



Smart Water Access

Hardware



User Manual

V1.0.2

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1. Introduction

1.1. Purpose of the Document

This document provides a comprehensive functional description of the Smart Water Access System. It serves as a reference for system designers, engineers, and stakeholders, outlining key aspects of the system's design, operation, and security.

1.2. System Overview

The Smart Water Access System integrates advanced hardware and software components, enabling municipalities and industries to manage water resources effectively. By utilising real-time data monitoring and automated controls, the system enhances efficiency and prevents unauthorised access, resource wastage, and automated water dispensing. It leverages modern technologies, such as cellular modems, to deliver robust performance in both online and offline modes.

1.3. Primary Objectives

- Security Measures**
Implement robust security protocols, including password protection and encryption, to safeguard the system's configuration and server communications from unauthorised access and tampering.
- Mobile and Desktop Applications**
Develop and integrate mobile and desktop applications to provide users with the ability to monitor and manage the system remotely.
- Real-Time Monitoring**
Ensure that the applications offer live status updates and notifications for error states to facilitate immediate response and troubleshooting.
- Protection Measures**
Utilise checksums and encryption techniques to ensure the integrity of data transmitted to the server, preventing data corruption or unauthorised alterations.
- Record Keeping**
Maintain detailed logs of system usage to support analysis, troubleshooting, and regulatory compliance.
- Operational Efficiency**
Flexibility in power sourcing, including solar and mains options.
Reduction of operational costs through automation and remote management.

2. Operation and User Interaction

2.1. Normal Operation Online mode (with network ON)

When the system is online, the controller communicates with the server in real-time, providing continuous updates and enabling remote control. During this mode, the system allows authorised access via swipe cards or mobile applications and follows standard protocols for water dispensing and data logging.

2.2. Offline Mode (with no network)

In offline mode, the system relies on pre-configured operational settings, logging data locally and transmitting it to the server once connectivity is restored. The system remains functional for authorised users, but remote access is disabled until the network is re-established.

2.3. User Interaction and System Feedback

The system provides users with clear, intuitive interaction methods through swipe cards, mobile applications, and push-button controls. Visual indicators and audio cues ensure seamless feedback across different system states.

2.3.1. System Free

When the system is powered ON or reset, it undergoes a booting procedure that takes approximately 30 to 40 seconds, depending on networking conditions, to initialise and enter the Idle State.

Visual Indicator

The indicator light on the swipe card reader turns **red** for around 30 seconds before changing to **blue**, signalling that the device is ready for use.

Audio Cue

An audible buzzer sounds to alert the user when the system is ready for use.

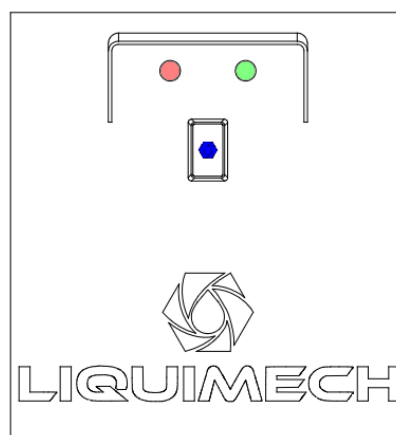


Figure 1: System IDLE

2.3.2. Access Granted

When a user successfully swipes their card, the system responds as follows:

Visual Indicator

The indicator light on the swipe card reader turns **green**.

Audio Cue

An audible buzzer sounds to alert the user that access has been granted.

Push Button Activation

Both the Open Valve and Close Valve push buttons light up, indicating that they are ready to be pressed.

System Action

The water distribution starts if the open valve push button is pressed within a pre-defined time (30 seconds). This action opens the valve, allowing the user to proceed with water dispensing. The process terminates if the close push button is pressed.

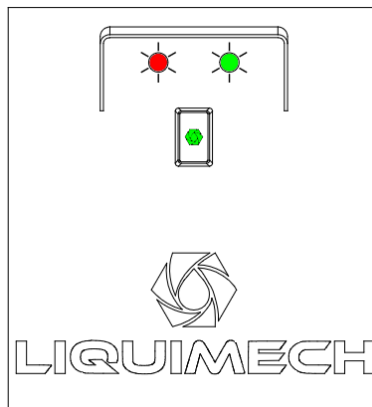


Figure 2: Access granted and PUSH button available to be pressed.

2.3.3. Access Denied

If the card swipe is unsuccessful, the system provides the following feedback:

- ❑ **Visual Indicator**

The indicator light on the swipe card reader blinks **red**.

- ❑ **Audio Cue**

An audible buzzer sounds to alert the user of the denial.

2.3.4. Adding Authorised Users via Mobile App

When the mobile app initiates the process to add a new user as an authorised user, the system enters Add Mode, where it saves all cards scanned on the swipe card reader module as authorised users:

- ❑ **Visual Indicator**

The indicator light on the swipe card reader turns **yellow**.

- ❑ **System Action**

The scanned card is added to the list of authorised users, granting them access to the system.

- ❑ **Audio Cue**

An audible buzzer single beep to alert the user that the scanned card has been successfully added.

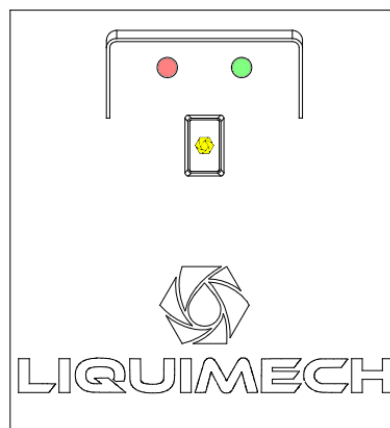


Figure 3: System on add mode for cards to be added.

2.3.5. Push Button Controls

Upon successful card access:

Open Valve Button

Pressing this button initiates water dispensing. The dispensing continues until the Stop button is pressed.

Close Valve Button

Pressing this button ends the water dispensing. The system logs the usage data, sends it to the server, and then returns to Idle State, ready for the next transaction.

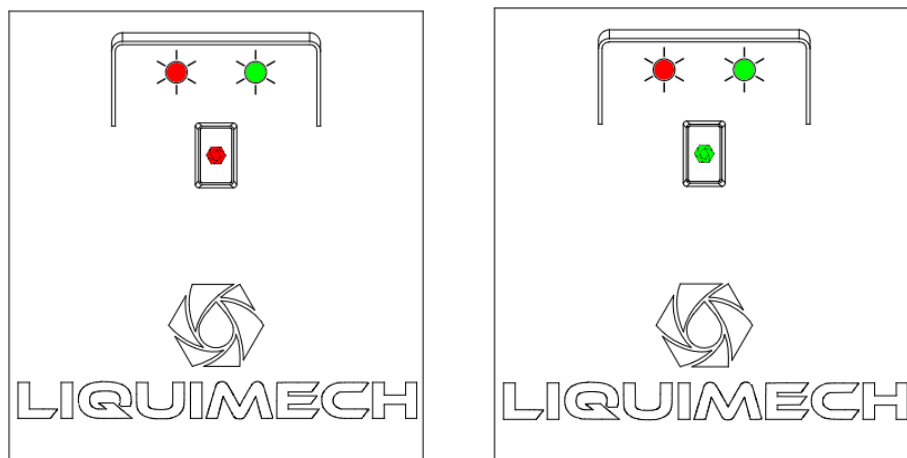


Figure 4: System allowing to use of push buttons either access being granted or emergency fill.

2.3.6. Emergency Fire Fill Option

In case of an emergency initiated via the software/ application, the system responds as follows:

❑ **Visual Indicator**

The indicator light on the swipe card reader turns **red**, signalling an emergency condition.

❑ **Push Button Controls**

Both the Open Valve and Close Valve push buttons are activated and will remain ON.

❑ **Completion Condition**

The emergency fill process will only be completed when the Close Valve push button is pressed or confirmed by the server to end the Emergency Fire Fill Option. This finalises the emergency procedure and returns the system to its Idle State.

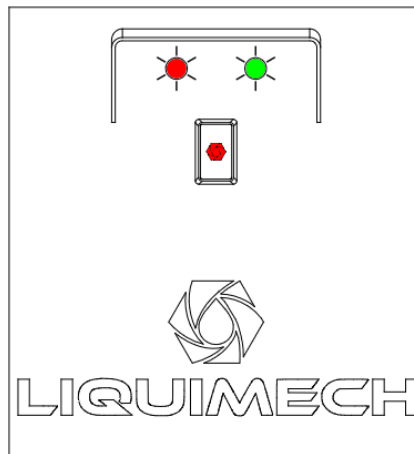


Figure 5: Emergency Fill activated allowing to press pushbuttons

2.3.7. Error States

In the event of an error, the system provides specific feedback to assist in troubleshooting:

Visual Indicator

The indicator light turns **red** and remains ON.

Error Message

An error message will appear on the display or be communicated through the mobile application, detailing the nature of the error.

Audio Cue

A distinct error tone beeps to alert the user.

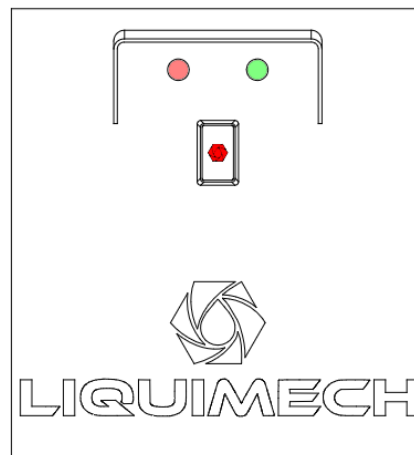


Figure 6: System in error state and red stays ON

2.3.8. System Busy

In the event of incoming messages from the server, the system enters busy mode and notifies users that the system has entered busy mode.

❑ Visual Indicator

The indicator light turns red for approximately 10 seconds and returns to **blue** without any audio cue.

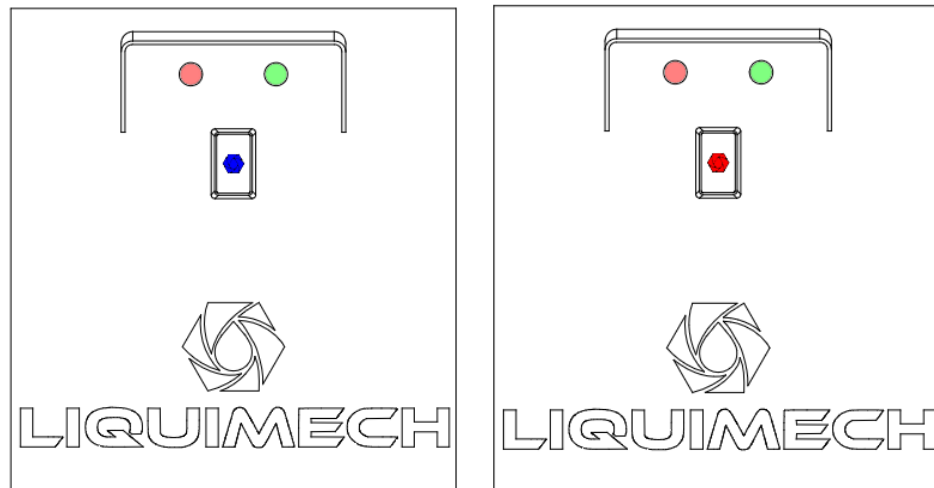


Figure 7: System turns red for around 10 seconds and returns to IDLE

Status	Description	Transitions
Idle State	The system is waiting for a swipe card to be scanned.	<ul style="list-style-type: none"> ▪ Moves to Authorisation State when swipe card access is granted.
Authorisation State	The system is validating user credentials either through a swipe card or a mobile device.	<ul style="list-style-type: none"> ▪ Moves to Filling State if authorisation is successful. ▪ Moves to Error State if authorisation fails or there are issues with the swipe card/mobile.
Filling State	Access has been granted, and the system is dispensing water.	<ul style="list-style-type: none"> ▪ Moves to Completed State once the dispensing process is finished or if the user presses the stop button. ▪ Moves to Error State if there are issues during the dispensing process.
Completed State	The system finalises the process and logs relevant data.	<ul style="list-style-type: none"> ▪ Returns to Idle State after completing data logging.
Error State	The system encounters any issues such as data logger errors, valve malfunctions, or communication problems with the swipe card module.	<ul style="list-style-type: none"> ▪ Returns to Idle State after the issue is resolved.
Lock State	The system enters to Lock state when the device lock is initiated via the mobile app.	<ul style="list-style-type: none"> ▪ The system remains in a locked state until an unlock command is received from the mobile app. ▪ Returns to Idle state upon unlock received

Add Mode	The system enters to add state when add mode is initiated via the mobile app and all the scanned cards are saved as authorised users.	<ul style="list-style-type: none"> ▪ The system remains in the add mode until an add mode is disabled from the mobile app. ▪ Returns to Idle state after add mode is terminated.
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Note: Please allow approximately a 3-second gap when scanning the next card.

3. Safety and Security

3.1. Safety Features

Error Handling and Data Logging

In case of any issue with the data logger, such as communication failure or corruption of transmitted data, the system immediately enters an **error state**. This triggers a notification to the user via the mobile or desktop application, providing details on the nature of the issue. During this error state, all water dispensing operations are suspended to prevent resource mismanagement or further issues. The system will remain in this state until the error is resolved or overridden by an authorised administrator.

System Timeouts

Ensure that operations such as adding or blocking users do not exceed a defined time limit, preventing the system from being locked in an operational state. If an operation takes too long, the system cancels the process and reverts to its idle state, notifying the user or administrator of the issue.

3.2. Security Features

Fire Mode


Enables emergency water access without swipe card authorisation for firefighting needs.

Data Integrity and Transmission Security

The system uses checksums and encryption for data transmission between the controller and the server. This ensures the integrity of the data and prevents unauthorised alterations, thus maintaining secure communication across the system.

Access Control

The system employs advanced encryption and password protection for user credentials and server communications to ensure that only authorised personnel can access or manage the system. Additionally, real-time monitoring of swipe card interactions and mobile app usage provides an extra layer of security by preventing unauthorised access to water distribution.



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