

User Report

Campus-wide Image Management Solution revolutionizes Workflows, increases Efficiency and optimizes Communication across Disciplines Group of the Protestant Foundation Augusta

Hospital Group of the Protestant Foundation Augusta in Hattingen and Bochum, Germany, consistently relies on Innovative Solutions from VISUS since 2001.

Today, managing the business of a hospital without going digital is a difficult thing to do. Hospitals which have confronted this issue at an early point in time can profit. The Group of the Protestant Foundation Augusta in Bochum/Hattingen, Germany, started out already in the year 2001. At that time, the focus was typically on radiology and radiological imaging. However, the caregiver with 1,100 beds took a different path right from the beginning, together with the Bochum-based IT service provider VISUS. "Digitizing the campus was a strategic project", outlines IT manager Kay Siercks. "We planned to realize a campus-wide image management, integrating further imaging-oriented departments into the concept for the PACS. We turned out to be successful quickly, e.g., with regard to endoscopy. To date, all other medical departments have been integrated, with modalities such as pelvis copy tower, 3D sonography, or digital cameras for documentation of decubitus. In addition, we communicate effectively with other hospitals and referring physicians. Now the focus needs to be increasingly on long-term archiving of the accruing volumes of data."

The development of the concept was based, on the one hand, on the requirements of the physicians regarding workflow optimization, and on the other hand, on cost issues. It was taken into consideration which activities do not make sense because they are carried out a



Augusta-Kranken-Anstalt GmbH

University teaching hospital of the
Ruhr University Bochum

The Protestant Foundation Augusta is a hospital group with a total of three locations and more than 1,100 beds. The Augusta-Kranken-Anstalt, a Protestant, non-profit hospital is the biggest house in the group with 567 beds. At the hospital sites Bochum-City Center, Bochum-Linden and the Protestant hospital of Hattingen the hospital of maximum medical care holds available a total of 16 specialised divisions. Here about 27,000 stationary and 13,000 ambulant patients are treated yearly.

multiple number of times, and which tasks can be carried out with better results and a higher degree of efficiency by use of modern technologies. “We were aiming at reaching three goals: optimizing workflows, facilitating cross-discipline communication, and increasing quality of therapy and care by continuous availability of all information required”, explains CEO Ulrich Froese.

But of course, functionality on the part of the user is not the only decisive criteria. Efficient management and administration of the PACS is of particular relevance in multi-site use. Due to limited bandwidths available between sites back in 2001, suitable solutions had to be found for centralized administration and archiving. This was achieved by decentralized temporary storage for optimized online access to images on-site with central archiving. The PACS is available for use on all PCs and thin clients – an approximate number of 800 – at any time.

The key prerequisite for the realization of a project of this kind was, however, the willingness to invest in future-oriented technologies. “At the time, this was not an easy thing to do because investments like these were not covered by any budgets. However, everybody involved in the project realized the potentials of the system at an early moment in time, and pushed for it consistently”, recalls IT manager Siercks. During the past years, the IT department changed its focus accordingly. It shifted away from a purely administration-driven approach to clinical issues such as workflow, facilitation of the work, etc.

Wanted: Strategic Partner with Flexible Solutions

This was the situation back in 2001: how can a hospital realize a project as ambitious as this if the comprehensive solutions of the large modality vendors are beyond budgets, and dedicated solutions are hard to come by? You look for a medium-sized, flexible vendor with innovative solutions. The Augusta group found it in VISUS - next door, as it were. “The geographic vicinity was important to us because plans were, right from the beginning, to create



Ulrich Froese
Managing Director



Kay Siercks
CIO

and maintain a long-term partnership with the IT service provider. In addition, the company's philosophy convinced us. Thanks to many years of documented DICOM expertise, VISUS could be considered the first modality-independent PACS vendor. And last but not least, the convincing price-performance ratio was a key argument" – these were, for Froese, the reasons which led to the co-operation with VISUS.

"The JiveX Enterprise PACS was based consistently on Web technologies at that stage in 2001; therefore, it was superior to existing systems – with regard to technology and functionality – already at that time. In our position as a reference customer, we were able to influence further development, with short paths directly to development and support", Siercks recapitulates. The partnership has made a very good development until today, for mutual benefit.

The Augusta Hospital has been, and is until today, the pioneer caregiver for many VISUS solutions. And each of these solutions turned out to be a full success, the same way as the partnership did on the whole. Of particular note are the foresight and vision of the company, which are put on a solid basis by systems which function reliably", says Froese with more than just satisfaction in his voice.

A Cumbersome Path - Crowned with Success

In spite of all positive aspects, in the course of the project quite some internal opposition had to be mastered. "However, that is totally normal in cases where you modify workflows which have been established for years. This requires the willingness to change, and appreciation of increases in efficiency. We had to lay the foundation for that in many cases", is Siercks' description of the cumbersome path which was, however, always crowned with success in the end. The following is a typical example: since late 2002, there existed no longer any conventional X-ray images at Augusta. At first, there was an outcry – but after a week, this was a

matter of the past. There was nobody who missed the X-ray images which had required search efforts, and a light source in front of which to position them by then”, explains Professor Dr. Matthias Bollow, Head Physician, Radiology.

On this basis, complex and comprehensive installations came into existence already at an early moment in time. The PACS is integrated seamlessly into the hospital information system (HIS) from Siemens and into the radiology information system (RIS) from iSOFT. “All interfaces are functioning properly and without problems, as does the integration of the modalities. Both aspects play a key role in daily routine”, underlines Siercks.

“The investment in our PACS has amortized within somewhat more than two years. We were able to reduce the cost of X-ray films, of archiving, and support contracts significantly and to streamline the workflows, increase the number of exams, and improve the quality of medical care”, Froese summarizes contentedly. In addition, the CEO emphasizes that it would not be possible to cope with the continuously mounting volume of image data - e.g. due to introduction of a multi-slice CT – without the PACS.

Introduction of PACS in Radiology

Obviously, it is primarily the Institute of Radiology which profits from the PACS. Head Radiologist Professor Bollow was able to put to use his experiences regarding PACS - from the Charité in Berlin - when the system was introduced at the Augusta Hospital in 2002. He, too, highlights the good co-operation which was developed with the IT service provider, resulting in mutual benefit – in particular in the field of PACS: “VISUS has profited from the know-how of our physicians regarding workflows in radiology and campus-wide image communication; and we obtained a new system which is highly modern from a technical point of view, and the design of which we were able to influence to a large degree. The system was oriented towards requirements, and was further optimized continuously; our demands were realized to a large extent. Once more, this showed a key strength of VISUS which



**Prof. Dr.
Matthias Bollow**
Head Physician
Radiology

Added modalities in the radiology

- ▶ **two CT**
- ▶ **one MRT**
- ▶ **two digital X-ray devices**
- ▶ **three ultrasound scanners**
- ▶ **digital mammography**
- ▶ **screening**

still makes the company stand out today: the quick reaction of the customer service regarding individual customization”.

Today in Radiology, reporting is done at ten PACS workplaces, and access to images and reports is possible from more than 800 workplaces campus-wide. Distribution of images to wards, to the ambulatory department, and to the ORs happens Web-based, access takes place via the patient record in the HIS. In order to ensure effectiveness of the daily routine, availability of all exams is safeguarded in the PACS. “This is how VISUS was successful in integrating our modalities from various vendors completely into the system. Even non-DICOM enabled ultrasound devices transmit their images via a special gateway from VISUS”, says Professor Bollow. Each year, the PACS needs to process around 40,000 exams with a data volume of approximately five terabytes.

However, the installation is not confined to the individual department. An external practicing radiologist, e.g., is fully integrated into the PACS on campus as a second client.

Seamless Workflow thanks to Integration into HIS and RIS

Seamless integration of the PACS into the HIS and the RIS also ensures a seamless workflow. An inpatient is registered for an exam via the HIS, and scheduled in the RIS. In cases where an inpatient or outpatient brings images from preceding exams with him, the relevant exams are imported into the PACS. Conventional X-ray images from referring physicians are scanned by the technologists as required. The data from the RIS required for the exam are linked with the image management via DICOM Worklist.

After the exam, the images are available to the wards directly in the PACS, and are sent automatically to the RIS worklist for reporting. Reporting is done via speech recognition directly in the RIS. Immediately after digital dictation, the preliminary report is available, with a note describing its status. This process is finalized, however, on the same day. “But colleagues can work already



PACS in the OR.

based on the preliminary report. This approach speeds up work and patient care significantly. In the pre-digital era, in the worst case it took up to a week from image acquisition to the physician's report; today, it takes a few hours at the maximum", explains Professor Bollow. This velocity is important in the optimization of workflows and as a contribution to reduced patient stays.

Increased Effectiveness and Smooth Processes

"The PACS increases the effectiveness at the Augusta Hospital on the whole, not just in the radiology department. Positive effects show along the entire care chain everywhere on campus", CEO Froese summarizes his view of the benefits of the system. From a physician's point of view, rapid access, from anywhere, to all the information has improved the quality of patient care.

"I can quickly obtain an overview of the entire history of a patient, including relevant previous images. And the previous image is, after all, the radiologist's friend", Professor Bollow emphasizes the relevance of this aspect. At a click with the mouse, all the information is available to the physician; searching and transport of images, costly in terms of time and staff, is eliminated. Last but not least, this helps improving quality and certitude in diagnostics. "This is supported by the options of post-hoc image processing and multi-planar reconstruction. This helps me to see more information in an image", adds the head radiologist.

The PACS contributes to accelerated processes in the entire hospital. Already the consistent use of voice recognition helps saving two to three days of work. "Radiology exams and reports, today, are no longer anything patients need to wait for. In the end, the accelerated processes contribute to a reduction in patient stays", is Professor Bollow's calculation. But there has been an additional improvement in the quality of the exams, too. "Without a digital representation of the images, reporting can no longer be done effectively based on the volumes of data from modern imaging technologies, in particular from CT. In JiveX, I can even view the image series easily at various parallel levels."

Communication Facilitated Significantly across Disciplines

For Prof. Dr. Alexander S. Petrides, Medical Director and Head of the Department of Internal Medicine, there is another aspect which is gaining increasingly importance: "In my opinion, the core issue regarding clinical workflows is the co-operation between the departments of internal medicine, surgery, and radiology. With the cross-discipline approach to patient care which is required today, e.g. with regard to care for tumor patients or in breast cancer diagnostics, imaging and reporting in radiology plays a key role". The expert's example is the tumor conference which involves various disciplines. In its context, there is rapid access online to all current and previous images so that the entire case history can be visualized. In order to find agreement on the optimal therapy, additional information can be retrieved, and integrated into the discussion.

But outside of clinical demonstrations, too, the PACS has facilitated communication across disciplines significantly. Each physician can access, at each computer in the hospital, all data pertinent to his patient. This allows for the discussion of images and reports between colleagues conveniently by phone. This, in turn, saves time, to the patient's benefit.

Since early 2008, the rounds at the hospital are also digital. This way, all the data is available online at the patient bedside. "With not all patients on rounds known to us physicians personally – in particular in the emergency ward –, it is even more important to have all the information instantly available. For example, X-ray images for last night's new arrivals are available during the morning rounds", are the benefits according to Professor Petrides.



**Prof. Dr.
A.S. Petrides**
Head Physician
Internal Medicine /
Medical Director

PACS Has Become an Integral Part of Hospital Routine

For Professor Bollow, he can imagine neither work in radiology nor clinical routine without the JiveX PACS. "It facilitates and accelerates all processes, it ensures availability of the data for patient care, and improves quality of care. Decisions can be taken faster and more promptly", he concludes contentedly.

This is the reason why he wishes for colleagues to understand, and use, more intensively the PACS solution as a tool for campus-wide communication. In this context, his emphasis is on the integration of all modalities without exception, and utilization on the part of all medical disciplines. "The more information is accessible in the PACS, the more the patient profits", states the head radiologist.

Image Viewing from Home

Since March 2009, there are additional options for radiologists thanks to a DICOM e-mail solution. "We use it primarily for the background duty by physicians, and for the purpose of supervising junior colleagues. In cases where difficult issues come up during night or weekend shifts, they can send the images to the experienced senior physicians, and receive a second opinion", is senior physician Dr. Ulrike Meyer's explanation of the process.

The entire system has been implemented on a preconfigured USB stick, so no software needs to be installed. The stick includes an encrypted partition in which the application is stored, as well as the image data. After the password has been entered, the DICOM Mail application launches automatically, and retrieves the encrypted image data from an e-mail server which has been installed specifically for this purpose. After receipt, the data is decrypted and presented. All unencrypted information is stored exclusively in the encrypted partition. This way, even in the event of loss of the stick, no patient information can end up in the wrong hands.

"I can retrieve, however, only those images which have been sent electively from the hospital", explains Dr. Ulrike Meyer. The



Dr. Ulrike Meyer
Senior Physician
Radiology

captured images are sent in encrypted format to an external e-mail server in the Internet. From there, the user retrieves the images via DICOM e-mail client. The DICOM e-mail format allows for secure transmission of patient information without the necessity of setting up a complex infrastructure such as, e.g., VPN access.

“I can download the images within just a few minutes. The USB stick includes a viewer with the functionalities known from JiveX. This allows me to view the images in good quality, and in a quick and also convenient manner”, is the positive evaluation of solution by the senior physician. In addition to supervision purposes, the DICOM e-mail solution is used in emergencies. Radiologists read the X-ray images at home, and promptly communicate their instructions for initial measures to be taken with the patient. They do not have to come to the hospital first, which saves time.

To Dr. Ulrike Meyer, this solution is a suitable kick-off for tele-radiology: “This way, we can improve patient care during night and weekend shifts, and assure the diagnoses of junior colleagues. The initial experiences are very positive. The entire system is very easy to handle. The key factor regarding acceptance, however, will be for the solution to run in a very robust and smooth manner.”

Introduction of PACS to Endoscopy

The endoscopy, too, profits from the PACS. Dr. Ekkehard Schmidt-Heikenfeld, senior physician, Department of Internal Medicine and his colleagues have been archiving their images in the system already since 2005. For this purpose, all modalities from a multitude of vendors are integrated into the system.

The exam order is booked into the schedule, and previous reports are prefetched automatically. After the exam, the images are transmitted directly to JiveX. Reporting is done in the department at the same day. “We can integrate relevant single images into the report, which is of particular relevance to our communication with colleagues on campus as well as with referring physicians”, says Dr. Schmidt-Heikenfeld. Consultations for the hospital in

Added modalities in the central endoscopy

- ▶ **two gastroscopy workstations**
- ▶ **two coloscopy workstations**
- ▶ **a ERCP (endoscopic retrograde cholangiopancreatography) workstation with digital X-ray equipment**
- ▶ **a sonography workstation**
- ▶ **a bronchoscopy workstation with digital screening**

Bochum-Linden, which is also part of the group, can be carried out very rapidly and conveniently today because that hospital is fully integrated into the PACS. "The images used to require transport, which was costly in terms of time and money. Now we can do our preparations for exams much more effectively because the examining physician is much better prepared for the individual patient and the case", summarizes the senior physician.

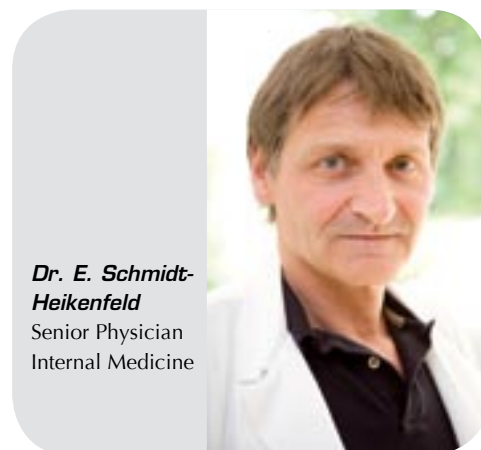
Clear and Structured Access to all Information

The PACS is very well accepted among his colleagues in internal medicine, too. "To us, it is a major facilitator in our work because it enables a clear, structured access to all information, ensuring a rapid overview regarding the individual patient and the case. Previously, maintenance of paper records was sometimes suboptimal; information required searches, which led – in quite a few cases - to delays in the exam and in the therapy", says the specialist in internal medicine.

On the whole, the significant benefit he sees is in the area of diagnostics: films can be archived, and retrieved and viewed for diagnostic purposes. It is in particular for follow-up exams that previous images are a key element in the evaluation of a case. In general, digital images offer more possibilities thanks to processing options, allowing for exams which are more targeted and more precise.

Dr. Schmidt-Heikenfeld, too, emphasizes improved communication: „For referring physicians, we can already add annotations in the image, which makes the consultations much more efficient. The cross-discipline conferences on campus profit considerably from the possibilities of digital image management, too. Live demonstrations, e.g., help bringing all participants up to date“.

Last but not least, the PACS helps to improve the service for patients because images can be presented to, and discussed with, the patient right after the exam. This option is being accepted very well.



Dr. E. Schmidt-Heikenfeld
Senior Physician
Internal Medicine

“We are highly satisfied with JiveX because it ensures for us easy and secure access to all information. The image quality is sufficient; all the various nuances in color are captured precisely. On the whole, the modifications in the work processes have contributed to increased effectiveness and to savings in time.”

Integration of Photographic Documentation into the PACS

At the Augusta Hospital, it is not only the classic medical imaging departments that transmit image information into the PACS. The site in Bochum-Linden is a hospital with a focus on geriatrics. It has two medical departments with a total of 81 beds, an attached department for short-term care with 40 beds, as well as a department for long-term nursing care for more than 100 patients. The site focuses primarily on services for internal conditions during the second half of people’s lives, with a specialization on conditions typical of older age. In addition to age, impairments of physical functions are key aspects for geriatric care – such as ambulatory difficulties, falls, arthrosis, osteoporosis, dementia, etc.

“Since 2004, we have been using digital photography to document forms of decubitus and changes in skin of patients, but also to document wounds. In addition, we capture movement disorders with brief videos. Primarily, these videos serve the purposes of juridical safeguards and continuing education. All images are stored locally; relevant images are sent into the PACS into which we are fully integrated”, describes head physician Dr. Olaf Hagen.

Exact Documentation and More Accurate Diagnostics

The PACS integration has made work more effective, and has improved quality, according to the head physician of the geriatrics department: “Digital archiving supports our diagnostic work substantially in allowing us to find prior comparable cases easily,



Dr. Olaf Hagen
Head Physician
Medical Geriatric
Clinic

and to make comparisons with the current patient. In pre-digital times, when we took photographs with a Polaroid camera, this required significant search efforts”.

The photographic and video documents illustrate exactly the progress patients make during therapy, and they complement the written report substantially. On the whole, geriatricians can convey a better picture of the patient’s state. This holds true, e.g., in cross-discipline communication with plastics surgeons which is facilitated greatly. The daily clinical demonstration at noon turns out to be more effective because during the meeting, photographs and videos can be integrated easily.

“With JiveX, we have a highly innovative system at our disposal which facilitates our work greatly and improves quality of care. I can no longer imagine myself working under other circumstances”, Dr. Hagen summarizes contentedly.

Integration of DICOM ECG into PACS

Since June 2009, Dr. Hagen and his colleagues at the Bochum-Linden site also integrate ECGs and related reports into the JiveX system. The waveforms are passed on electronically in DICOM format to the digital information system where they are available to the clinical workflow. Just like the images and reports from radiology, this information can be searched and displayed using the patient’s name. During the round, they are retrieved via laptop, and discussed directly at the patient bedside.

The writing of reports takes place in the PACS just like in the radiology workflow. “The changeover of reporting from the classic, paper-based workflow to digital processes requires familiarization, however”, observes the head physician of the geriatrics department. “Whoever is used to the long paper strips providing a quick overview needs to adjust to screen-based reporting. The change is much more significant in comparison with X-ray images.”



***Integration of digital wound-
documentation into the JiveX system.***



Integration of ECGs into the JiveX System.

However, the integration of DICOM ECG into the PACS offers significant benefits, as Dr. Hagen explains: "All ECGs are available, at any time, in conjunction with further images, reports, and additional information. During reporting, I can take measurements electronically, and simply enlarge measuring intervals. Last but not least, our options for demonstration purposes are now better. During a conference, it used to be quite impossible to show the narrow paper strips with the ECG waveforms to colleagues – at least in a way that they were actually able to see something." In order to use the system effectively, however, each workplace should be equipped with a display. This is the only way direct reporting of ECGs can be ensured.

Communication with Referring Physicians from the PACS

Cross-sector and integrated models of care are of importance in patient care today. In this context, rapid, seamless communication of image and report data plays a key role in the efficiency and quality of care. This holds true just as well for hospitals with multiple sites as it does for care providers with central radiology departments. Teleradiology solutions help saving the time and money required for the transport of X-ray images, and they improve diagnostics.

In this context, the Augusta Hospital relies on two approaches: communication via a portal from the company ISPro for referring physicians with integrated image distribution from VISUS, as well as on direct data transfer via JiveX DICOM Mail. "Via the portal for referrers, we currently communicate electronically with around 50 referring physicians. The referrer signs a user agreement, and obtains – via a secured data connection (Virtual Private Network, VPN) – access to the images and approved reports for his patients. Both are cached on a separate server, access does not take place directly to the PACS archive server for reasons of security," is IT manager Siercks' explanation of the model.

The transmission of images and reports via DICOM e-mail has already been implemented successfully for selected referring physicians in the context of the "telemedicine24" project.

This allows for easy and – in particular – secure transmission of high-volume image data in reporting quality. In addition, some radiologists have been equipped with this solution for background duty. For this purpose, they obtain a USB stick with an integrated and preconfigured DICOM Viewer.

Furthermore, direct DICOM communication takes place between some departments of the hospital and with co-operation partners at the Protestant Hospital in Herne/Germany. For special case discussions, images are sent from there via a VPN connection to the Augusta Hospital and vice versa.

Outsourced Long-Term Archiving as a Service

Wherever large volumes of data are generated, like here at the Protestant Foundation Augusta, storage automatically becomes an issue. This is why, since 2008, the Bochum hospital has been paying particular attention to outsourced archiving. CEO Froese explains why: "In recent years, data volumes have increased drastically due to the growing technological sophistication of modalities, the increased number in modalities on campus, as well as new diagnostic methods and techniques. Against this background, how can we meet the legal requirements (in Germany, similarly in other countries) of audit-proof archiving for a period of ten, or 30 years respectively, in the most effective and cost saving way? Archiving is not a core competency of the Augusta Hospital, and therefore it made sense to find a service provider for this task. In addition, our internal efforts for staff, operation, migration, storage space, etc. would have been much too costly anyway."



***External long-term archiving with
JiveX SSP.***

This service provider is VISUS, in co-operation with T-Systems. The Bochum-based IT service provider takes care of the infrastructure and data flow, whereas the Telekom subsidiary provides the communication lines and the data center. The solution encompasses the installation, upkeep, and maintenance of the necessary systems; the Protestant Foundation Augusta does not need to invest in hardware or software. Any data and hardware migrations required in the context of the mandatory period of record keeping are also part of the service.

The launch of the project turned out to be rather laborious because enormous volumes of data had to be moved. For example, 1,400 DVDs with data from 2002 to 2006 required backup, which was very time-consuming. On the whole, 36 terabytes of data were moved, consisting of small files. "We started out with the Protestant Hospital Hattingen because the volume of data was significantly smaller there compared to the Augusta Hospital in Bochum.

This helps us making conclusions for large volumes of data at a later time", explains Siercks. The information is then kept available on-site in a non-lossy format for three years, and afterwards is archived also on-site in a format with lossy compression. "Clinical evidence shows that frequency of access approaches zero after those three years," according to the IT manager. In case the images are indeed needed, they are made available again within just a few minutes.

No Internal Archiving, no Worries

In order to comply with German data privacy regulations, the transfer is carried out in three steps. First, the data is sent to the VISUS Archive Gateway. There, the data is encrypted and transmitted to the data center where it is stored in an encrypted format with non-lossy compression. "This means that the data cannot be used by anybody outside our campus", Siercks emphasizes. The data center does not only take care of audit-proof long-term archiving,

but also ensures media transition, migrations, and high availability. "We have a guarantee of all requested data from the long-term archive being made available within a maximum of 15 minutes at each computer on campus. This applies 24 hours per day, seven days a week – which includes time slots when not all the staff in the radiology department or in the archive is present", says IT manager Siercks.

Fees for the service are based on use of storage space over time (terabytes per year). "To us, this is significantly more economical than operating a long-term archive ourselves", says CEO Froese. "With regard to a successful realization of the project, we place a high degree of trust in our reliable partner VISUS and the well-established vendor T-Systems."

- ▶ **Kay Siercks**
CIO
- ▶ **Ulrich Froese**
Managing Director
- ▶ **Prof. Dr. Matthias Bollow**
Head Physician Radiology

*Augusta-Kranken-Anstalt GmbH
University teaching hospital of the
Ruhr University Bochum*

Bergstraße 26
44791 Bochum, Germany

phone: +49 234 - 517 12 - 19
fax: +49 234 - 517 12 - 18

www.augusta-bochum.de
siercks@augusta-bochum.de