision<sup>®</sup> software package Batch-economy

This software package offers equipment which is sufficient for the running of a batch operation laboratory reactor system. A suitable system is such as the LabKit<sup>™</sup>-alr2 on page 16. It is customised for LabManager<sup>®</sup> 2 and LabManger<sup>®</sup> 3 or LabBox<sup>®</sup> 2 and LabManger<sup>®</sup> Classic 1.

You can find the contained LabVision<sup>®</sup> modules in the synoptic table on page 185.

Product code	Description
SL-LABVIPBATE	LabVision® software package Batch-economy for batch operation

### **Recommended AS modules**

Product code	Description	
SF-PID4	Controller module with 4 PID and application oriented controllers	
SF-PDNAMUR	NAMUR protocol drivers	
SF-ANWTAB	User-defined linearisation tables	
SF-HITUNE	Automatic parameterisation for SF-PIDxx temperature cascade controller	
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure	

### LabVision® software package Batch-standard

This software package is customised for LabManager® 3 or LabManager® Classic 1 for the automation of medium-sized batch processes. You can find the contained LabVision® modules in the synoptic table on page 185.

Product code	Description
SL-LABVIPBAT	LabVision® software package Batch-standard for the running of medium-sized batch processes

### **Recommended AS modules**

Product code	Description
SF-PID8	Controller module with 8 PID and application oriented controllers
SF-PDNAMUR	NAMUR protocol drivers
SF-HITUNE	Automatic parameterisation for SF-PIDxx temperature cascade controller
SF-ANWTAB	User-defined linearisation tables
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure

### LabVision<sup>®</sup> software package Batch-plus

This software package is customised for LabManager® 3 or LabManager® Classic 1 and LabManager® Classic 2 for the automation of large batch processes. You can find the contained LabVision® modules in the synoptic table on page 185.

Product code	Description
SL-LABVIPBATP	LabVision® Software package Batch-plus for the running of large-sized batch processes

### **Recommended AS modules**

Product code	Description
SF-PID16	Controller module with 16 PID and application oriented controllers
SF-ANWTAB	User-defined linearisation tables
SF-PDNAMUR	NAMUR protocol drivers
SF-HITUNE	Automatic parameterisation for SF-PIDxx temperature cascade controller
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure

## LabVision<sup>®</sup> module overview

## LabVision<sup>®</sup> modules full version

Product code	Option / Function	Catalogue page
SL-ACTIONTRACK	ActionTracker™ for the recording of user activities as an EasyBatch™ recipe program	164
SL-ALRRUF	Alarm call by telephone via voice output	154
SL-ANWINT	Programming interface for Visual-Basic, C++ or DELPHI	171
SL-BENRECH	Access control with user administration and issuing of rights	151
SL-BERICHT	Extended process report with batch/recipe filter	142 the trace of t
SL-CALIBR	Calibration module for the administration of AS calibration data independently of the status of the project	171 E
SL-CLONLV	Clone tool for LabVision® (parallel reactor system)	159
SL-DESIGN	Worksheet designer	145
SL-DIAPROT	Dialogue and report forms with tables and diagrams	156 <sup>1</sup>
SL-EASYBATCH	Table-based batch control	163 ig
SL-EMLRUF	Alarm call by e-mail	153 g
SL-EXPORT	Automated, externally controlled data export	150
SL-HIBATCH	unit operation based batch control with graphic recipe operational sequence editor	157
SL-HILIMSSQL	HiLIMS <sup>™</sup> server software for multiple-user version without an SQL server license	167 <u>e</u>
SL-HILIMS	Laboratory information management system with external SQL server	167 pres
SL-HITEXT	HiText™ multitasking control and online evaluation	155 pip
SL-JOURNAL	Programmable electronic laboratory notebook	165
SL-KALDAS3	KalDas™ 3.0 for reaction calorimetry	37
SL-LABCAM	Multi-LabCam system, server with event-driven video/photo documentation	153
SL-LABVOICE	Synthesised voice output for message, HiText™ and alarm call modules	153 E
SL-MULTIBATCH	HiBatch™ extension for parallel synthesis	159 S
SL-MULTIPROJ	Multiple starting of LabVision® on a computer (several projects parallel)	149
SL-ONLGRA	Online chart with reference curve display, capable of several MDI child windows	144
SL-PNKSIM	Emulator fir HiTec ASs (including HiSim™)	172
SL-PROJMOD	Project module generator and editor for LabVision®	147 Jarah
SL-REZGEN	Recipe series generator	353 dd 9
SL-RIEDIT	RI-CAD™ in accordance with EN ISO 10628	147 147
SL-SCHANA	Analogue plotter, capable of several MDI child windows	143 og
SL-SCHERE	Event plotter	144
SL-SCHPHA	Phase plotter	143
SL-SELFIL	Selectors and filters	150 IS
SL-SIGNA	Electronically signed file storage for LabVision® and HiText™	171 IV
SL-SMSRUF	Alarm call by SMS message	154
SL-SRVMOD	Modbus server for the provision of LabVision® data for Modbus/TCP clients	191
SL-SRVOPC	OPC server direct access 2.0 for LabVision <sup>®</sup> systems from 2.11 onwards, configurable full version	191
SL-SWITCHER	Enables the administration of various LabVision® versions on a PC	171 នូ ទី
SL-UEBMEL	Monitoring and messaging	152 Joint Land Land Land Land Land Land Land Land
SL-WEBVISPLUS	WebVision™ with the possibility for multiple starts, simultaneous access to several projects	151
SL-WEBVIS	Access to active LabVision® projects via a TCP/IP connection	151

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### LabVision<sup>®</sup> modules light Version

Various modules are also available as a light version. The dimensions are such that in most cases they are sufficient for simple tasks.

Full-version and light-version modules may be combined.

Product code	Option / Function	Catalogue page
SL-DESIGNL	Designer, light version, one worksheet with 400 visualisation objects	145
SL-HIBATCHL	Batch control module, light version, with 20 steps, 4 recipe flow diagrams	157
SL-HILIMSL	Single user license HiLIMS™ with local SQL database (max. volume 4 GB; no external SQL server access)	167
SL-HITEXTL	HiText™ light version, 4 programs each of 100 lines	155
SL-ONLGRAL	Online chart, light version, 2 diagram pages each with 8 curves	144
SL-RIEDITL	RI-CAD™ light version, one worksheet with 120 visualisation objects	147
SL-SCHANAL	Analogue plotter, light version, 2 plotter pages each with 8 curves	143
SL-SCHEREL	Event plotter, light version, without note function.	144
SL-SCHPHAL	Phase plotter, light version,maximum of 3 phases	143
SL-SRVOPCL	OPC server direct access 2.0 for LabVision® systems from 2.11 onwards, light version not configurable	191
SL-WEBVISL	WebVision™ light version, only multi-plotter visualisation	151

### LabManager<sup>®</sup>/MSRmanager<sup>™</sup> AS modules

Product code	Option / Function	Catalogue page
SF-ANWTAB	User-defined linearisation tables	176
SF-AWLPLUS	Extended IL module with structured text in HiText™ oriented syntax	176
SF-AWL	IL EN 61131 control module, including programming surface	174
SF-DATLOG	Data logger function, data buffering in an AS in the case of an OS failure	177
SF-HITUNE	Automatic parameterisation for temperature cascade controllers	174
SF-PIDxx	PID or application-related controllers	173

xx = 4, 8, 16, 24, 32 or 64 controllers

Note: A Modus driver for an AS is already contained in the SF-PDMODBUS option

### Libraries

Product code	Option / Function	Catalogue page
SL-BIBRILK	Glass and laboratory device library for RI-CAD™	147
SL-GOPBIB	Unit operation library for LabVision®	160
SL-MICROBIB	MicroLab™ Designer library for LabVision®	149
SL-MODBIBALR	Project module template library for LabVision®, full version	149

Note: The unit operation library (SL-GOBIB) and the project module template library (SL-MODBIBALR), are also available in a light version (SL-GOBIBL, SL-MODBIBALRL)

### Servers

Product code	Option / Function	Catalogue page
SL-SRVMOD	Modbus server for the provision of LabVision® data for Modbus/TCP/IP clients	191
SL-SRVOPCL	OPC server direct access 2.0 for LabVision® systems from 2.11 onwards, light version not configurable	191
SL-SRVOPC	OPC server direct access 2.0 for LabVision® systems from 2.11 onwards, configurable full version	191

### Others

Product code

SL-TELES

**Option / Function** 

Remote maintenance software

Catalogue page

Laboratory Reactor

Systems

Fermentation Technique

**Automation Technique** 

## LabVision<sup>®</sup> servers

### OPC servers

The new HiTec Zang OPC DA 2.0 server enables networked access to loaded LabVision<sup>®</sup> projects.

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The industrially compatible (Direct Access 2.0) OPC server provides OPC clients with read and write access to data points and objects in LabVision® projects. Thus, bi-directional communication is enabled, both with external SCADA systems and also between different LabVision® units on one or various different OSs (this additionally demands an SF-PDOPC driver)

#### The light version of the OPC server (SL-SRVOPCL) offers

- Access to the values of all numerical data points and device components
- > Access to text data points
- > Access to reporting data points (alarms)
- > Communication of the data point status (e.g. sensor break, manual)
- > Possible interrogation of important data point characteristics such as unit, identifier, automation device
- > Multi-project support (SL-MULTIPROJ)
- > Support for user administration (SL-BENRECH)

#### The full version (SL-SRVOPC) additionally offers

- → Access to HiText<sup>™</sup> and HiBatch<sup>™</sup> programs
- > Access to configured exports
- > Loading and saving of user-defined (optionally signable) configuration profiles

Product code	Description
SL-SRVOPC	OPC server direct access 2.0 for LabVision <sup>®</sup> systems from 2.11 onwards, configurable full version
SL-SRVOPCL	OPC server direct access 2.0 for LabVision® systems from 2.11 onwards, light version not configurable

### Modbus servers

The Modbus server enables networked access to loaded LabVision® projects.



#### The Modbus server offers

- Access to the values of all numerical data points and device components
- > Access to reporting data points (alarms)
- > Multi-project support (SL-MULTIPROJ)

The industrially compatible Modbus server provides Modbus clients with read and write access to data points and objects in LabVision<sup>®</sup> projects. Thus, bi-directional communication is enabled, both with external SCADA systems and also between different LabVision<sup>®</sup> units on one or various different OSs (this additionally demands an SF-PD-MODBUS driver)

Product code

Description

Modbus server for the provision of LabVision® data for Modbus TCP/IP clients

**Process Analytics** 

Sensors

Laboratory Apparatus

Accessories

### SoftManager™

#### The virtual AS

The SoftManager™ supports all characteristics of the new MSRmanger™/LabManager® and has downward compatibility to existing LabManager® Classic and MSRmanager™ devices.

SoftManager<sup>™</sup> permits the use of sub-stations directly above an OS. A requirement is BCUE bus coupler slide-in modules (LM-BCUE) in the sub-stations.

#### SoftManager<sup>™</sup> permits the use in an AS of

- > Serial interfaces of a PC or suitable plug-in cards
- > Instruction list (IL) EN61010 and AWLplus™
- User-related and control system device components of a LabVision<sup>®</sup> system
- Communication device components for pumps, thermostats, stirrers and valves
- > NAMUR and Modbus device components

To operate with interfaces a protocol driver SF-PDNAMUR or SF-PDMODBUS an the needed interface data points are required.

#### Product code SF-SOFTMAN

Description

SoftManager™, LabManager® emulator, dongle required

## HiBuilder™ data evaluation and presentation



A decisive factor in the development of HiBuilder<sup>™</sup> was the demand from many users for a program which combines the simple handling of table-oriented programs with the practically unlimited possibilities of a high level language compiler and which additionally provides a graphical representation in a quality suitable for technical and scientific documentation with public appeal.

HiBuilder<sup>™</sup> can be coupled online via a network with a measurement and control computer so that the current process data are available at the workplace without delay. Complete evaluation programs with a comfortable Windows<sup>®</sup> user interface can be created using HiBuilder<sup>™</sup> in a fraction of the time normally required. Ready-to-use dialogue elements, such as input fields, buttons, option switches are provided for this. Examples are the RAMOS<sup>®</sup> software, LiquiMaster<sup>™</sup>, DosiMaster<sup>™</sup>, KalDas<sup>™</sup> etc.

Spreadsheets in HiText  $^{\rm M}$  syntax enable even demanding evaluations to be created in a clear manner.

The graphical display satisfies the general requirements in relation to the form of diagrams within technical and scientific publications.

The advantages

- » Online coupling for data acquisition
- » Easy handling of even large data volumes
- » Very quick arithmetic
- » HiText<sup>™</sup> syntax for any desired number of complex evaluation programs and worksheets
- » Graphical representation in a quality suitable for public appeal
- » Form generator for dialogue forms, records and reports
- » Mathematical and statistical functions
- » Windows® copy function for tables, diagrams and forms
- » Data export and import for Microsoft® Excel®, data bases etc.



Application created with HiBuilder™

Prefabricated diagram layouts can be adapted as desired to individual needs. A freely editable data table is included in each diagram.



Diagrams can be printed out on paper, transferred to a word processing or DTP program and be reworked using graphics programs such as CorelDRAW<sup>®</sup> or Designer under Windows<sup>®</sup>.

The scopre presentation exactly matches the printed document (WYSIWYG principle).



#### Product code

SD-HIBUILDER

### Description

Program for data evaluation and graphic display under Windows®

#### Large scope for the design of diagrams

- > Free axis allocation of the values, display in an x-y or x-t coordinate system
- > Various line styles, colours and thickness, error bar display and various plotting symbols
- > Freely placeable axes
- > Linear, logarithmic and automatic scaling
- > Large and fine grid dimensions, extra grids, auxiliary lines

The legend and explanatory text can be freely positioned. A data table exists for each diagram. Changes to the table have a direct impact on the chart.

Dialogue forms, reports and self-calculating forms can be created with the aid of the form generator.

In this way you can give your evaluation programs an appealing and easy to handle user interface.

The chart and the table values can now be transferred via the Windows<sup>®</sup> clipboard into a word processing program, such as Microsoft<sup>®</sup> Word<sup>®</sup> and thus be simply integrated into a report.

The functions used here only represent a small section of the various possibilities of HiBuilder<sup>™</sup>. The spreadsheets and the mathematical and statistical functions which are especially customised for the measurement data evaluation give the user the opportunity to automate evaluations of virtually any desired complexity.

Thus, HiBuilder<sup>™</sup> completes the uninterrupted data chain from a sensor up to a presentation which is currently demanded. Inadvertent mistakes can be ruled out. This saves time, costs and inconvenience.

Examples of HiBuilder<sup>™</sup> applications can be found under reaction calorimetry, KalDas<sup>™</sup> and services, application programming.

## RI-CAD<sup>™</sup> CAD program for RI flow diagrams



RI-CAD<sup>™</sup> is the stand-alone version of the LabVision®-RI-CAD<sup>™</sup> software module for Windows®, Linux (Ubuntu, Debian) and Mac OS X® systems. The program enables the creation of P&I diagrams and other forms of drawing without a long time for familiarisation. For this reason it is particularly popular for use in training.

RI-CAD<sup>™</sup> was especially developed for the drawing of P&I diagrams and contains a library in accordance with EN ISO 10628. The P&I diagrams can be used for the planning and documentation of a system.

Attached to the library elements is additional information which can be extended as desired to include such as supplier or maintenance information. The library can be expanded as desired using your own graphic objects.

2D drawings may be exchanged via the optional DXF import/export filter with other CAD systems such as AutoCad®.

Thanks to its easy handling RI-CAD™ is also very popular outside the automation technology area.

RI-CAD<sup>™</sup> works based on vector elements. These elements can, in contrast with pixel-oriented drawings, be modified at any time without influencing other elements or suffering a loss in quality. It is, for example, easily possible to increase or reduce the size of a single element without having to completely redraw the whole drawing.

The proven program which is popular with our customers as a result of the extent of its functions and its ease of learning was completely newly created for the version 2 in a modern development environment. Old P&I diagrams (data format PLS) can be opened, edited and saved using the new version.

#### New functions

- > Simple operation (thematic toolbars)
- > Auxiliary lines
- > Legend to current DIN standard
- Each page may contain several layers
- > Creating, deleting and editing of layers
- > Attributes such as visibility, printability and editability
- > Protection against editing, exporting, printing and viewing
- > Saving the document's metadata
- > Parameterised export (quality levels, resolution etc.)
- > Several standard working user interfaces and a freely configurable working user interface
- > Use of headers and footers and frames
- > Automatic updates
- > User characteristics

You can download a free-of-charge demonstration version from our website in order to obtain a better overview of the extent of the functions and operation.



Universities and other training or further education institutes can request a free-ofcharge version of RI-CAD™ including libraries via our website!

Product code	Description
SA-RI-CAD	RI-CAD™ stand-alone software for the creation of P&I diagrams
SA-RI-CAD-DXF	RI-CAD™ DXE import and export filter

### Laboratory component library

The laboratory component library for RI-CAD<sup>™</sup> contains displays of the components of a laboratory process plant which are more detailed and more realistic than the objects in the EN ISO 10628 library.

Here you will find glass reactors of various designs and sizes and glass appliances, such as reflux separators, coolers, vessels etc. as well as clear representations of other laboratory apparatus.

Further libraries are available for training purposes. Please apply to us.



#### **Product code** Description SL-BIBRILK

Glass and laboratory device library for RI-CAD™

### Conversion of pressure units

			Torr				
	Ра		at	atm	(at 0 °C;	m Ws	PSI
	(N/m²)	bar	(kp/cm²)	(kg/cm²)	mmHg)	(at 4 °C)	(lbf/in <sup>2</sup> )
1 Pa =	1	10-5	1.02x10 <sup>-5</sup>	9.869x10 <sup>-6</sup>	7.5x10 <sup>-4</sup>	10-4	145.05x10 <sup>-6</sup>
1 bar =	10 <sup>5</sup>	1	1.019	0.9869	750.006	10.1971	14.5038
1 at =	9.81x104	0.981	1	0.9678	735.56	10	14.223
1 atm =	1.01325x10⁵	1.0133	1.0332	1	760	10.332	14.695
1 Torr (mm Hg) =	133.32	1.3158x10 <sup>-3</sup>	1.36x10 <sup>-3</sup>	1.316x10 <sup>-3</sup>	1	13.595x10 <sup>-3</sup>	19.337x10 <sup>-3</sup>
1 m Ws =	980.67	0.1019	0.1	0.09678	73.556	1	1.4223
1 PSI=	6894.8	0.06895	0.070307	0.06805	51.715	0.70307	1

### Conversion of temperature units

- > 0° Celsius = 32° Fahrenheit = 273.15 Kelvin = 491.69° Rankine
- $rac{}^{\circ}R = (9/5) \cdot K$
- >  $^{\circ}F = ^{\circ}C \cdot (9/5) + 32$
- $\Rightarrow \ ^{\circ}F = [K 273.15] \cdot (9/5) + 32$
- $^{\circ}C = 5/9 \cdot [^{\circ}F 32]$

### Conversion of length units

- > 1 m = 3.2808 ft = 39.37 in = 1.0936 yd = 6.214×10<sup>-4</sup> mile
- > 1 km = 0.21 mile
- > 1 in = 25.4 mm = 2.54 cm = 0.0254 m = 0.08333 ft = 0.02778 yd =  $1.578 \times 10^{-5}$  mile
- > 1 ft = 0.3048 m = 12 in = 0.3333 yd =  $1.894 \times 10^{-4}$  mile
- > 1 mil = 0.001 inch =  $2.54 \times 10^{-5}$  m =  $2.54 \times 10^{-2}$  mm
- $> 1 \text{ mm} = 10^{-3} \text{ m}$
- > 1 cm =  $10^{-2}$  m = 0.394 in = 0.0328 ft
- > 1 mm = 0.03937 in
- → 1 Å (Ångstrøm) = 10<sup>-10</sup> m
- > 1 mile = 1.6093 km = 1609.3 m = 63346 in = 5280 ft = 1760 yd
- > 1 yd = 0.9144 m = 36 in = 3 ft =  $5.682 \times 10^{-4}$  mile

### Conversion of volume units

- > 1 ft<sup>3</sup> = 0.02832 m<sup>3</sup> = 28.32 dm<sup>3</sup> = 0.03704 yd<sup>3</sup> = 6.229 lmp. gal (UK) = 7.481 gal (US)
- > 1 in<sup>3</sup> = 1.6387×10<sup>-5</sup> m<sup>3</sup> = 1.639×10<sup>-2</sup> dm<sup>3</sup> (litre) = 16.39 cm<sup>3</sup> = 16390 mm<sup>3</sup>
- > 1 gal (U.S.) =  $3.785 \times 10^{-3}$  m<sup>3</sup> = 3.785 dm<sup>3</sup> (litre) = 0.13368 ft<sup>3</sup> =  $4.951 \times 10^{-3}$  yd<sup>3</sup> = 0.8327 lmp. gal (UK)
- > 1 lmp. gal (UK) =  $4.546 \times 10^{-3}$  m<sup>3</sup> = 4.546 dm<sup>3</sup> = 0.1605 ft<sup>3</sup> =  $5.946 \times 10^{-3}$  yd<sup>3</sup> = 1.201 gal (US)
- > 1 dm<sup>3</sup> (litre) =  $10^{-3}$  m<sup>3</sup> = 0.03532 ft<sup>3</sup> =  $1.308 \times 10^{-3}$  yd<sup>3</sup> = 0.220 lmp gal (UK) = 0.2642 gal (US)
- > 1 yd<sup>3</sup> = 0.7646 m<sup>3</sup> = 764.6 dm<sup>3</sup> = 27 ft<sup>3</sup> = 168.2 lmp. gal (UK) = 202.0 gal (US)
- > 1 pint = 0.568 dm<sup>3</sup> (litre)
- >  $1 \text{ km}^3 = 10^9 \text{ m}^3 = 10^{12} \text{ dm}^3 \text{ (litre)} = 10^{15} \text{ cm}^3 = 10^{18} \text{ mm}^3$
- >  $1 \text{ cm}^3 = 0.061 \text{ in}^3$
- > 1 m<sup>3</sup> = 10<sup>3</sup> dm<sup>3</sup> (litre) = 35.31 ft<sup>3</sup> = 1.308 yd<sup>3</sup> = 220.0 lmp. gal (UK) = 264.2 gal (US)

## Your way to HiTec Zang ...



A detailed route description may be found under http://go.hitec-zang.de/directions

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