



Digestion and Distillation Solutions

**Highest throughput and
maximized flexibility**



We offer solutions for Kjeldahl and beyond

From milling to analysis

For more than 50 years BUCHI has been developing outstanding solutions for the determination of Kjeldahl nitrogen and non-Kjeldahl applications. It is our utmost ambition to understand and meet your personal demands. Our solutions include innovative products for the entire process workflow, bespoke application support, sophisticated data management and professional maintenance. Thousands of satisfied customers all over the world in quality control and R&D laboratories enjoy our comprehensive approach.

Food



Protein, Non-Protein Nitrogen (NPN), casein (NCN), Total Volatile Basic Nitrogen (TVBN), sulfur dioxide (SO₂), hydroxyproline, formaldehyde, ash

Beverage



Protein, alcohol, volatile acids, diacetyl, sulfur dioxide (SO₂)

Feed



Protein, Non-Protein Nitrogen (NPN)

Chemicals / Agricultural



Ammonia, nitrate, nitrite (Devarda), cyanide (CN), total nitrogen

Environmental Analysis



Ammonia, Total Kjeldahl Nitrogen (TKN), phenol, formaldehyde, phosphate, Chemical Oxygen Demand (COD), nitrate, nitrite (Devarda), heavy metals, (sulfated) ash

Pharmaceutical / Cosmetics



Organic nitrogen, ammonia, urea, formaldehyde, sulfated ash

Our distillation and digestion portfolio comprises of four distinct methods. This allows you to perform classical nitrogen determination according to Kjeldahl, but also reflux digestion typically for heavy metal determination, direct distillation of steam volatile compounds and pre-incineration. For each method we provide one or several solutions. A solution consists of a recommended set of products, applications and a comprehensive service package including software to meet your distinctive needs.

Kjeldahl



Analyte

Protein, nitrogen, NPN, TKN, urea, casein

Method

Nitrogen determination according to Kjeldahl

Milling

Knife mill

Digestion

IR and block digesters

Distillation

Distillation units with different levels of automation

Analysis

Integrated and external titrators

Solutions by BUCHI

«Throughput» p. 6
«Flexibility» p. 8
«Basic» p. 10

Reflux digestion



COD, heavy metals, hydroxyproline, phosphate

Reflux digestion by means of air or water cooling

Knife mill

IR digesters

Third party analytical instruments

«Reflux» p. 12

Direct distillation



Nitrate, nitrite, ammonia, volatile acids, alcohol, diacetyl, TVBN, phenol, SO₂, CN, formaldehyde

Direct distillation of steam-volatile compounds

Knife mill

Distillation units featuring reduction, acidification, steam regulation

Titrators; third party analytical instruments

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Incineration



Ash, sulfated ash

Pre-incineration

Knife mill

Wet Digester

Gravimetric determination

«Incineration» p. 16

Find detailed information at:

www.buchi.com/en/knowledge/technologies/kjeldahl



Solution «Kjeldahl Throughput»

Nitrogen determination at high throughput and full automation

You cope with ever increasing sample loads for nitrogen determination according to Kjeldahl, with rising costs per analysis and requirements for thorough documentation. We offer a solution for analyzing up to 120 samples in a one-person working day, providing a maximum degree of automation in sample and data processing.

KjelSampler K-377



KjelLink PC Software



KjelMaster K-375



KjelDigester K-449



Recirculating Chiller F-314



Scrubber K-415

Your most important benefits

More samples per day and yet flexible

- Unprecedented sample throughput is achieved, with the minimal number of instruments due to accelerated digestions and perfect synchronization between the KjelDigester K-449 and KjelSampler K-377.
- Fully automated process from sample preparation to titration for unattended operation. Direct data exchange with balances, bar code readers, printer, LIMS and PC.
- Quick determination of priority samples using 'Express Positions' even when complex sequences are being operated. Manual single sample operation is possible at any time.

Fully compliant

- Excellent reproducibility by thoroughly programmable procedures including both colorimetric and potentiometric titration in compliance with AOAC, EPA, ISO, EC and DIN regulations.
- Different access levels of authorization, thorough reporting and tracked data manipulation following GLP guidelines.

Comprehensively safe

- Environmentally sound and safe operation. Automated and effective fume transfer, neutralization and cooling of harmful digestion fumes and automatic sample transfer by the KjelSampler K-377 to the KjelMaster K-375.
- Optimal operator protection. Automated and supervised processes, tight sealings and protection shields.

Your solution «Kjeldahl Throughput»



- Distillation, titration: KjelMaster K-375
- Autosampler: KjelSampler K-377
- Digestion: KjelDigester K-449
- Neutralization: Scrubber K-415 (TripleScrub^{ECC})
- Cooling: Recirculating Chiller F-314
- Milling: Mixer B-400
- Data Management: KjelLink PC Software

- Comprehensive list of reference applications
- Customized application support
- Authorized IQ, OQ and PQ documentation
- Useful tools for application development
- Practical workshops, trainings and seminars
- Preventive maintenance including IQ/OQ/PQ
- Minimize downtime thanks to our service hotline

"The «Kjeldahl Throughput» solution for albumin determination in blood plasma is so convincing that we didn't wait too much time to have more than one unit in the lab!"
Quality Control Manager, albumin production, Italy

Solution «Kjeldahl Flexibility»

Nitrogen determination with greatest flexibility and convenience

You want to be flexible by using your products for classical Kjeldahl analysis also for related applications without time consuming changes. Our highly modular solution copes with semi-automated Kjeldahl applications as well as direct distillation.

Linked external titrators



MultiKjel



SpeedDigester K-439



Recirculating Chiller F-308



Optional reflux digestion



Scrubber K-415

Your most important benefits

Highly flexible and convenient

- Save money by using MultiKjel with the innovative reaction detection sensor to reduce your sodium hydroxide consumption for Kjeldahl applications. Combine titrators and dedicated accessories with integrated features and varying sample tube sizes.
- Convenient operation thanks to automated procedures: programmable digestion temperature profiles, automated dilution, alkalization and optional acidification, followed by titration, calculation and aspiration of chemicals.
- Meeting changing needs with ready-to-use pre-programmed methods for various sample matrices and storage of 96 personalized methods.

Fast

- Large digestion time savings of up to 135 minutes. Fast heating and cooling by means of infrared heaters. Optional continuous addition of H_2O_2 .
- Concerted online titration with dedicated titrators while the sample is still being distilled. Automated calculation and result transfer.

Safe and secure

- Maximum safety thanks to perfectly sealing joints and the ultimate four stage Scrubber K-415 (QuadScrub^{ECO}).
- Unauthorized process or data manipulation can be prohibited by password protection of the MultiKjel.

Your solution «Kjeldahl Flexibility»



- Distillation: MultiKjel
- Digestion: SpeedDigester K-439
- Neutralization: Scrubber K-415 (QuadScrub^{ECO})
- Cooling: Recirculating Chiller F-314
- Options: SO_2 accessory and Devarda splash protection for direct distillation; H_2O_2 and reflux accessories; external third party titrators for automated colorimetric or potentiometric titration



- Comprehensive list of reference applications
- Customized application support
- Authorized IQ, OQ and PQ documentation
- Useful tools for application development
- Practical workshops, trainings and seminars
- Preventive maintenance including IQ/OQ/PQ
- Minimize downtime thanks to our service hotline

"BUCHI's flexible solutions makes it possible to efficiently determine protein, TVBN and pepsin. It is easy to use and offers useful safety features for the operator."

Mrs. Suporn Pintong, Quality Control Manager, Grobest Corporation Co. Ltd., Thailand

Solution «Kjeldahl Basic»

Nitrogen determination fulfilling basic needs

You look for a cost-effective product for basic nitrogen determination according to Kjeldahl with straightforward operation. We provide an entry-level solution with little need for sophisticated programming or automated titration but with various options to extend the scope of applications.

Scrubber K-415



Alternative water jet pump



SpeedDigester K-425



EasyKjel

Your most important benefits

Cost-effective

- Entry level solution for basic Kjeldahl applications with little need for automation and documentation.
- More than two hours faster digestion: rapid heating and cooling with IR digestion and further optional acceleration with continuous H₂O₂ addition.
- Flexible multipurpose use for reflux digestion even with varying sample tube sizes. Optional automated acidification and gentle distillation by using the EasyKjel.

Easy to use

- Straightforward operation without programming.
- Quick and easy use with the SpeedDigester K-425 for reflux or H₂O₂ digestion.
- Flexible use of varying sample tube sizes.

Safe and sound

- Keeping the lab atmosphere free of harmful fumes using the Scrubber K-415 (DuoScrub). Ultimate sealing of BUCHI's precise tube joints with the tight suction modules.
- Excellent reproducibility thanks to superb thermal homogeneity and process supervision (RSD < 1%).
- Thorough process and operator safety with sensors for tube detection, cooling water, protective and service door.

Your solution «Kjeldahl Basic»



- Distillation: Distillation Unit EasyKjel (Kjel Line)
- Digestion: SpeedDigester K-425
- Neutralization: Scrubber K-415 (DuoScrub); alternative: Water jet pump



- Comprehensive list of reference applications
- Customized application support
- Authorized IQ, OQ and PQ documentation
- Useful tools for application development
- Practical workshops, trainings and seminars
- Preventive maintenance including IQ/OQ/PQ
- Minimize downtime thanks to our service hotline

"The unit provides fast and accurate results. The operational procedure is very easy and cuts labor costs."
Institut of Agricultural Science, China

Solution «Reflux Digestion»

For COD, heavy metal and hydroxyproline determination

You deal with limited lab space, changing samples and demands for different analytes requiring reflux digestion. We offer a modular all-in-one solution for both Kjeldahl and reflux digestion matching pre-existing external analytical instruments.

Scrubber K-415



SpeedDigester K-439

Recirculating Chiller F-308



Specific accessories
for reflux digestion



Link to to automated
COD analysis



Optional H₂O₂
digestion



Your most important benefits

Range of applications

- Aqua regia, HNO₃ or HCl digestion under reflux (water) for heavy metal analyses in soils, electronic waste, water, food, feed, textile or hydroxyproline in meat.
- COD determination to evaluate the water quality using air condensers according to ISO 6060.
- Fast IR digestion for nitrogen determination according to Kjeldahl. Optional acceleration by continuous addition of H₂O₂ using a dedicated suction module.

Flexible and fast

- Quick and easy switch between Kjeldahl and trace metal, hydroxyproline or COD digestion without laborious conversions.
- Meeting changing needs with 20 ready-to-use pre-programmed methods for various sample matrices and storage of 30 personal methods.
- Classical Kjeldahl digestion time can be reduced to 30 minutes.

Safe operation

- Keeping the lab atmosphere free of harmful fumes with the ultimate four stage scrubbing system. Safe operation with aqua regia.
- Gentle and controlled addition of H₂O₂ with the help of the dedicated optional H₂O₂ suction module.
- Excellent reproducibility thanks to superb thermal homogeneity and process supervision (RSD < 1%).

Your solution «Reflux Digestion»



- Digestion platform: SpeedDigester K-439
- Neutralization: Scrubber K-415 (QuadScrub^{ECO})
- Cooling: Recirculating Chiller F-308
- Digestion options: Reflux by air or water, H₂O₂ suction module



- Comprehensive list of reference applications
- Customized application support
- Authorized IQ, OQ and PQ documentation
- Useful tools for application development
- Practical workshops, trainings and seminars
- Preventive maintenance including IQ/OQ/PQ
- Minimize downtime thanks to our service hotline

"The SpeedDigester is the ideal tool for dealing with medium sample loads for both TKN and heavy metal determinations."

Municipal Sewage Plant, France

Solution «Direct Distillation»

Semi-automated direct distillation of steam-volatile compounds

You deal with limited lab space, changing samples and demands for different analytes requiring direct steam distillation. We offer a modular all-in-one solution covering various steam-volatile compounds with semi-automated operation and direct link to external titrators.

Recirculating Chiller F-314



Linked external titrators



MultiDist

Options for direct distillation



SO₂ distillation



Devarda reduction



Your most important benefits

Range of applications

- Steam volatile compounds such as alcohol, TVBN, volatile acids or phenols are separated best by gentle distillation under reduced steam power.
- Nitrates or nitrites are conveniently reduced in-situ using programmable optional reaction steps.
- Automated dosage of strong acids such as phosphoric acid directly into the distillation tube yields exhaustive distillation of SO₂ or formaldehyde.

Convenient and reproducible

- 96 personalized methods for various sample matrices featuring steam regulation, reduction and dosage of strong acids. Ready-to-use BUCHI approved Application Notes guarantee reproducible operation.
- Communication with a wide variety of titrators reduces manual operation, enables documentation and LIMS integration.
- Prevention of carry-over even of strongly foaming samples thanks to the dedicated Devarda splash protector.

Flexible and safe

- Quick and easy switch between Kjeldahl and direct distillation without laborious reconnection of chemical tanks.
- No manual addition of harmful chemicals. Automated cooling media control.

Your solution «Direct Distillation»



- Distillation: MultiDist
- Cooling: Recirculating Chiller F-314
- Options: SO₂ accessory, Devarda splash protection and acid pump for direct distillation; external third party titrators for colorimetric or potentiometric titration



- Comprehensive list of reference applications
- Customized application support
- Authorized IQ, OQ and PQ documentation
- Useful tools for application development
- Practical workshops, trainings and seminars
- Preventive maintenance including IQ/OQ/PQ
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“The use of the BUCHI distillation unit and the density gauge has significantly accelerated the determination of the alcohol concentration of our medicine and thus made our daily laboratory routine much easier.”
Manufacturer of herbal medicine, Germany

The best solution for your need

Comparison by customer needs, application and characteristics



Needs/Solutions	Page									Samples per day	
«Kjeldahl Throughput»	6				●			● ¹	● ²	20 to 120	
«Kjeldahl Flexibility»	8		●				●			10 to 40	
«Kjeldahl Basic»	10	●				●				< 10	
«Reflux Digestion»	12		●							6 to 36	
«Direct Distillation»	14						●			1 to 40	
Analyte											
Protein, nitrogen, TKN, urea, casein, NPN		●	●	●	●		●	●	●	●	Nitrogen determination according to Kjeldahl
COD, heavy metals, hydroxyproline		●	●								Reflux digestion by air or water cooling
Sulfated ash, ash					●						Pre-incineration
Ammonia, nitrate, nitrite							●	●	●	ammonia only	Direct distillation including in-situ reduction (Devarda)
SO ₂ , formaldehyde, CN, diacetyl, TVBN, volatile acids, phenol								optional			Direct distillation with dosage of strong acids
Characteristics											
No. of samples ³		6/12	12	20	20	4/6		●	●		Sample dilution, steam regulation
Tube size [mL]		500/300/100	500/300/100	300	300	90/49/20		●	●		Dosage (H ₃ BO ₃ , NaOH) and aspiration
Temp./time control			●	●	●			optional			Dosage of strong acids
Heat up time to 400 °C		10 min	10 min	20 min	20 min	5 min	40	256	> 100'000		Result memory
Method memory			50		9	9	8	96	infinite		Method memory
Scrubber control			●	●	●	●		external	internal		Communication with titrator
Auto lift					●			●	●		Port for tank level sensors
Sampler rack				●	●				●		Port for balance, ethernet, KjelSampler

¹ In combination with the KjelSampler K-376 or K-377

² In combination with the KjelMaster K-375

³ Only five 500 ml tubes fit into one SpeedDigester row

Benefit from over 50 years of experience

Frequently asked questions

Explore the differences in IR and block digestions. Learn how to use your Kjeldahl equipment for non-nitrogen applications. Understand the different titration modes. Find out how to reduce your digestion time to 30 minutes.

IR versus block digesters

What are the benefits of IR digestion?	Fast and flexible digestion in terms of sample tube size and non-Kjeldahl applications.
What are the benefits of block digestion?	There is a higher degree of automation (lift) and throughput (compatible with KjelSampler). Some regulations explicitly refer to block digesters.
Why do IR digesters need higher set temperatures?	The IR heat transfer is less effective as there is no direct contact of the sample tube with the heating block. Hence, higher set temperatures are required to achieve the boiling temperature.

Non-nitrogen applications

Why are block digesters of limited use for other applications than Kjeldahl?	Block digesters in general accommodate only one tube size (300 mL). The format is less suitable for modular and bulky glass setups. Both disadvantages are overcome by the flexible SpeedDigester.
What must be considered when distilling steam-volatile compounds other than ammonia?	Depending on the analyte the instrument features "dosage of strong acids", "steam regulation" and "in-situ reduction (Devarda)" are mandatory.

Titration modes

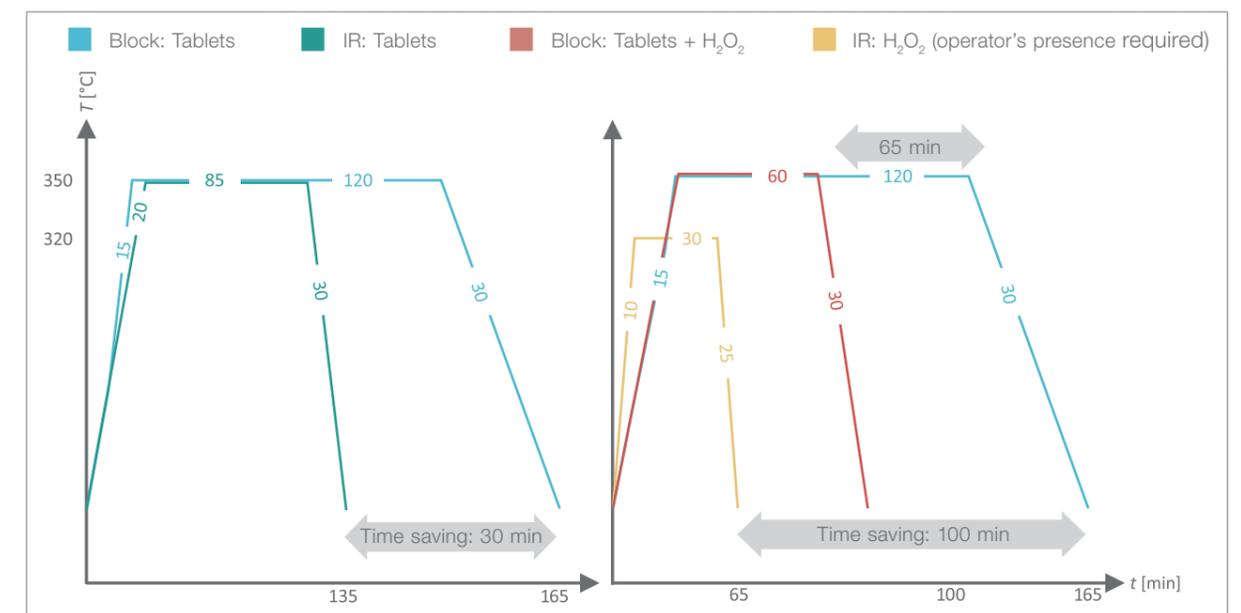
What is the benefit of potentiometric titration?	It allows for lower detection limits, shorter analysis times, online titration as well as the patented automated IntelliDist mode and back titration. There is no need for any indicators.
What is the benefit of colorimetric titration?	It makes sensor calibration obsolete, offers extended lifetime and the endpoint is optically visible.
What is online titration?	Titration starts while distillation is still in progress. Hence, the analysis time for samples with a high nitrogen content can be significantly shortened.
Can I use my own existing titrator?	The MultiKjel / MultiDist are able to communicate with numerous external titrators. Refer to the operation manual.
What is the benefit of back titration?	Back titration is only used when boric acid is not allowed to be used. It requires an optional external dosing unit for precise addition into the receiver.

Accelerating digestion for highest sample throughput

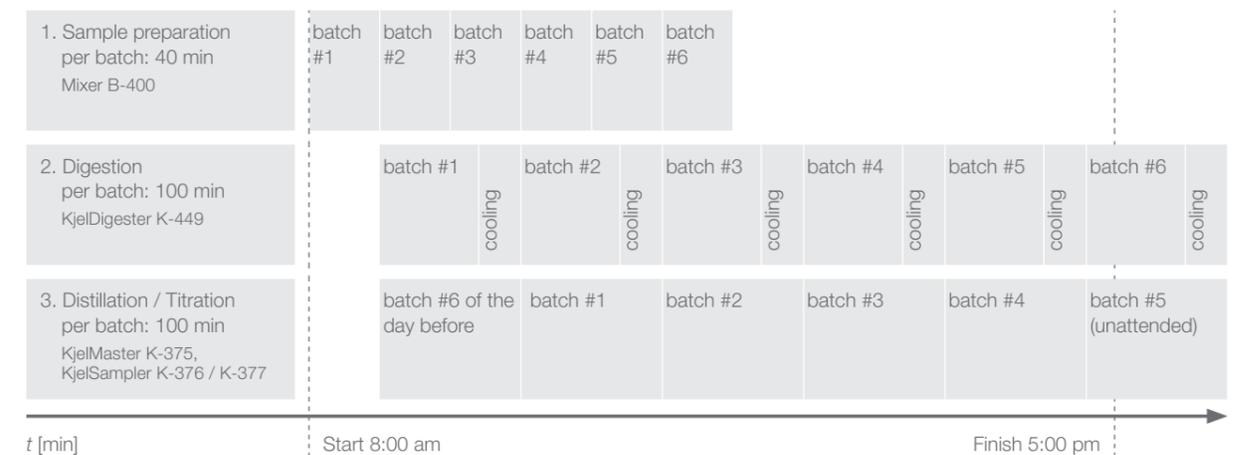
How can I speed up time-consuming heat-up and cool-down periods?	IR digesters are up to 30 minutes faster than block digesters (green vs. blue graph).
Is it possible to shorten the digestion period by adding H ₂ O ₂ and Kjeldahl Tablets prior to heating?	Yes, the time used for metal salt catalyzed Kjeldahl digestions can be reduced by up to 65 minutes (red vs. blue graph).
Is it possible to totally replace metal salts by H ₂ O ₂ ?	Yes, a very fast (30 minutes) and environmental sound digestion is achieved by continuously adding H ₂ O ₂ via capillary funnels (yellow graph).

Reduce heat-up / cool-down periods

Reduce digestion period



Use optimized «Kjeldahl Throughput» solution to get the highest sample throughput (batch size: 20 samples)



Complete your digestion and distillation portfolio
Complementary and related products

Mixer



The Mixer B-400 combines optimal homogenization efficiency with simple operation and flexibility.

Scrubber



The Scrubber K-415 with up to four cleaning steps provides maximum safety for operator and environment.

Recirculating chilling



Sustainable cooling in accordance with economical and ecological needs is achieved with the Recirculating Chiller F-308 and F-314.

Suction modules



Use dedicated suction modules for aqueous samples (condensate trap), accelerated digestion (H_2O_2), metal or COD digestion (reflux).

KjelLink PC Software



KjelLink features thorough documentation, facilitated LIMS interaction, multiple user data management and at-the-desk monitoring.

NIRMaster™



Near Infrared Spectroscopy is the preferred technology to complement classical Kjeldahl analyses with a fast screening method.

Sample tubes



BUCHI precision glass tubes stand for extended lifetime, trouble-free operation even with foamy or splashy samples, and safe processing.

Kjeldahl Tablets



Our high quality Kjeldahl Tablets guarantee reproducible digestions and consider ecological and economical aspects.

Chemicals



Use the BUCHI approved indicator, reference substances and weighing boats for proper operation and reliable performance qualification.

Extraction units



Complete the nutrition analysis with total fat extraction in full compliance with AOAC regulations with the help of the FatExtractor E-500 and UniversalExtractor E-800.

SpeedExtractor



The SpeedExtractor E-914 and E-916 excels in pressurized extraction for residue and contaminant determination in food, soils or consumer products.

Encapsulator



Immobilize flavors & fragrances, vitamins or oils using the Encapsulator B-390 and B-395 Pro.

Core messages to our customers

BUCHI creates added value

“Quality in your hands” is the guiding principle that shapes our philosophy and our actions. It challenges us to provide outstanding services that are precisely tailored to your needs. This means that we must stay in close contact with our customers. That is why we keep in touch and continue to work very hard to understand you and your business even better.

We help you by providing high-quality products, systems, solutions, applications and services that offer you added value. This allows you to focus entirely on your processes and your work.



Competent

We have the technological expertise and decades of experience needed to provide competent support and work with you to continually improve our services.



Reliable

We guarantee the quality and functionality of our equipment and will continue to help you quickly and efficiently whenever something does not operate to your satisfaction.



Safe

By collaborating closely with you, we do everything in our power to make our products, systems, solutions, applications and services as safe as possible for people and the environment.



Cost-effective

We strive to create a high level of economic benefit and maximum added value for you.



Global

As an international family-owned business with own subsidiaries and qualified distributors, we have a presence wherever you are located.



Easy

We support you by providing carefully designed solutions as well as instruments and systems that are easy to operate.



Sustainable

We support environmentally friendly processes and manufacture products that have a long service life. We utilize advanced technologies to leave the smallest environmental footprint possible.

We are represented by more than 100 distribution partners worldwide.
Find your local representative at:

www.buchi.com

Quality in your hands

