SARTORIUS

Biobrain®
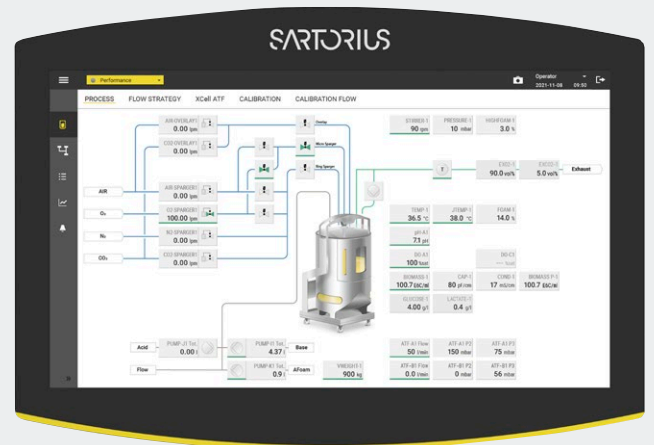# Software and
Automation
Platform

Product Information

Biobrain® is a standard Sartorius automation platform powering Sartorius process units for up- and downstream processing as well as fluid management technologies (FMT). Biobrain® is specially tailored to be applied in regulated pharmaceutical and biopharmaceutical production environments.

Features and Benefits

- cGMP-ready for standalone and various integrated scenarios
- Compliant with industrial standards (e.g., GAMP 5 Cat 4, ISA-88)
- Highly configurable
- Reduced training effort
- Features, security, and compatible instrument types continuously evolving

One Software Solution for Process Units in Up- And Downstream Processing

Biobrain® is a modular automation platform tailored to the diverse needs of various process units in upstream processing, downstream processing, and fluid management (Table 1). By combining the data benefits of reliable industrial hard- and software with a high degree of fully traced configurability and adaptability, Biobrain® can help bioprocess scientists keep up with the increasing demand for flexibility in the era of Bioprocessing 4.0.

In the coming years, Biobrain® will be the standard instrument software solution for newly introduced Sartorius products and product upgrades for instruments targeting commercial manufacturing. As such, Biobrain®-powered process units will share a highly similar user experience across the Sartorius product portfolio, resulting in reduced operator training efforts, improved service quality, a richer functional scope, and seamless integration opportunities.

Table 1: *Currently Available Biobrain®-Powered Product Families*

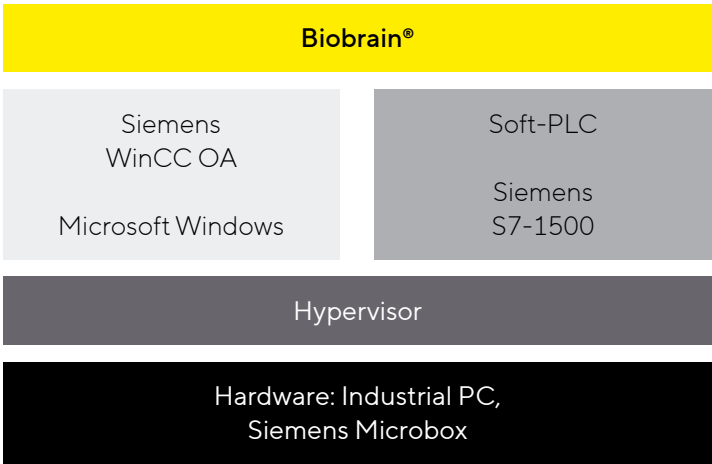| Product Family |
| --- |
| Biostat STR® |
| Biostat® RM |
| AliquoT® |
| Celsius® FFT for large volumes |

Reliable Technology and Industrial Standards

To ensure a safe and user-friendly operation, an automation system for a bioprocess requires a proper strategy. Biobrain® is based on an industrial Siemens Simatic S7-1500 PLC logic controller and Siemens WinCC open architecture (WinCC OA). Siemens I/O boards, as well as the usage of industrial interfaces like Profinet, ensure a reliable and durable hardware foundation.

Typical system setups may consist of an industrial PC (IPC) with a virtualization layer (hypervisor) that allows independent execution of the local graphical user interface software and deterministic execution of PLC software.

Alternatively, versions with physical Hardware PLC are available for some product families.

Figure 1: *Biobrain® Technology Stack*

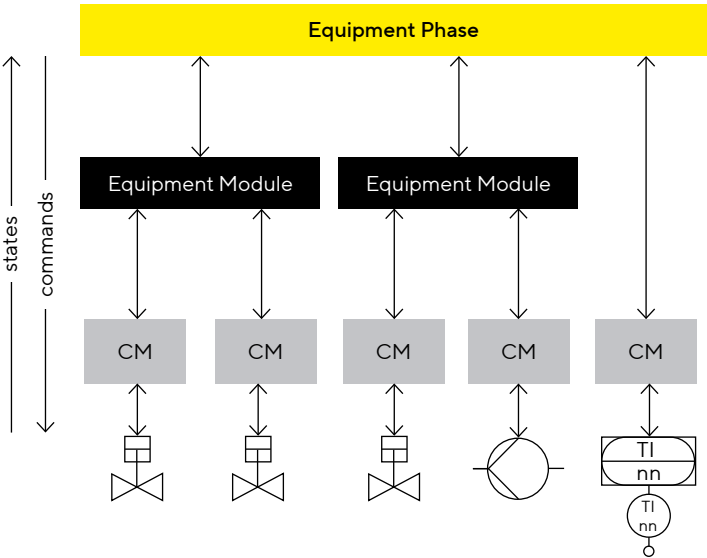| Biobrain®	
Siemens WinCC OA Microsoft Windows	Soft-PLC Siemens S7-1500
Hypervisor	
Hardware: Industrial PC, Siemens Microbox	

ISA-88 Design Philosophy

Biobrain® is based on the ISA-S88 standard for batch control, models, and terminology. This standard provides structures and models that can be used to describe plants and processes in a uniform structure.

Following ISA-88, the automation logic of Biobrain® is organized into control modules, equipment modules, and equipment phases (Figure 2). Control modules perform low-level tasks such as driver-based communication with connected sensors or actuators, data filtering, or PID control strategies. Equipment modules represent a logical group of control modules and provide all necessary capacities for a certain process functionality (e.g., pressure-controlled pump operation) to equipment phases. Equipment phases perform stepwise procedural control to realize small process segments (e.g., harvesting of a bioreactor or filling a bag).

To further automate process execution, the equipment phase can be parametrized and triggered by recipe phases, which are further grouped into recipe unit operations and unit recipes. While control modules, equipment modules, and equipment phases are executed in the deterministic PLC with a representation in the WinCC OA-based user interface, recipe phases, recipe unit operations, and unit recipes are executed only on the visualization layer. This enables Biobrain® users to freely create, modify, and validate recipes using the intuitive recipe editor of Biobrain® Supervise.

Figure 2: *Biobrain® Design Philosophy, Based on ISA-88*

Real-Time Monitoring and Control of Bioprocesses

Biobrain®-powered instruments are primarily designed for either equipment phase or phase level control but also allow lower-level access to control modules such as actuators, sensors, or PID controllers for users with corresponding permissions. All typical levels of control (control modules, equipment phases, and recipe) can be accessed in the monitoring area. The main view screen presents a clear, minimalized, schematic view of the process unit and the most relevant process parameters. Additionally, alarms and charts can be accessed directly from here.

Figure 3: *Main View Screen in Monitoring Area Representing Relevant Sensors | Actuators, (Here Biostat® STR 3).*
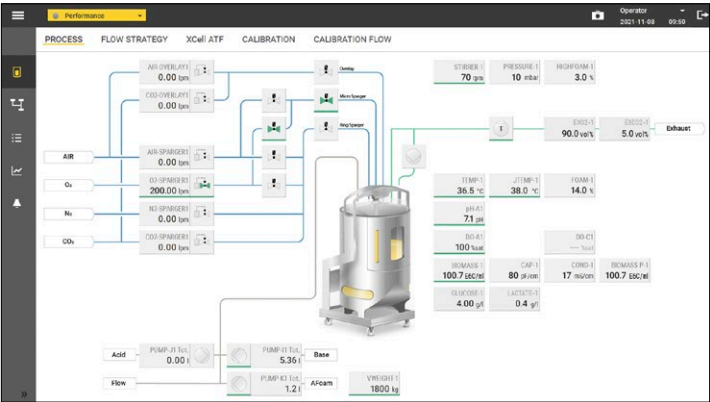
Monitor Real-Time Process Data

The charting module provides a graphical presentation of online and historical trends. Users can select up to 8 values, such as process values, setpoints, and outputs, to be displayed together. Line types, colors, and symbols can be modified; time and value axes can be adjusted. Two-finger pinch and zoom gestures can be used to navigate on the touch screen. Additionally, plot preferences can be stored as reusable templates.

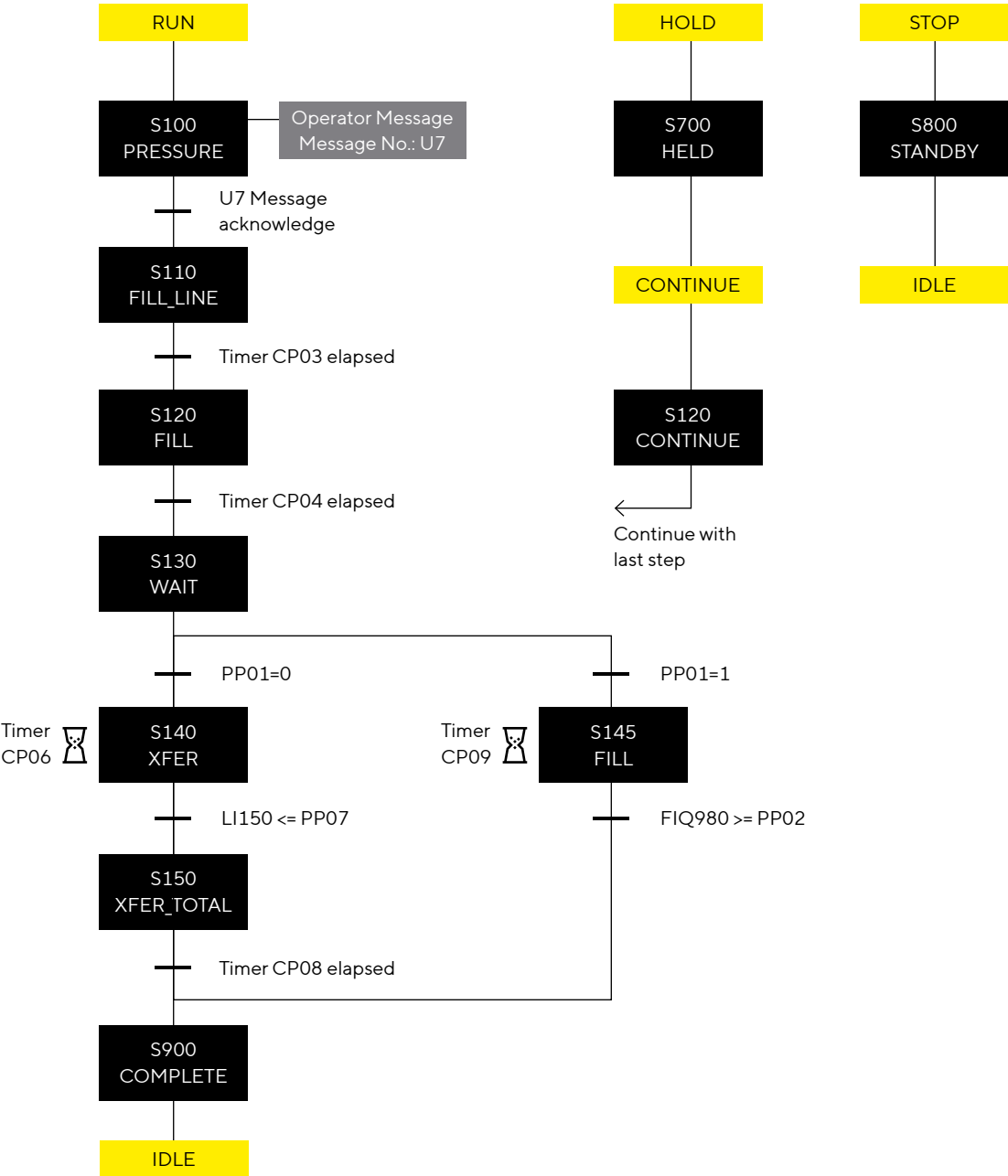**Figure 4:** *Charting of Process Variables*

Equipment Phase Control

Equipment phases provide a structure for procedural control, which allows a stepwise execution of control actions at the process equipment, e.g., automatic sterilization with heat, hold, and cool steps. Phase parameters allow users to adjust the phase execution, e.g., sterilization temperatures or timers. After a phase is started by an operator, the phase is executed automatically without any operator interactions. For phases that need operator interaction at certain steps within the sequence, an operator prompt is provided to inform the operator about the required actions. Corresponding actions are logged in the audit trail.
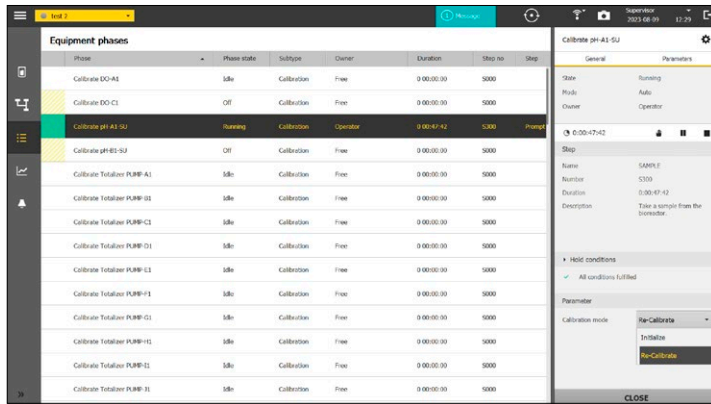
An entire basic process can be executed by an equipment phase, e.g., harvesting of a bioreactor or filling of a bag. Phases can be activated individually or in parallel if they do not share the same equipment modules. Equipment phases of Biobrain®-powered instruments apply the ISA-88 state model, including sequences for running, holding, suspending, pausing, aborting and stopping. All available equipment phases of an instrument are provided and pre-qualified by Sartorius and can be operated directly using the HMI or triggered via the OPC UA interface.

Figure 5: *Example for a Procedural Equipment Phase Structure (Here Filling of the Bags)*

Unit Recipe Control

To further automate bioprocesses and reduce operator errors, recipes can be created and run to schedule the execution of equipment phases. Unit recipes are tailored to execute the process of a single process unit and are created using Biobrain® Supervise as a standalone tool, available for installation on any office PC.

Biobrain® Supervise recipe editor for Biobrain® allows users to create comprehensive unit recipes using sequential and | or parallel branches, as well as jumps. User guidance steps and decision phases can be included to reduce operator failures. Recipes can be transferred to the Biobrain®-powered instrument for local execution or remotely from Biobrain® Supervise.
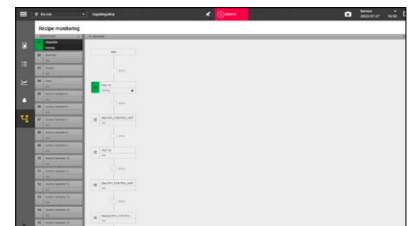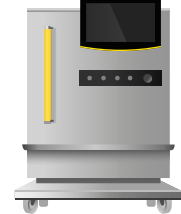
Figure 6: *Recipe Creation and Local Execution*

Biobrain® Supervise recipe editor for Biobrain®
Generate the unit recipe

Biobrain® instrument
Recipe locally executed

Biobrain® screen
Following the execution

Let Us Help You!

Sartorius offers the creation of customer-specific recipes for different applications trough our Advanced order handling service.

Contact: AOE-Support@Sartorius.com

To learn more about recipe editing and execution for Biobrain®-powered devices, please refer to the recipe datasheet, available separately.

Modern User Interface

The modern user interface of Biobrain® provides a visually appealing, user-friendly experience that enhances usability, improves productivity, and empowers users to make data-driven decisions during batch planning and execution (Figure 7-10). It serves as an essential tool in optimizing biopharmaceutical processes while ensuring a pleasant and intuitive working environment for the users. The interface is optimized for touch-operation with button sizes designed for challenging environments e.g., when using gloves.
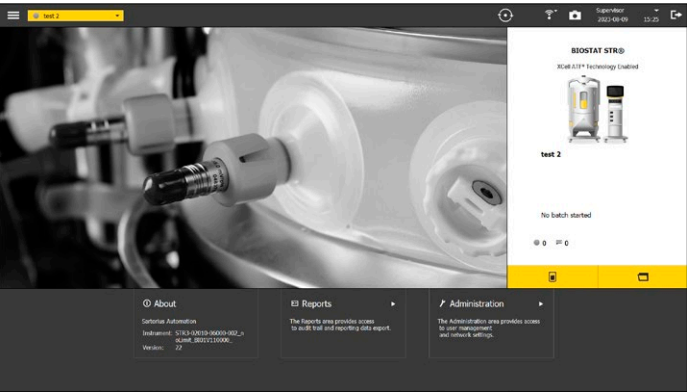
Figure 7: *Example Start Screen*

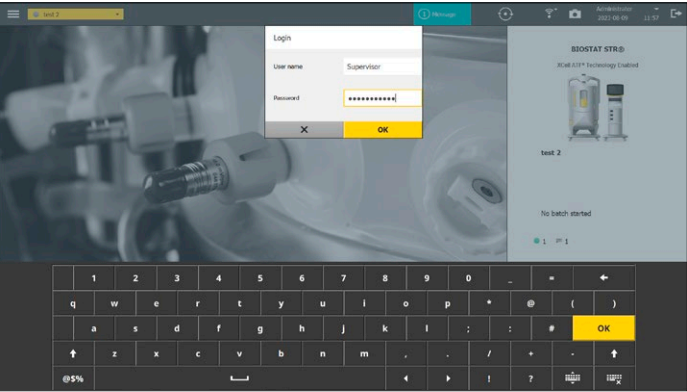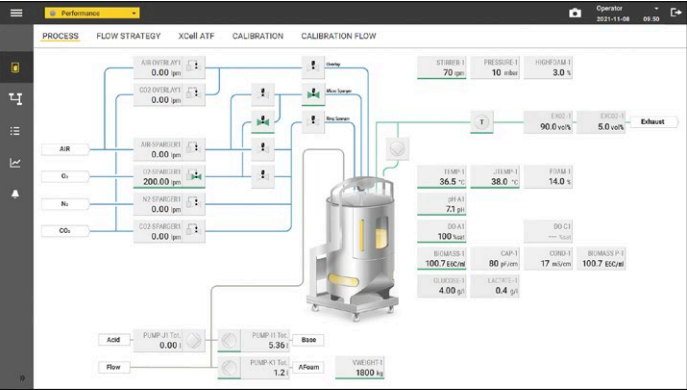**Figure 7a:** *Login With On-Screen Keyboard*

Figure 8: *Monitoring Area With Representing Relevant Sensors | Actuators, (Biostat® STR 3).*


Ready for cGMP

Biobrain®-powered products provide a rich functional scope satisfying all requirements to be implemented in regulated cGMP environments. Development and testing of the software modules are performed according to the GAMP life-cycle approach, enabling the system to be categorized as a GAMP Category 4 Software regarding computer systems validation as matching the requirements for a configurable software. A 21 CFR Part 11 assessment report is provided along with the documentation package.

Among the functionalities tailored for the deployment of Biobrain®-powered products in regulated environments are advanced access control, audit trail, alarms & event management, and batch management.

Access Control

The module for access control ensures only users with sufficient permission rights can perform relevant operations on the system (Figure 9). Biobrain® uses a typical user | role | permission model where users are assigned one or multiple roles, while roles may have one or more permissions. This setup guarantees system administrators full control over the assigned rights. Furthermore, password complexity guidelines, auto-logout behavior, and more can be defined. The Biobrain®-powered instrument can be connected to a domain server to be embedded in centralized user management. In this case, domain user groups are assigned to roles. Alternatively, users and their roles can be maintained locally without connecting to a domain server.

Figure 9: *Configurable Access Control*
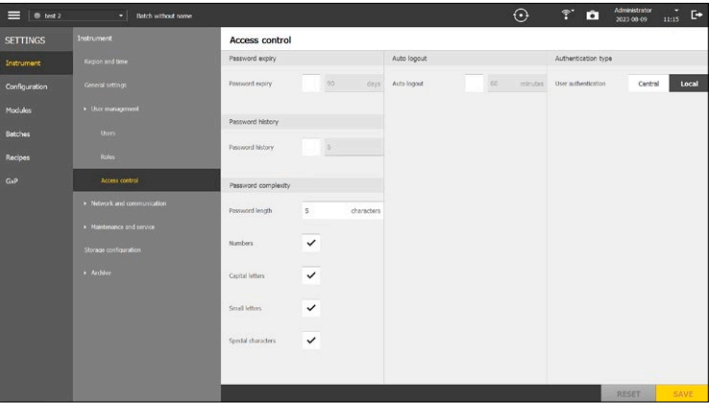
Audit Trail

Biobrain® includes a robust audit trail feature that records and tracks all users within the biopharmaceutical production process. Every action is logged, from parameter changes and data entries to system configuration modifications, providing a comprehensive and tamper-evident record of activities for regulatory compliance and process transparency (Figure 10). Entries contain information for timestamps, usernames, and changed parameters, including old and new values. If required, the operator must provide a reason statement before the change is executed.

Figure 10: *Audit Trail*

Alarm Management

Users can configure custom alarms based on pre-defined thresholds, ensuring prompt identification and response to abnormal conditions. Warnings and alarms are visually and audibly indicated. The software maintains a comprehensive alarm history, storing detailed information about each triggered alarm.

Data Management and Data Integrity

Users with special rights, such as system administrators, can select up to 150 variables to be historized on the instrument for one year (Figure 11). For longer-term storage, archives can be created (manually and scheduled) and stored offline. Archived data can be re-imported for review and report creation (Figure 12). Stored and archived data, such as process data, alarms, and audit trail events, cannot be altered by any user.

Figure 11: *Configurable Data*

Figure 12: *Archiving Management*

Seamless Integration

Biobrain®-powered process units can be deployed and operated in diverse IT infrastructures. The systems do not only provide interfaces to file servers, NTP servers for time and date synchronization, or domain servers for authentication but also provide a powerful OPC UA interface. The latter enables connection to DCS, SCADA, Historian, or MES solutions from various providers, such as Sartorius or Siemens. To learn more about the variety of integration opportunities, please refer to our separate application note covering all possible integration scenarios.

Flexibility

The instrument software of Biobrain®-powered instruments facilitates seamless configuration of the instrument across diverse processes, encompassing a wide design scope. Users can enable | disable sensors or actuators, define default setpoints, establish alarm thresholds, and set equipment phase parameters with ease. Such instrument settings can be stored as templates, which can be approved and loaded on demand. This ensures batches to have identical starting conditions.

Reliability, Cyber Security, And Antivirus

We understand the critical importance of cybersecurity in the biopharmaceutical industry and have implemented comprehensive measures to protect our software solution and the valuable data it manages. By prioritizing cybersecurity, we aim to provide our customers with peace of mind, ensuring the confidentiality, integrity, and availability of their sensitive information and processes. Third-party antivirus software solutions can be installed on the Biobrain®-powered instrument if required. Sartorius assists such undertakings by providing an antivirus response document, including recommended antivirus software solutions.

Life-Cycle

Biobrain® is developed using modern iterative software development approaches with regular releases, which follow semantic versioning. Biobrain®-powered products are updated regularly to incorporate improvements and additional features. Such updates are available for customers via Sartorius Service. Data migration features ensure data integrity during update | upgrade procedures.

Relevant Documentation

Biobrain®-powered products come with a rich set of software-related documentation. The documents listed in Table 2 are available by default.

Table 2: *Biobrain® Software-Related Documentation*

Document	Content
Biobrain® software manual	Instruction manual for the Biobrain® software
21 CFR Part 11 assessment report	The objective of this document is to describe how Sartorius Quality Management System and organization supporting Biobrain® platform and products derived therefrom, helps end users to be compliant to 21 CFR Part 11 requirements.
OPC UA connection setup documentation	This doucment is the user guide for the OPC UA connection setup.
OPC UA interface report	This document describes the procedure how to integrate devices based on Biobrain by use of the OPC UA interface.
Antivirus software guidance	This document is the user guide for the Antivirus software, which is needed for the Biobrain® platform.

Technical Specifications

Category	Functionality	Description
cGMP	Access control (local)	Local user management for setting up users, assigning roles, and defining privileges. Define minimum password complexity, password expiry, auto-logoff behavior, and user locking after a series of false attempts.
	Access control (centralized)	Connect the instrument to a domain and name server to allow centralized access control and assign roles to match with domain groups.
	Audit trail	All relevant user interactions are tracked, including timestamp, old and new value as well as a reason statement (if required and provided).
	E-signature	Additional user credentials entries are necessary for central operations such as batch start | stop | abort or batch report release (if configured accordingly).
	Batch management	Create, approve, start, and stop batches. Select the recipe to be executed during the batch run. After batch completion, create, review, release, and export a batch report. Store up to 100 batch reports on the process unit.
Connectivity	OPC UA server	Connect securely to any OPC UA client (e.g., DCS, SCADA, or Historian solution) using state-of-the-art security modes and policies as well as server certificate handling. Identify the server structure in an OPC server report.
	Remote data acquisition and alarms | events	Acquire and historize data via OPC UA, remotely record and react to alarms, and audit trail events.
	Phase-level integration	Connect to SCADA or DCS systems via OPC UA to execute any equipment phase available on the Biobrain®-powered devices. Remote control can be deactivated by an on-site user.
	Recipe level integration	Connect to an MES system via OPC UA to remotely plan, start, and stop batches and trigger the execution of recipes.
Process monitoring and control	Process control	Intuitive and reliable process monitoring for process values, setpoints, and controller settings. Start, select, and execute equipment phases, follow recipe execution.
	Charting	Follow trends of process values and setpoint, set up customizable charts with up to 8 process values at the same time, store chart settings as templates.
	Alarm management	Define alarm limits for process values, identify and acknowledge active alarms, and review historical alarms. Alarms are indicated visually and audibly. Alarms can be silenced.
	Recipe editor	Create and edit recipes using the standalone Biobrain® Supervise recipe editor for Biobrain® by scheduling the execution and parametrization of equipment phases. Import recipes, assign to batch, start, stop recipes.
	Operator messages	React to useful operator prompts for local operator interaction e.g. during setup, calibration phases, define specific operator messages in recipes.
General	Time and region	Set Region, time and time format accordig to your location. Actual time can be synchronized by connecting to a network time protocol (NTP) server.
	Language	System language is English.
	Screenshots	Take and export screenshots of any screen in the HMI.
Product life-cycling	Lossless update | upgrade	Export user settings to the data container, update system software, and reimport the container to restore all user settings.
	Enhancements	Software is continuously improved to and product updates and upgrades become available.
Data management	Local data management	Select up to 150 process values and setpoints to be historized on the process unit for up to one year.
	Archiving	Process data, events, and alarms can be archived on external devices (network or USB mass storage). Archives can be re-imported to review historical batch data and (re-)create batch reports. Archiving can be triggered manually or scheduled regularly.
	Backup | restore	Back up the entire system and restore it later. Corresponding software and corresponding documentation are separately available.
Service	Ready for Advanced Services	Biobrain®-powered devices are ready for remote service access using the dedicated secured interface.
Cyber security	Antivirus support	A guide about recommended 3rd party antivirus software and necessary settings is provided.
	USB port activation | deactivation	USB ports on the Biobrain®-powered process units can be activated | deactivated.

Ordering Information

Item	Description	Order Number
Backup and restore software for Biobrain®	3rd party software solution to create and restory system backups	BPS0042
AOE	Advanced order execution service	ZB-MB-HA-0045
IC	Interface consulting service	ZB-MB-HA-0044
Customized recipe for Biobrain®	Tailored recipes for your needs	BPS0052