

VALIDATION SUMMARY

MAS-100 Libra® Settle Plate Changer



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1. INTRODUCTION

This summary documents the validation of the MAS-100 Libra® settle plate changer. This instrument is developed following GAMP® 5 guidelines.

1.1. DESCRIPTION OF THE MAS-100 LIBRA SETTLE PLATE CHANGER

The MAS-100 Libra automated settle plate changer is an advanced robotic instrument designed for passive air monitoring of airborne microbial contamination. It can handle up to six 90mm agar plates, making it highly efficient for continuous environmental monitoring.

This versatile instrument supports a wide range of culture media formulations in 90mm Petri dishes, allowing for the detection of various microorganisms. By eliminating the need for human intervention, the MAS-100 Libra ensures uninterrupted monitoring for up to 24 hours.

Control and configuration of the MAS-100 Libra are highly flexible, with options ranging from a simple one button interface to integration with a superordinate system via digital input/output ports or Modbus TCP. Additionally, the instrument can be easily configured through its integrated user interfaces, accessible via a standard internet browser.

The MAS-100 Libra is well-suited for applications in pharmaceutical isolators and critical production environments, as it tolerates VHP decontamination cycles and does not emit particles, making it ideal for use in grade A (ISO 5) cleanrooms.

1.2. INTENDED USE

The MAS-100 Libra is used during microbiological quality control as part of a risk-based quality assurance. The instrument is used to determine the airborne microbial contamination via gravimetric deposition onto an agar plate (passive air sampling).

1.3. GLOSSARY

ABBREVIATION	MEANING
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulation
FDS	Functional Design Specification
EMC	Electromagnetic compatibility
FW	Firmware
GAMP®	Good Automated Manufacturing Practice
ISO®	International Organization for Standardization
ISPE®	International Society for Pharmaceutical Engineering
MS	Module Specification
NTP	Network time protocol
N/A	Not Applicable
SW	Software
TC	Test case
TCP	Transmission Control Protocol
TCX	Executed test case
URS	User Requirement Specification
BUI	Browser-based User Interface

1.4. TRACEABILITY DURING PROJECT DEVELOPMENT AT MBV AG

The MAS-100 Libra software and hardware documentation, including the specifications, requirements and validation documentation, are managed by MBV AG on Aligned Elements (Life Cycle Management system to ensure compliant development documentation for regulated products, for efficient design history file management which is fully CFR 21. Part 11 compliant). Each issue is traceable from User Requirement Specification (URS) to Functional Design Specification (FDS) to Modul Specification (MS) to Test case (TC) and to Executed test case (TCX).

The detailed documentation can only be viewed upon request by authorized agents of a customer during a scheduled audit.

1.5. QUALITY MANAGEMENT DOCUMENTATION REFERENCES

The following internal and external documents were part of the validation efforts:

DOCUMENT TYPE	TITLE
R&D Documents	User requirement specification
	Functional and design specification
	Module specification
	Failure mode and effects analysis
	Master Test Report
	Test cases (in Aligned Elements)
	Executed Test cases (in Aligned Elements)
	Traceability matrix (in Aligned Elements)
User Manuals	MAS-100 Libra® User Manual
	MAS-100-Libra® Quick Start Guide

1.6. GUIDANCE AND REGULATION REFERENCES

The development and usage of MAS-100 Libra® relate to following texts and regulation:

- Eudralex Volume 4: European Good Manufacturing Practice guidelines:
- Annex 1: Manufacture of Sterile Medicinal Products
- Annex 11: Computerized systems
- 21 CFR, part 210 and part 211 - US Current Good Manufacturing Practice
- 21 CFR, part 11 - Electronic Records; Electronic Signatures
- FDA Guidance for Industry: Sterile Drug Products Produced by Aseptic Processing — Current Good Manufacturing Practice
- ISO® EN 17141: Cleanrooms and associated controlled environments - Biocontamination control
- ISPE® Good Practice Guide: Process Gases
- ISPE® GAMP® 5 Guide: A Risk-Based Approach to Compliant GxP Computerized Systems.

1.7. VALIDATION PURPOSE

1.7.1. GENERALITIES

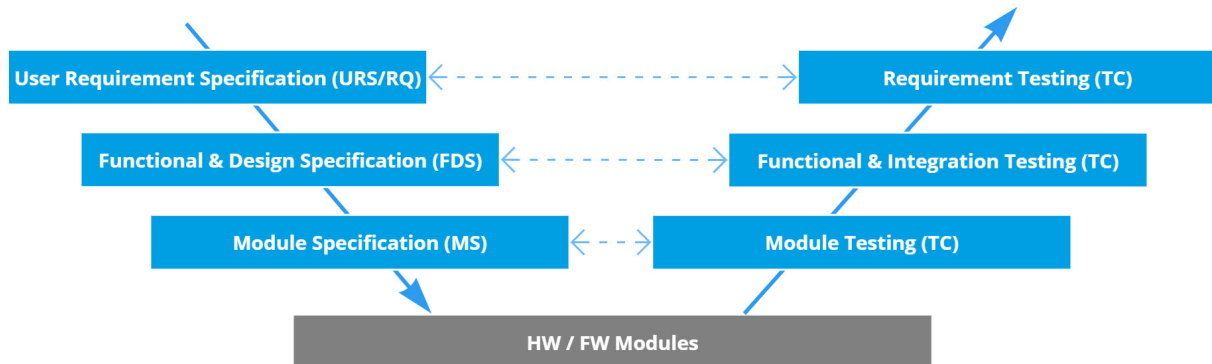
Aim of the present validation is to verify that the MAS-100 Libra complies with its requirements and specifications.

The validation activities follow good engineering practices and development is managed following GAMP5. This includes the following:

- Requirements & Specifications: verify the completeness, correctness, and testability of the MAS-100 Libra.
- Code Verification to verify the compliance with Coding Standards and code Writing Good Practices.
- Validation of the User Requirement Specification by running Application Test Cases.
- Validation of the Functional Specification by running Integration Test Cases.
- Traceability Matrix to keep track of the link between the Requirements/Specifications and the tests.

- Risk Assessment including a Failure Mode and Effect Analysis.

The structure of the specifications / tests is according to category 5 product as described in the GAMP guidelines:



1.8. TEST LEVELS AND FOCUS

TEST LEVEL	TESTER	FOCUS	DEVICE UNDER TEST	EXAMPLE	MANAGED IN / TRACED TO
Requirement Testing	MBV & Validation partner	Testing based on URS & defined use cases (User manual)	Entire instrument & Software	VHP decontamination compatibility verified by external partner	Aligned Elements / URS
Functional & Integration Testing	MBV & development partners	Combination of individual modules	Entire instrument or combination of multiple modules	Handling process testing with different process settings.	Aligned Elements / FDS
Hardware Module Testing	MBV & development partners	Individual module functioning	Low level access to hardware modules	Performance testing of the real time clock	Aligned Elements / MS
Software Module Testing	MBV & SW development partners	Development tool for SW application	Software application with simulator	Sending and receiving Modbus TCP commands	Aligned Elements / MS
Software Unit Testing	SW Development partner	SW development partners	Individual software class	N/A	SW partner / Aligned Elements

2. RESULTS

2.1. INSTRUMENT UNDER TEST

All validation activities were performed on the following instrument. Please note that updates and revisions of instrument hardware and firmware are managed under change control require successful reexamination before release.

DESCRIPTION	ARTICLE NUMBER MBV	ARTICLE NUMBER MERCK	PICTURE
MAS-100 Libra® settle plate changer	201120	N/A	

2.2. REQUIREMENTS AND SPECIFICATIONS VERIFICATION

The requirements and specifications verification was performed by reviews made by the project team before implementation and testing. This table lists an extract of the tests done on the MAS-100 Libra instrument. The complete list of tests is detailed in Aligned Elements.

2.3. REQUIREMENT TESTING

REQUIREMENT TESTING	DESCRIPTION	EXPECTED RESULT	RESULT
Reliability during plate handling for 90mm non-lockable plates	Verify plate handling of MAS-100 Libra using different process parameters and at least one plate type	The instrument has an error rate $\leq 0.1\%$	Passed
Reliability during plate handling for 90mm lockable plates	Verify plate handling of MAS-100 Libra using different process parameters and plate types	The instrument has an error rate $\leq 0.4\%$	Passed
Performance test under ambient conditions	Verify instrument performance at ambient conditions (i.e. temperature, pressure, humidity) for all variations of the handling process parameters	Successful plate handling was performed for all process configurations	Passed
Performance test under environmental conditions	Verify the instrument performance at extremes of operation range (0°C and 40°C)	Successful plate handling was performed for at least one handling cycle at 0°C. Successful plate handling was performed for at least one handling cycle at 40°C.	Passed

Cleaning and sterilization	Verify that cleaning of the housing and VHP decontamination of the instrument has no adverse effect on the handling process	Cleaning test with wiping of the housing with standard agents (Ethanol, 70/30 IPA, Quaternary ammonium, H ₂ O ₂ + peracetic acid) has no adverse effect on the instrument. 30 back-to-back VHP decontamination cycles have no adverse effect on the instrument.	Passed
Particle emission	Verify particle emissions by the instrument with acceptance levels passed specified Grade A according to EU GMP Annex 1	Emitted particle levels during operation are below the limits for Iso 5 (grade A)	Passed
Airflow perturbation	The air flow onto the exposed plate is not perturbed by the instrument design	CAD studies are performed to evaluate the instruments effect on the air flow towards the plate	Passed
Successful decontamination of the internals using VHP	Study the decontamination efficacy at critical locations of the instrument and its internal volume using bioindicators and enzyme indicators	All tested locations at and in the instrument are properly disinfected with the reference VHP cycle	Passed
Minimal RTC battery running time	Verify capacity RTC battery and RTC power consumption when instrument is off	A fully charged RTC battery can supply the real time clock for more than 10 years with power	Passed
Transportation test	Verify that transportation does not have an influence on MAS-100 Libra performance	Transportation test is done according to ASTM D4169-23e1 DC 13. MAS-100 Libra is not damaged and fully functional after the test.	Passed
EMC Testing	Verify electromagnetic compatibility through external lab	No deviation found. Behaviour according to IEC 61326-1:2020 .	Passed
Electrical safety testing	Verify electrical safety through external lab	No deviation found. Behaviour according to IEC 61010-1:2010, IEC 61010-1:2010/AMD1:2016, IEC 61010-2-081:2019.	Passed
Plate capacity	The instrument can perform handling with at least 6 plates	The instrument can perform a handling process with a maximum stack height of 90mm. The available agar plate types do have a height of less than 15 mm when stacked onto each other.	Passed

2.4. FUNCTIONAL AND INTEGRATION TESTING

FUNCTIONAL AND INTEGRATION TESTING	DESCRIPTION	EXPECTED RESULT	RESULT
Device size and weight	Verify that instrument size, footprint, and weight matches requirements	Footprint smaller 32'400mm ² Instrument height is max 300mm Instrument weight is below 5kg	Passed
Instrument access	Verify login process based on user roles and rights	Without restricted access: Login not required to access and adapt instrument configuration. When Access is set to be password-restricted, the access to the configuration tile of the WebUI is only possible after login with the System Administrator role and password. The Service is able to issue a temporary password for the System administrator to enable access in case of password loss.	Passed
Instrument log	Verify instrument log functionality	The instrument log can be accessed without login from the BUI; it loads and is displayed correctly. Each log entry has a specific time stamp. The exported log file is in xml format. It's not possible to clear the instrument log. A FW update does not alter prior entries of the instrument log. The instrument log has a storage capacity of 25'200 entries internally stored in 12 partitions	Passed
Sensor and actuator functionality	Verify whether sensors and actuators perform under application conditions	When the device is connected to 24VDC+-10% power the sensors and actuators perform as expected: The device can be initialized Plate handling is successful WebUI is accessible.	Passed
Electrical interfaces	The electrical interfaces to MAS-100 Libra must be clearly described and labeled and all functions must be tested.	The interfaces have laser-marked labels Each interface uses a different plug (no mismatch possible) Functionality of all interfaces verified. The electrical interfaces are accessible for the user.	Passed

2.5. MODULE TESTING

MODULE TESTING	DESCRIPTION	EXPECTED RESULT	RESULT
Status indication	Verify status indication through the internal LED	Correct handling operation is displayed using green constant LED color. Awaiting plate stack insertion or removal is indicated using green flashing LED color. Error states are indicated with red flashing LED color. Yellow LED color indicates special modes (self-test, decontamination mode, etc. or a state requiring initialization.	Passed
Timer check	Verify the accuracy of the instrument timer	The WebUI allows performing a timer check to verify the instrument timer against a NTP reference server	Passed
Instrument self-test	Verify the self-test routine	The WebUI allows performing an instrument self-test to verify the instrument and all sensors and actuators work as desired. The test output can be displayed as a well formatted test report.	Passed
Configuration	Verify configuration submenu for System Administrator: Presence and functionality of all configurations All changes in the configuration submenu are logged in the instrument log	Time configuration works as expected. Interface configurations work as expected. Instrument label works as expected. Handling process parameters work as expected. Plate dimension configurations work as expected.	Passed
Lifetime testing	Verify that the functionality of all components and the entire system for prolonged use	Instrument functionality was proven without issues for at least 5 years of use with six plates handled at 200 days per year.	Passed
Barcode scanning of agar plates	It shall be possible to submit agar plate barcodes to MAS-100 Libra in order to incorporate the plate ID into the internal instrument log	Plate barcodes can be submitted to MAS-100 Libra. The instrument log correctly lists the barcodes at plate sampling entries.	Passed
Life cycle assessment	The instrument has undergone a detailed life cycle assessment	The environmental impact of the instrument was evaluated, and the development incorporated measures to maximize sustainability	Passed
Noise emission	The noise emission during operation is low	The maximum noise in operation emission is below 70dB	Passed
Firmware update	Verify that firmware can be updated through the WebUI	The WebUI has a button on the configuration tile to upload a firmware file and start a firmware update. After firmware update, the instrument log and instrument configurations are unaffected.	Passed
Type label	The instrument type label is checked for conformity	Type label is checked by external body. Instrument serial number is present also in QR code format	Passed

Error detection	The instrument detects plate or lid loss	The instrument reports an error when the lid is not attached to the plate after sampling. The instrument reports an error when the lid is not removed prior sampling. The instrument reports an error if the plate number changes during the process.	Passed
Exception handling	A multi-level exception handling including manual intervention can be enabled	The instrument configuration enables the user to define how to react on critical handling events and when an error is issued.	Passed
Operation with gloves	Safe and effective use with gloves	The remote button can be triggered with isolator gloves. The instrument does not have sharp edges that pose risk to the isolator gloves.	Passed
Digital IO interface	Status indication and operation are possible through the interface	Instrument states are reported as depicted in the user manual. All digital input ports work as listed in the user manual.	Passed
First air	During sampling, the open agar plate is the highest point of the system	The principle of first air is met – the upper rim of the agar plate is at the sampling location the highest point of the instrument	Passed

2.6. 21 CFR PART 11 CONTROLS

MAS-100 Libra does neither store user information nor electronic signatures and as such is not directly applicable for 21 CFR part 11.

3. CONCLUSION

The conclusion of the MAS-100 Libra validation is that requirements and functional specifications have been fully validated and released to operate per written product specifications. The MAS-100 Libra instrument is fit for its intended use.