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Revision History:

Version No	Date	Prepared by / Modified by	Significant Changes
V0.1	7-11-2022	Ms. Priyanka Yadav	Initial Draft
V1.0	9-11-2022	Ms. Priyanka Yadav	Review comments incorporated

1. INTRODUCTION

o The "Mold Remote Condition Monitoring System" is an engineered system, build specifically to fulfil the need of remote condition monitoring of the Molding machine.

o It is based on highly reliable industrial grade PLC (WAGO 750-8212) and AWS IoT.

o It is the ProStream and EdgeIQ implementation for the Mold remote management.

2. PURPOSE

The purpose of this document is to plan for testing a project named **""Mold Remote Condition Monitoring System"**. The testing activities involved in this project are test case creation, test case maintenance and test execution of the created and maintained test cases. It covers information about the tools to be used and the specific test scenarios that are to be performed.

This document should be updated whenever there is any change as per the requirements.

This document sets the scope of verification testing, the overall strategy to be adopted, activities to be completed, general resources required, and methods and processes to be used to test the release.

3. SCOPE OF TESTING

o Provision a new Mold Management endpoint in the field.
o Receive Periodic Telemetry Messages (PTM) from a previously provisioned and authenticated endpoint.
o Update Remote configurations for a named endpoint.
o Trigger a Remote command on the named endpoint.
o Receive historic PTMs that have been periodically saved in the device's persistent storage for diagnosis purposes.
o Update device PTM save and publish frequency from the AWS server.
o Validating the PTM messages that are being sent and recorded.
o Reliability of the client to keep recording the PTMs in the condition of network failure
o Timestamp recorded is in UTC and is checked using the NTP server.

3.1. TEST STRATEGY

This Test Plan will cover the following testing activities as identified in the testing strategy:

o Test case creation: Test cases are created according to the requirements documents.
o Maintaining test cases followed by the review as per the updated software version.
o Test cases execution
o Test report

3.2. TEST ITEMS

Below is the list of test items, validation Task should be created corresponding to each developer's User Stories in JIRA.

Under validation Tasks, Acceptance criteria should be written. Test cases should be written based on the acceptance criteria mentioned in Validation Tasks.

Test Items	Description
Provisioning and Certificates	o Device ID is assigned for each device. o Device unique ID sent to AWS server during provisioning. o Device gets provisioned only once with AWS-provided certificates. o After successful provisioning, the Device retain the provision status. o Device connects to the AWS server with the configured certificates. o Device persists AWS certificates in the persistent memory.
Cycle time and Cycle record	o Molding Cycle is the Process from close to open to close. o Cycle time is the time taken for mold to complete one molding cycle. The device shall be able to o persist the cumulative count of molding cycles in persistent memory. o send the cumulative count to the AWS server as part of a periodic telemetry message (PTM) or real-time telemetry message on the pre-configured topic. o calculate the average cycle time of up to the last 100 molding cycles o persist the average cycle time of up to the last 100 molding cycles in persistent memory until it is successfully sent to the server. o send the average cycle time of up to the last 100 molding cycles on the AWS server as part of PTM on the pre-configured topic. o calculate the average cycle time of up to the last 1000 molding cycles. o persist the average cycle time of up to the last 1000 molding cycles in persistent memory until it is successfully sent to the server. o send the average cycle time of up to the last 1000 molding cycles on the AWS server as part of PTM on the pre-configured topic. o calculate the average cycle time of up to the last 10000 molding cycles. persist the average cycle time of up to the last 10000 molding cycles in persistent memory until it is successfully sent to the server. o send the average cycle time of up to the last 10000 molding cycles on the AWS server as part of PTM on the pre-configured topic.
Time Stamp(ts)	The timestamp is the time when the message was snapshotted. The device shall be able to o send the main power OFF event as SEM to AWS server with the timestamp in real-time on the pre-configured topic. o percentage level as SEM to AWS server with the timestamp in real time on the pre-configured topic. o The lost event as SEM to AWS server with timestamp on the pre-configured topic as it reconnects.

	o power ON event as SEM to AWS server with the timestamp in real time on the pre-configured topic. o System Provisioned event as SEM to AWS server with timestamp on the pre-configured topic in real-time. o power shutdown event as SEM to AWS server with timestamp on the pre-configured topic in real-time. o BIST report to the server as SEM with the timestamp. o Device Timestamp sent in the PTM record should match with the server Time stamp as requested by AWS o System time is changed 15 min ahead of the current time. Check if the timestamp in the PTM message is as per the changed time - (expected) timestamp must be the same as per changed time. o Check if publish and save operation occurs at the same frequency as defined in the config file. - (expected) save and publish must occurs as per configured time interval.
On Demand Diagnostic message (ODM)	The device shall be able to perform the following actions when receiving the ODM to o keep a record of the last status of all the sensors and system events that occurred as On Demand Diagnostic message. o persist the ODM until it is successfully sent to the server. o send ODM when the server sends the command to the device for the ODM message. o send ODM as message type 2 for PTM when the server sends the command to the device for the ODM message. o Timestamp sent in the PTM record SHALL match with the server Time stamp as requested by the AWS server. o able to make the updates in the configuration files for the time of sending the PTM messages. o able to make updates in the frequency for saving the PTM messages. o able to update the frequency for publishing the PTM messages. o able to set the Time zone in GMT for frequency and publishing the PTM messages. o able to save PTM at every 5th min with configured PTM message format. o able to publish the RCR every 1 hour to the cloud or AWS Server.
Configured Frequency	o Device shall be able to make the updates in the configuration files for the time of sending the PTM messages.
Cumulative count	o Device shall persist the cumulative count of molding cycles in persistent memory and send the cumulative count to the AWS server as part of periodic telemetry message (PTM)
Network Issues	o Device shall keep retrying to connect with the network every 2 min of time duration if it is disconnected. o Counter should keep on counting and display progress after.
Power off	o Device shall consider main power OFF as a system event ID 3. o Device shall persist the main power OFF event until it is successfully sent to the server. o Device shall be able to send main power OFF event as SEM to AWS server with the timestamp in real-time.

NTP	o Wait until the time is corrected by the NTP server after 10 min. o Check if in PTM message timestamp is corrected - (expected) time stamp must be as per the corrected system time. Check if publish and save operation occurs at the same frequency as defined in the config file after time is corrected by the NTP server - (expected) save and publish must occurs as per configured time interval.

3.3. TEST SCHEDULE
- Unit Testing
- Integration Test
- Regression testing
- Exploratory testing
- System Testing

3.4. TESTING ENVIRONMENT REQUIREMENTS

Items	Description
Processor	Intel(R) Core (TM) i5CPU
RAM	8 GB
Operating System	Linux (Ubuntu 20.04
Hard Disk	256 GB or more required for installation
Hardware	Industrial grade PLC (WAGO 750-8212)
Software/ Tool	JIRA, Putty, Windows Power Shell, AWS CLI

4. CONTROL PROCEDURES

Pass/Fail judgment table:

Pass Criteria	o The expected results and actual results are the same as provided in the check sheet. o The application should function properly and there should be no freeze or hang state in the application by any means. o Test cases should be executed as per the steps mentioned in the test case.
Fail Criteria	o The expected results are judged based on Requirement Document and the actual results are different. o Freeze or hang state is observed. o Not able to execute a particular test step as per the test case sheet. o The phenomenon that is strange judging from the eyes of the customer.

4.1. DEFECTS ANALYSIS AND CLOSURE

All the defects found during test execution should go through the following procedure:

o Logging of defects:
o Analysis of defects:
o Verification of fixes:
o Defect tracking till closure:
o The above-mentioned Procedures and Defect Management of MOLD RCM, we are using JIRA.

Defects are classified as follows according to the severity of the impact on the system:

Severity	Impact
Critical	Defects that may cause the system to hang, crash, produce incorrect/ unexpected results or behaviour, or corrupt user data with no known workaround. This type of issue blocks the entire process i.e., the Testing team from progressing past the blocker and development from working on other areas. This type of issue could significantly impact the release of the product.
High	Major function disabled/ incorrect, Non-conformance to standards. Defects that cause incorrect results or behavior with a known workaround. A large and/or critical portion of the system is affected which would not cause an operational failure.
Medium	Loss of functionality or other problem(s) is present, which causes some parts of the system to not function correctly. A workaround is available to move forward with the process/ testing.
Low	Defects that affect limited areas of functionality that either can be worked around or ignored.

Priority will be assigned to each defect.

Priority	Definition
P1-Stopper	This type of defect must be resolved immediately. It could be related to the feature planned in the current milestone release. Cannot release the code with this defect.
P2-High	The defect requires high attention and must be resolved as soon as possible Could be related to a highly desirable feature planned for this release, but do not stop the release.
P3-Medium	The defect should be resolved in the development activities' normal course (low priority). Of interest, but not planned or expected in this release

Priority	Definition
P4-Low	This type of defect can be deferred, resolved in a future major system release, or not resolved at all.

Suggestive Guideline:

Priority	P1	P2	P3	P4
Blocker	√	×	×	×
High	√	√	×	×
Medium	×	√	√	√
Low	×	×	√	√

5. TEST DELIVERABLES

Below are the deliverables:

Sl. No	Deliverables	Description
1	Test Plan	The document describes planning for testing of MOLD RCM and test strategy details.
.2	Test Case Document	This document will maintain all the test cases created for Sprints.
3	Traceability Matrix	This document will have the mapping of requirements and test cases, this will ensure the completeness of test cases.
4	Test Report	This document will have a test execution summary containing the total number of test cases executed, test cases passed, failed, and not executed.

6. RESOURCES & RESPONSIBILITIES

Designation	Name/Title
Practice Head - Embedded Engineering	Mr. Anurag Srivastava
Principal Practice Architect - Embedded Engineering	Mr. Parag Gupta
Senior Technical Lead	Mr. Manoj Sharma

Senior QA	Ms. Priyanka Yadav

7. REFERENCES

Reference Documents
SRS_Mold_RCMS_V1.0
RCM Mold-NFR - ZMXPlatforms - Confluence (atlassian.net)

8. GLOSSARY

Abbreviation	Description
RCMS	Remote condition monitoring system
RCR	Remote condition record
AWS	Amazon web server
PTM	Periodic telemetry message
PIM	Periodic inspection message
SEM	System event message
ODM	On-demand diagnostic message
BIST	Built-in self-test