## DL100 Digital Lock Specification

Revision A, 03/22/2023

## Overview:

The DL100 Digital Lock is a device that will be used for access control of a gate or door. The system will consist of a PCB with keypad, and a direct connect page for programming. When a valid user (guest) enters a code on the built-in keypad, the device will activate as programmed. **Because the device will commonly be installed where internet access is not available, all memory and commands will be stored locally on the device. This includes all entry codes and device settings.** A simple Plug & Play setup is required for user friendly setup.

Note: This is a very simple standalone digital lock system with all memory and commands generated by the device. A simple direct connect page or the built-in keypad will be used for programming of User (Guest) codes and all system settings.

Note: Consider using WiFi programming for future remote programming via mobile app to web server to device.

## Mechanical Specifications Overview:

1. Power input 12-24 AC or DC, **Reverse Polarity protected** = can switch polarity without failure. Power input to PCB. Power will be supplied by an outside power source – usually the gate motor or a plug-in transformer.
2. Power draw Power draw should be minimal so unit can be used in solar applications.
3. Exit input Exit Input shall have Exit and C. Input will allow an external device such as a pushbutton to be connected to the system to operate the relay. When the Exit circuit is connected, the relay will activate and remain active until the circuit is disconnected. When the Exit circuit is disconnected, the relay will deactivate unless a Hold command is active. Exit input is a connection between EXIT and Common.

* ON = Circuit activates the relay when circuit is High (connection between EXIT and C).
* OFF = Circuit deactivates relay when circuit is Low (no connection between EXIT and C) unless a different command is activating the relay

1. Number of relays One (1) relay shall be available. Relay shall have NO, NC, C outputs.
2. Relay functions None, momentary hh:mm:ss, latch, unlatch, toggle

* None = Relay is not activated
* Momentary hh:mm:ss = Relay is activated for set time. Time needs to be programmable with hour:minute:second format.
* Latch = Relay is activated and will not deactivate until an Unlatch command is given. Unlatch command can be unlatch code or unlatch schedule.
* Unlatch = Relay is deactivated.
* Toggle = Relay is activated when valid toggle code is entered, then deactivated when valid toggle code is entered again.

1. Buzzer A built-in buzzer shall be on the PCB and activate when buttons are pressed and certain criteria is met. Examples but not limited to:

* Buzzer will sound for every keypad button pressed so user knows button was pressed.
* Buzzer will sound if valid code is entered
* Buzzer will sound if invalid code is entered
* Buzzer will sound for correct program steps when keypad programming
* Buzzer will sound for incorrect program steps when keypad programming

1. Reset button A built-in button shall be on the PCB to allow the device to be physically reset. Reset functions will include:

* Reset all settings and clear memory of device
* Reset program password only without clearing any memory on the device

1. Status LEDs Built-in LEDs shall be on the PCB to show the status of power, relay, and exit input:

* Power LED is ON when power is supplied to the device
* Relay LED is ON when relay is active
* Exit LED is ON when exit input is active (connection between Exit and Common)

1. Wireless Module Built-in module will allow authorized users to access the device for local programming. Module should be WiFi. Note: WiFi programming for future versions with remote programming via mobile app to web server to device.
2. System Processor A built in processor (such as an Atmel processor or Micro Chip) will be used for the system to function as a standalone device not connected to a remote server or the internet. Processor needs to be fast enough and powerful enough for all functions to be local. Processor will also function as a local server for programming. (Previous product used Micro Chip PIC18F26K20-I/SO)
3. System Memory Built-in memory will be used for the system to function as a standalone device not connected to a server or the internet. Memory needs to be large enough for all functions, settings, and a minimum of 100 user entry codes. (Future versions may include WiFi Server connection, fingerprint recognition, and/or RFID.)
4. Keypad Connector Shall have a plug-in connector from for external waterproof metal keypad. Connector shall be mounted vertical on board to help prevent moisture buildup on connections. Connector shall prevent keypad cable from being plugged in backwards.
5. Wiring Terminal Built-in wiring terminal for all input and outputs:

* Power 12-24 AC/DC reverse polarity protected
* Power 12-24 AC/DC reverse polarity protected
* Exit Input
* Exit Common
* Relay NO
* Relay C
* Relay NC

1. FCC Components Wi-Fi components shall be FCC approved. Unit shall be compliant with FCC Part 15 and Part 68.
2. Temperature -20C to 60C
3. Humidity 5% to 100%
4. Surge protection Shall have built-in surge protection on all inputs.

## Feature Specification Overview:

1. Direct Connect Programming A simple direct connection shall be used for local programming of all features and settings. Page needs to be simple and user friendly. Will be for Android and iPhone.
2. Direct Connect Page A simple direct connection page shall be developed for programming and end user control of the device. Basic features will include but not limited to: Open button, Hold button, Close button, view system status, and program system settings. Will be for Android and iPhone.
3. Keypad Programming Programming can be done using the metal keypad when mobile app programming is not used. Audible feedback from the built-in buzzer will assist in programming verification. Keypad programming will be limited to basic program functions such as adding/editing a guest code.
4. System Status System status can be viewed when the app connects to the device. Should display the Device Name, current state of Relay and Exit input.
5. Entry Codes User (Guest) Entry Codes will be the 4-6 digit number assigned to a user (guest). The device will look at the entry code settings to determine if a user’s code is valid or invalid. A minimum of 100 entry codes shall be available. Entry codes (and MAC ID if implemented) settings will include:

* Entry code
* User (guest) name. Default = Blank
* Relay Function. Default = Momentary 00:00:02
* Limited Use = Off (unlimited use)

1. User (Guest) Name A name can be assigned to each User (Guest). If a code is programmed via the keypad instead of a smart phone, the name will be the default Blank. Default = Blank (no name)
2. User (Guest) Relay Functions Relay Default = Momentary 00:00:02 (hh:mm:ss).

* None: Entry code does not activate relay.
* Momentary: Entry code activates relay for hh:mm:ss and then deactivates.
* Latch: Entry code can only latch the relay.
* Unlatch: Entry code can only unlatch the relay.
* Toggle: Entry code will Latch the relay on first activation, and unlatch the relay on next activation.

1. User (Guest) Limited Use A setting allowing a user (guest) entry code to be used xxx amount of times. Once the number of times has been used, the code becomes inactive. Example: a contractor may be given a code that will open the gate 10 times. On the 11th try, the code will not open the gate. (Also known as a Flash Code) Default = Off (unlimited uses)
2. Display Entry Code List A list of entry codes including user name should be displayed when programming using the mobile app. List should be able to be displayed numerically by code or alphabetically by user name.
3. Add Entry Code Individual entry codes should be able to be programmed using the app or keypad. When adding a new code using the app, the following settings will be programmed: Code, User (Guest) Name, Relay function, Limited Use setting. When adding a new entry code using the keypad, the following settings will be programmed: Code, Relay function.
4. Edit Entry Code Individual entry codes should be able to be edited using the app or keypad.
5. Delete Entry Codes Individual entry codes should be able to be deleted using the app or keypad.
6. Device Name A specific name can be given to the unit to help identify it to the user. Example: unit name = front gate. This name will be displayed on the Home Page screen when the app is used. Default = DL100
7. Device WiFi Name A specific name can be given to the unit to help identify it when listed in a WiFi List of devices. Sometimes there may be multiple devices close to each other so a specific name for each unit will be required. This name will be displayed on the user’s mobile phone settings. Default = DL100
8. Device WiFi Password A specific password can be given to the device to access the device network when programming with the mobile app. Default = password
9. Entry Code Length Entry Codes will be 4-6 digits and will be programmable in system settings. All codes will be the same length as set in system settings. Example: If 4-digits is set, then all codes will be 4-digits. If 6-digits is set, then all codes will be 6-digits. Default = 4-digits
10. Lockout Setting Lockout helps prevent unauthorized users from using multiple codes to try to access the system. The system has a 5-minute lockout feature that is activated when “xx” number of invalid entry codes are entered. The count is cleared each time a valid entry code is entered. Once the system enters the lockout mode, it may only be reset by waiting the 5-minutes or resetting power. The default setting is “OFF” which will turn the feature off allowing for unlimited entries.
11. Sleep Mode Sleep mode is used to turn the keypad back light off 30 seconds after use to save power. Once in sleep mode, any key pressed will turn the keypad light back on.
12. Programming Access Code A simple 6-digit numeric password will be used to enter programming mode when using the keypad. The password can be changed in system settings. Default password = 000000.
13. Program Code Reset The password should be able to be factory reset back to 000000 if it is ever lost or forgotten. Resetting the password to the factory 000000 should be able to be done without entering programming – backdoor reset. To reset the Program Code back to default 000000:

* Press and hold C (\*) and the reset button at the same time for 10 seconds.
* Device will beep two short beeps (BEEP BEEP)
* Press Enter (#) to confirm Program Code reset
* Device will beep three short beeps (BEEP BEEP BEEP)

1. System Reset All settings and memory should be able to be cleared and reset to factory settings. Resetting the system will delete all entry codes and reset all settings to original default settings. To reset the system:

* Press and hold C (\*) and Enter (#) and the reset button at the same time for 10 seconds.
* Device will beep two short beeps (BEEP BEEP)
* Press Enter (#) to confirm system reset
* Device will beep three short beeps (BEEP BEEP BEEP)

1. # and \* Ignored The # and \* keys should be ignored if pressed for less than 4 seconds before or after an entry code is entered. Some competitor products require the \* or # to be pressed to start or end the entry code

## Mobile App Specification Overview:

1. Log In To be determined by development team. Log in to access device for app programming.

* Local WiFi direct connection
* Prefer a name address instead of a numeric address. Example: DL100 instead of 192.168.4.4

HOME PAGE:

1. Home Page Includes Device Name, Open button, Hold button, Close button, Relay status, Exit Input status, and buttons to go to pages including: Codes, Settings.
2. Device Name Will display the current device name.
3. Hold button Should latch and hold the relay until the close button is pressed, unlatch code is entered on the keypad, or a toggle off code is entered on the keypad.
4. Open button Should activate the relay for xx:xx:xx time (hh:mm:ss). Default will be 00:00:02 (2 seconds). Needs to be adjustable since different applications require different activation times.

* Setting should be under Entry Code and will be set for each individual user.

1. Close button Should unlatch the relay.
2. Relay status Should show the current state of the Relay (not the last button pressed). Settings displayed will be ON, OFF. When app is opened, it will check the current state of the relay.

* ON = Relay NO and C circuit is active
* OFF = Relay NO and C circuit is inactive

1. Exit status Should show the current state of the Exit Input. Settings displayed will be ON, OFF. When app is opened, it will check the current state of the Exit Input.

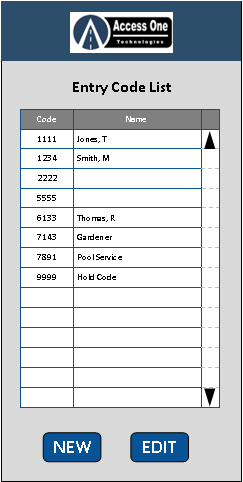
* ON = Exit Input is active (High) – Connection between Exit & GND
* OFF = Exit Input is inactive (Low) – No connection between Exit & GND

1. Program buttons Program buttons should allow user to select what section of programming to go to:

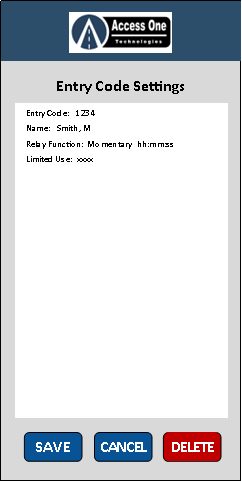
* Codes = Goes to Entry Code Programming page.
* Settings = Goes to Device Settings Programming page.

ENTRY CODE LIST:

A minimum of 100 Entry Codes should be allowed.

1. Entry Code List A list of entry codes including user name should be displayed when programming using the mobile app to add/edit/delete an entry code. List should be able to be displayed numerically by code or alphabetically by user name. A specific entry code or user name should be able to be selected for programming. Fields include Code, User (Guest) Name.

* Code – Code assigned to Guest
* Name – Guest Name

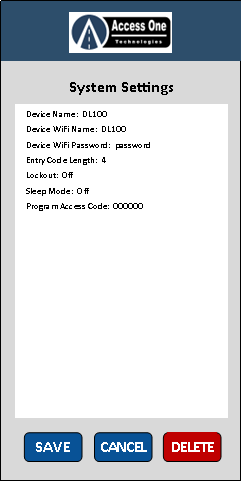
1. New/Edit Buttons Buttons used to set up a new entry code or edit an entry code.

* NEW – When pressed, will go to new Entry Code Settings Page to add new code and user (guest).
* EDIT – When an entry code or user name (guest) is selected in the list and then the Edit button is pressed, will go to the existing Entry Code Settings Page for that guest and display current settings. Settings can then be edited.

ENTRY CODE SETTINGS:

1. Entry Code 4-6 Digit code assigned to user (guest). This is the code a user will enter on keypad for access. Default = blank
2. User Name Name assigned to entry code for reference. This is used to help identify the user to a specific code. Default = blank
3. Relay Function Relay function for each entry code. Each individual code will have its own relay function. Default = Momentary 00:00:02 (2 seconds).

* None: Entry code does not activate relay.
* Momentary: Entry code activates relay for hh:mm:ss and then deactivates. Should be settable for each individual code with hh:mm:ss setting.
* Latch: Entry code can only latch the relay.
* Unlatch: Entry code can only unlatch the relay.
* Toggle: Entry code will Latch relay on first activation, unlatch relay on next activation.

1. Limited Use A setting allowing an entry code to be used xxxx amount of times. Once the number of times has been used, the code inactive. Example: A contractor may be given a code that will open the gate 10 times. On the 11th try, the code will not open the gate. (Also known as a Flash Code) Default = Off (unlimited uses)
2. Save Cancel Delete Save, Cancel, Delete buttons to make changes.

SYSTEM SETTINGS:

1. Device Name A specific name can be given to the device to help identify it to the user. Example: unit name = front gate. This name will be displayed on the Home Page screen when the app is used. Default = DL100
2. Device WiFi Name A specific name can be given to the device to help identify it when listed in a Bluetooth or WiFi List of devices. Sometimes there may be multiple devices close to each other so a specific name for each unit will be required. This name will be displayed on the user’s mobile phone settings. Default = DL100
3. Device WiFi Password A specific password can be given to the device to access the device network when programming with the mobile app. Default = password
4. Entry Code Length Entry Codes will be 4-6 digits and will be programmable in system settings. All codes will be the same length as set in system settings. Example: If 4-digits is set, then all codes will be 4-digits. If 6-digits is set, then all codes will be 6-digits. Default = 4-digits
5. Lockout Setting Lockout helps prevent unauthorized users from using multiple codes to try to access the system. The system has a 5-minute lockout feature that is activated when “xx” number of invalid entry codes are entered. The count is cleared each time a valid entry code is entered. Once the system enters the lockout mode, it may only be reset by waiting the 5-minutes or resetting power. The default setting is “OFF” which will turn the feature off allowing for unlimited entries.
6. Sleep Mode Sleep mode is used to turn the keypad back light off 30 seconds after use to save power. Once in sleep mode, any key pressed will turn the keypad light back on.
7. Programming Access Code A simple 6-digit numeric password will be used to enter programming mode when using the keypad. The password can be changed in system settings. Default password = 000000.
8. Save Cancel Delete Save, Cancel, Delete buttons to make changes.

## Keypad Programming:

Because the device will not include a LCD display, most programming will be done using a smart phone connected to the device. In some cases where a smart phone is not available, basic programming will be done using the built-in metal keypad. Only simple basic programming will be done because of the complexity of features and options. Features programmable using the keypad will include a simple entry code. More complex features will need to be programmed using a smart phone. Future features may need to be added to the keypad programming after customer evaluation.

1. Simple Code A simple entry code shall be programmable using the built-in keypad. A simple code means that most feature defaults will be used to minimize the programming steps. If a more complex code is required, then it will need to be programmed using a smart phone. Features that will be programmable include the entry code number and the relay function (momentary 00:00:02 or toggle). To program delete a simple code using the keypad:

* Enter Program Mode:
  + Press and hold the C (\*) for 5 seconds
  + Two quick normal beeps sound (Beep Beep)
* Enter the Program Access Code (default = 000000)
  + Enter the 6-Digit Program Access Code then press Enter (#)
  + Two quick normal beeps sound if valid Program Code (Beep Beep)
  + One long (2 second) beep sounds if invalid Program Code (BEEEEEEP)
* Select Add Code, Edit Code or Delete Code:
  + Press 1 then press Enter (#) to add new code, or
  + Press 2 then press Enter (#) to edit existing code, or
  + Press 3 then press Enter (#) to delete an existing code
  + Two quick normal beeps sound (Beep Beep)
* Enter Code (Default = 4-digits)
  + Enter the entry code and then press the Enter (#)
  + Two quick normal beeps sound if valid Code (Beep Beep)
  + One long (2 second) lower beep sounds if invalid Code (BEEEEEEP)
* Select relay function or confirm delete:
  + Press 1 then press Enter (#) for Momentary 00:00:02 (2 seconds)
  + Press 2 then press Enter (#) for Toggle
  + Press 3 then press Enter (#) to confirm delete
  + Three quick normal beeps confirm code is programmed or deleted. (Beep Beep Beep)
* Exit Program Mode:
  + Press and hold the C (\*) for 5 seconds to exit programming
  + Two long normal beeps sound to confirm exit. (BEEEEEEP, BEEEEEEP)
* All other defaults are set for the code. Simple code settings:
  + User Name = blank
  + Limited Use = Off

## Buzzer functions and sounds:

1. Keypad press Short normal beep when any button on the keypad is pressed (Beep)
2. Valid Code/ID Two short normal beeps when a valid code is entered on the keypad (Beep Beep)
3. Invalid Code/ID One long beep (2 seconds) when an invalid code is entered on the keypad (BEEEEEEP)
4. Keypad Programming Specified under keypad program section.

## Keypad Specs:

The keypad and specs for this device will be:

Manufacturer: YuYao JieXin Electronics Technologies Co., LTD

Model Number: JXS01B-QR

<http://www.jiexinsuper.com/productshow/420.html>

Diagram, schematic

Description automatically generated

## Revision Overview & Options:

Multiple units will be developed for a full line of digital locks. Possibly consider a single PCB to handle all or most units and features are turned on/off by firmware revision. Example: DL100 is a very simple unit with only 100 codes and no time clock features but a different firmware version would allow for time clock features and more memory making it the DL1500. And a different version of firmware would allow for WiFi Server connection for the DL1500-MG. All three units use the same board but features allowed are set by firmware installed???

1. DL100 Very basic and low cost unit. Minimal features available.
2. DL1500 Standard unit with 7-Day Timer. Standard features available.
3. DL1500-MG Standard unit with 7-Day Timer and Web Server connection for remote programming and activation.
4. DL2000 Advanced unit with 7-Day Timer, Fingerprint reader and/or RFID reader.
5. DL2000-MG Advanced unit with 7-Day Timer, Fingerprint reader and/or RFID reader, and Web Server connection for remote programming and activation.

## Revision Changes:

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| --- | --- | --- |
| Revision | Date | Changes & Notes |
| A | 03/23/23 | Original spec |
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**Access One Technologies**

316 Maidu Dr

Chester, CA 96020

(530) 931-8118