IORPMS - Automated Medication Pump Integration Documentation

1. Introduction

This document details the integration of the new automated electric medication pumps (hereafter referred to as 'Pumps') into the existing Integrated Opioid Replacement Patient Management System (IORPMS). The purpose of this integration is to automate the dispensing of prescribed medications, reducing manual errors and improving efficiency.

This documentation serves as a reference for the facility's technical staff to understand the implemented solution and provides a guide for integrating future pump additions.

2. Scope of Integration

The integration covers the following key areas:

- **Communication Protocol:** Establishing reliable communication between the IORPMS host PC and the Pumps via a standard USB connection.
- **Command Issuance:** Implementing software logic to translate IORPMS dispense requests (e.g., drug ID, dosage, volume) into specific control commands for the Pumps.
- **Status Monitoring:** Basic error logging and status feedback from the Pump to the IORPMS.

3. Implemented Solution Overview

3.1 Hardware Connectivity

Component	Connection Type	Interface	Notes
Electric Pump	USB Cable	Standard USB Port (Host PC)	Requires a standard A-to-B, depending on pump model.
Host PC	N/A	IORPMS Application	Runs the IORPMS software and hosts the communication driver.

3.2 Software Architecture

The integration utilizes a dedicated **Pump Communication Module (PCM)** within the IORPMS application layer.

- **PCM Function:** Manages the serial communication over the virtual COM port established by the USB connection.
- **Command Set:** Implements the proprietary command set required to control the specific pump models.
- **API Exposure:** Exposes a simple, high-level API to the main IORPMS application for dispensing operations.

4. Technical Details and Configuration

4.1 USB Serial Port Configuration

When a Pump is connected via USB, the operating system (OS) typically recognizes it as a virtual serial port (VCOM).

- **Default Baud Rate:** 9600 bps (This may be updated/adjusted based on future pump specifications)
- **Data Bits:** 8
- **Parity:** None
- **Stop Bits:** 1

Action Required: The COM port assigned by the OS (e.g., COM3, COM5) **must be manually configured** in the IORPMS database directly for the system to identify the correct Pump connection.

4.2 Pump Control Command Structure

All commands issued from the IORPMS to the Pump follow a standardized structure. This structure is essential for future development and scaling.

- **Format:** `[PUMP_PORT] [BAUD_RATE] RAW [START_COMMAND][MLx400][DIRECTION(P/D)][MLx400][END_CHAR(R)]`
- **Example Dispense Command (Conceptual):** `/1m50h10j4V1600L400z4000D4000R` (Where `/1m50h10j4V1600L400z` is Start, `4000` is Dispense Quantity, `D` is Direction, `4000` is Dispense Quantity, `R` is End)

Command Part	Description	Parameters
`4000`	Dispense Medication Volume	Volume * 400 e.g. 4000 for 10ml
`P/D`	Dispense Direction	`D` for forward and `P` for reverse depending on pump configuration

5. Guide for Future Pump Additions

This section provides instructions for integrating new or additional pumps into the IORPMS.

5.1 Step 1: Physical Connection and Driver Installation

1. Connect the new Pump to an available USB port on the Host PC.
2. If required, install the manufacturer's specific USB-to-Serial driver.
3. Note the assigned COM port number from the OS Device Manager.

5.2 Step 2: Verification of Communication Protocol

1. Confirm that the new pump operates using the existing **Baud Rate, Data Bits, Parity, and Stop Bits** defined in Section 4.1.
2. If the new pump uses a different protocol, the Pump Communication Module (PCM) code **must be updated** to handle the new settings. This may require developer intervention.

5.3 Step 3: Command Set Compatibility Check

1. Verify if the new pump's operational command set is compatible with the standard commands defined in Section 4.2.
2. If the new pump requires new or modified command codes, the **PCM must be extended** to support the new protocol variant (may require developer intervention).

5.4 Step 4: IORPMS Configuration

1. Go to `localhost/phpmyadmin` and login as `root`.
2. Select IORPMS database (typically `methadone`).
3. In the query box, execute the sql query: `INSERT INTO` `` `pump_devices` `` `(label, port) VALUES (‘Pump A’, ‘COM3’);` where `‘Pump A’` can be replaced with a label of your choice and `‘COM3’` replaced with actual com port number of the pump noted in Step 1.
4. Save the configuration and test the connection using the Prime button in the Pump Reservoir page.

6. Maintenance and Troubleshooting

Issue	Potential Cause	Recommended Action
Pump Not Responding	Incorrect COM Port assigned.	Verify the COM port in Device Manager matches the IORPMS configuration.
	Loose USB connection.	Check the USB cable connection at both the PC and the Pump.
	Pump power off.	Ensure the Pump is powered on and initialized.
Dispense Error	Incorrect command parameters sent.	Consult admin/supervisor for resolution
	Pump internal fault.	Consult admin/supervisor for resolutions
	Low reservoir quantity	Ensure the pump reservoir quantity is updated to be more than the dosage is dispensed.

7. Pump Usage

7.1 Intro

Pump usage is located in the “Dispense with pump” menu option inside “Dispensing Pharmacy” section. As monitoring measure, each pump must be topped up and indicated in the system for dispense to happen without errors, if the pump calculated remaining volume is equal or less than the volume to be dispensed, an error will be displayed on dispensing attempt, e.g. if calculated remaining volume is 50mg and user attempts to dispense 50mg or more, like 60mg, 80mg and so on, alert will be displayed with low quantity remaining, this helps mitigate dispensing nothing if there isn’t any medication left avoid other errors. The calculated remainder is calculated by the quantity dispensed for the particular pump.
The “Dispense with pump” section only displays clients with **Methadone** drug assigned, to dispense other medications, use Dispense without pump which displays all other clients.

7.2 Topping up pump

1. To top up the pump, head to the **Pump Reservoir** page inside **Dispensing Pharmacy** where you will see summaries/histories for the different installed pumps.
2. Click the Top up button to show the top up dialog.
3. Select the pump to top up and provide the quantity in **milligrams (mg)** and click submit.
4. This will indicate the content in the pump reservoir has been changed/updated and ready to be dispensed.

7.3 Prime/Test pump

1. To prime (fill the pump tube)/test the pump, navigate to **Pump Reservoir** page inside **Dispensing Pharmacy** where you will see summaries/histories for the different installed pumps.
2. Click the Prime/Test the pump button to show up the prime dialog.
3. Select the pump to prime (always ensure the available quantity is enough to prime the pump) and click submit.
4. This will prime/fill up the tube so that it's ready for the next dispensing.
5. If the reverse option is selected, then it will reverse the pipe content back to the reservoir to empty the pipe.
6. This ensures the pump is working correctly and when issuing medication, the correct medication quantity is dispensed.

7.4 Issuing medication

1. Navigate to **Dispense with Pump** page inside **Dispensing Pharmacy**.
2. Search for specific client with **Methadone** dosage.
3. Click **Dispense** button against their name/row.
4. On dispense page, make sure you select the correct pump before dispensing.
5. For any errors, refer to trouble shooting above.