Glyph Reader User Manual

Revision History

Revision	Release Date	Notes
1.0	1/31/2026	Initial Release

Table of Contents

Introduction

The Glyph Reader is an interactive gesture recognition device that uses an infrared sensor to track wand movements and recognize predefined patterns (spells). Draw magical patterns in the air, and the device responds with visual feedback, LED effects, sound effects, and can trigger home automation actions via MQTT.

Hardware Overview
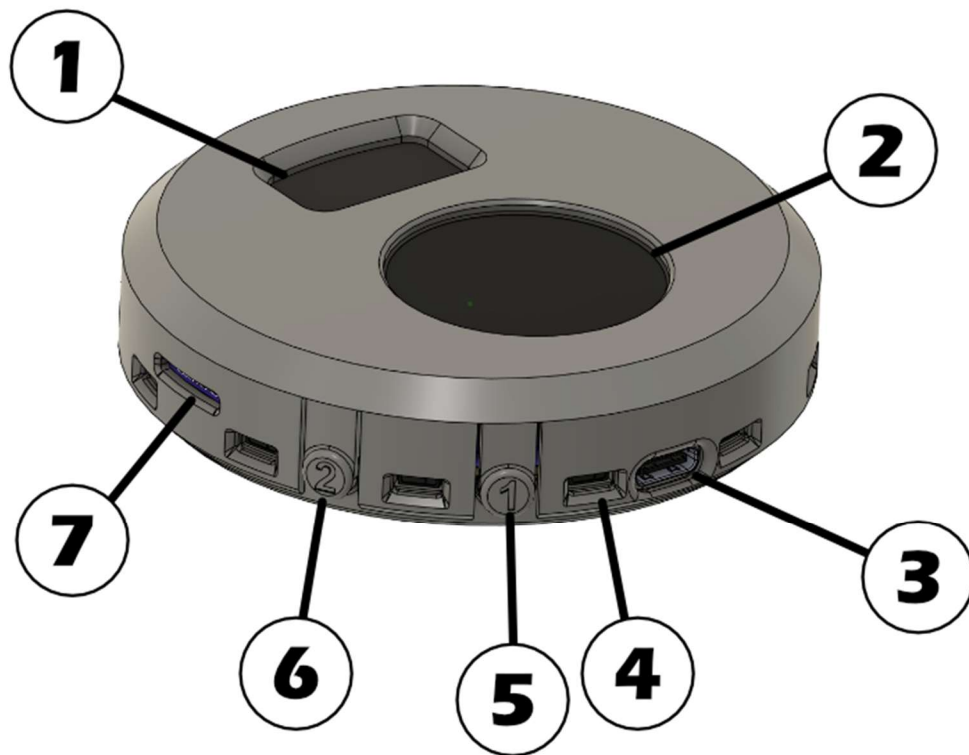
1. Wand Detection Sensor
2. Display
3. USB-C Connector for power
4. Effect LEDs (12 places)
5. Button 1
6. Button 2
7. Micro SD Card Slot

Initial Setup

First Power-On

1. **Power the device** using a USB-C cable
2. The **setup screen** will display initialization progress of various systems.
3. The device can now be used in offline mode
4. If desired, the device can be connected to your wifi to enable connections to home automation, see later section

Using the Device

Field of View

Sensor

The sensor in the Glyph Reader has a fairly narrow field of view. It's important to make sure the wand is in view when trying to use the device.
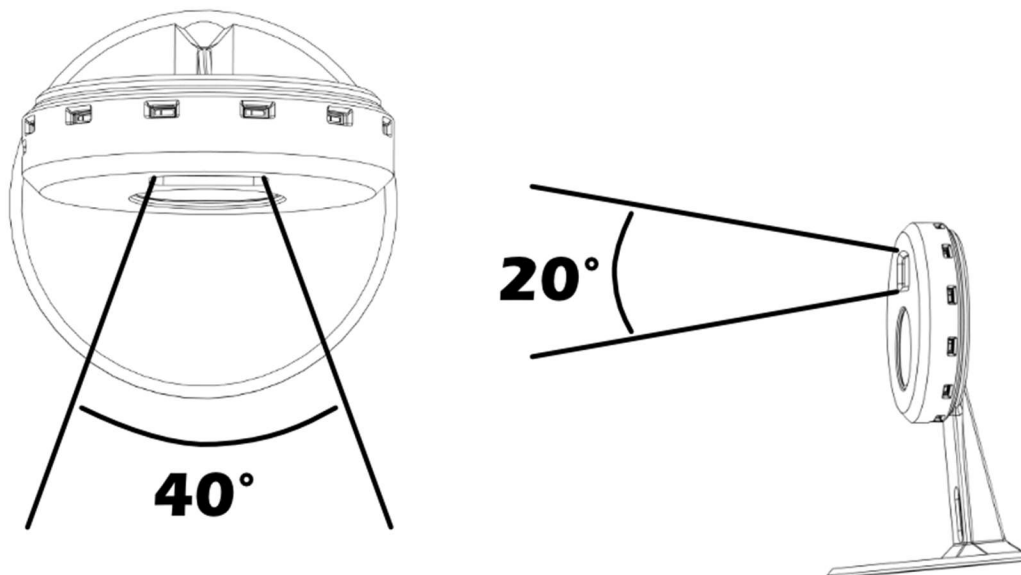
Wand

The IR emitter in the wand has a 60° Field of view, try to keep it pointing as directly at the Glyph Reader Sensor as possible
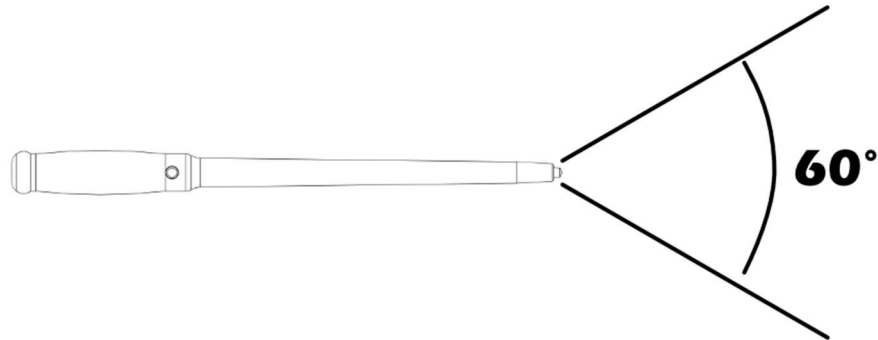
Basic Gesture Flow

1. **Point your wand** at the device (IR LED tip facing camera)
   - LED ring turns **yellow**
   - Display will show the wand tip location in its field of view
   - Move the wand to a position that is appropriate for the starting point of the spell you want to cast
2. **Hold still** for ~600ms
   - LED ring turns **green** (READY state)
   - Display shows a green ring around the perimeter
   - If sound is enabled a confirmation chime will be played
3. **Draw your spell pattern** in the air
   - Display shows a trace of your spell
   - LED ring turns **blue** (RECORDING)
4. **End Spell** by turning off the wand
   - Device processes your gesture against known spell patterns

Successful Match

When your gesture matches a spell (Highest score ≥70% similarity):

1. **Display**: Shows spell name and image (if available)
   - Spell name displays for 3 seconds
2. **LEDs**: Random color effect
   - Effect lasts 5 seconds
3. **Sound:** If sound is enabled, a random sound effect will be played
4. **MQTT**: Publishes spell name if MQTT is configured
5. **Special Spells**: Nightlight control (if configured)

No Match

When gesture doesn't match any spell:

1. **Display**: Shows "No Match"
2. **LEDs**: Solid red
3. **Sound**: If sound is enabled, an error chime will be played

Other Feedback Messages

- **"Too Small"**: The bounding box of the traced spell was not large enough (200x200 pixels)
- **"Too Short"**: Gesture had too few points (less than 50 points)

Screen Behavior

- **Backlight timeout**: 60 seconds of inactivity
- **Wake up**: Any spell detection wakes the screen

WiFi Configuration

When the device has no saved wifi network, or can't find a saved network, it will create a WiFi access point used for setup:

1. **Connect to the access point**:
   - Network Name: GlyphReader-Setup
   - No password
2. **Open a web browser** and navigate to:
   - http://192.168.4.1
   - Or the captive portal should open automatically
3. **Configure WiFi**:
   - Click "Configure WiFi"
   - Select your home WiFi network from the list
   - Enter your WiFi password
   - Click "Save"
4. **The device either will connect or create the Access Point again if connection fails**

Accessing the Web Portal After Setup

Once connected to WiFi, access the device at:

- http://glyphreader.local (recommended)
- Or by IP address (check your router)

Offline Mode

If WiFi is not configured or unavailable:

- Device operates in offline mode
- MQTT features disabled
- Web portal accessible at http://192.168.4.1 when connected to the created access point
- Local spell detection still works

Web Portal Settings

Access the web portal to configure advanced settings.

MQTT Configuration

Purpose: Send spell detection events to home automation systems

- **MQTT Host**: IP address or hostname of your MQTT broker

    o Example: 192.168.1.100 or homeassistant.local

- **MQTT Port**: Default is 1883

- **MQTT Topic**: Topic where spell events are published

    o Example: home/wand/spell

    o Published message will have the spell name as the payload

Nightlight Settings

Configure spell-based nightlight control (also available via on-board settings):

- **Nightlight ON Spell**: Choose which spell activates nightlight
    o Example: "Illuminate"
- **Nightlight OFF Spell**: Choose which spell deactivates nightlight
    o Example: "Dark"
- **Nightlight Raise Spell:** Choose which spell makes the nightlight brighter
    o Example: "Raise"
- **Nightlight Lower Spell:** Choose which spell makes the nightlight brighter
    o Example: "Lower"
    o

You can set the same spell for On and Off, the device will toggle the status with each detection of the spell

Sound Settings

Sound effects can be enabled or disabled with the checkbox. This setting is not available in the on board menu, and the device defaults to sounds being off.

Custom Spell Names

If you have defined custom spell patters either via direct tracing, or through the spells.json file (see later in this manual), you can rename them here. If you have no custom spells no fields will be generated.

Location Override

Location is used to determine when to turn the nightlight off, the device calculates local sunrise time and sets that as the time to turn off the Nightlight.

If the device is connected to wifi it will find its rough location automatically and set these.

If you wish to override the location, or set the location for device that is not connected to wifi, you can enter your local Latitude, Longitude, and Time zone offset

Gesture Tuning Parameters

Settings for detecting and tracking spells can be fine-tuned if desired. No tuning should be required for the device to function, but changing some settings may make it work better for different people.

Stillness Threshold (default: 20 pixels)
- Maximum movement considered "still" to start spell tracing
- Used to detect ready state at the beginning of a spell

Ready Stillness Time (default: 600ms / 0.6 seconds)
- How long must the wand stay inside the stillness threshold to enter READY state

Movement Threshold (default: 15 pixels)
- Minimum movement required to start recording a gesture after entering ready state
- Setting too low may cause false starts more often, but higher settings may make the device feel sluggish

Gesture Timeout (default: 5000ms / 5 seconds)
- Maximum time allowed to complete a gesture
- Gesture ends automatically if exceeded

IR Loss Timeout (default: 300ms / 0.3 seconds)
- How long IR can be lost before ending gesture
- Allows brief tracking loss without ending spell

Saving Settings
- Click "Save Settings" button
- Settings are stored in non-volatile memory and will survive reboots

Nightlight Mode

Activating Nightlight

Method 1: Spell-based
- Configure nightlight spells in web portal or on-board settings
- Cast the configured "ON" spell

Method 2: Button Control
- Single-click **Button 1**

Nightlight Brightness

Adjust while active:

- Cast "Raise" spell: Increase brightness
- Cast "Lower" spell: Decrease brightness

Nightlight Timeout

- If device is connected to wifi the device will calculate the approximate time of the next sunrise and turn off at that time.
- If the device is not connected to wifi and the location has not been set, the nightlight turns off after a set 8 hours

Turning Nightlight Off

The night light can be turned off before the timeout in two ways:

- Cast the configured "OFF" spell
- Press button 1 on the device

On-Board Settings Menu

Configure various settings without using the web portal

Entering Settings Mode

1. **Double-click Button 2**
2. Display shows settings menu
3. Camera tracking is **disabled** while in settings

Settings Menu Display

- **Top Line**: Settings Category
    - Example: Night Light or Spells
- **Second Line:** Specific Setting
    - Example: On Spell or Off Spell
- **Center**: Current value (spell name or "Disabled")
- **Bottom**: Navigation instructions
- **Mode indicator**:
    - < BROWSE > (yellow): Navigating between settings
    - [EDITING] (green): Changing a value

Navigating Settings

Browse Mode (default):
- **Button 2 (single-click)**: Move to next setting
- **Button 1 (single-click)**: Enter edit mode

Edit Mode:

- **Button 2 (single-click)**: Cycle through setting options
- **Button 1 (single-click)**: Save and exit edit mode

Available Settings

Night Light

1. On Spell: Which spell turns the Night Light on
2. Off Spell: Which spell turns the Night Light off
3. Raise Spell: Which spell turns the Night Light Brightness up
4. Lower Spell: Which spell turns the Night Light Brightness down

Spells

1. Add Spell: This setting allows you to directly teach the device a new spell pattern (see section on adding spells for more details)
2. Spell Color: You can change the color of the matched spell pattern image, or choose to have a random color selected each time

Exiting Settings

- **Long-press Button 2** (hold 1 second)
- Returns to normal operation
- Camera tracking re-enabled

Home Automation Integration

MQTT Publishing

The device can be configured to send MQTT messages when a spell is matched to allow triggering various automations

Topic: Configured in web portal (e.g., home/wand/spell)

Payload: Spell Name

Use your preferred home automation software (home assistant, node red, etc) to configure actions based on the MQTT trigger.

SD Card

The device ships with an sd card installed and ready to go, however if you need to replace the card for some reason it should be formatted in a way that the device can recognize. To setup a new card do the following

1. **Format SD card**: FAT32 file system, allocation size set to 4096
2. **Ensure all image files are placed in the root directory of the card**
    All stock images are provided in the github page
3. If you wish to enable sounds, create a folder named "sounds", and place all the sound effect files in it
    All sound files are provided in the github page
4. If you wish to customize spells, create a spells.json file in the root directory of the sd card (see next section for details)
5. **Insert into device**: SD card slot is on the left side of the device, contacts towards the back of the device

In the github repository there is also an sdCard.zip file that has all the required stock files that can be unzipped onto a new SD card

Customizing Spells

You can modify the existing spells, and add your own custom spells to the device.

Customizing spells is done by placing a spells.json file on the SD card. Example and starting files are provided on the github page

github.com/FutilityDesigns/Glyph-Reader

New spells can be added in the same spells.json file, or the device can be taught new patterns directly through the settings menu

Modify Spells

Any of the built in spells can be modified to change their name, displayed image, or even the spell path.

File: spells.json

```
{
 "modify": [
  {
   "name": "Ignite",
   "customName": "fire"
   "imageFile": "my_ignite.bmp"
   "pattern": [
    {"x": 100, "y": 100},
    {"x": 200, "y": 200},
    {"x": 300, "y": 100}
   ],
  }
 ]
}
```

Fields:

- name: Exact name of existing spell to modify (required)
- customName: desired new name (optional)
- imageFile: name of replacement image to use, include extension type (optional)
- pattern: Array of {x, y} coordinates (optional)
  - Use a grid of X: 0-1024 Y: 0-768
  - 0,0 is the upper left, 1024,768 is the lower right
  - Straight lines can be defined with a start and end point
  - Curves should be broken into smaller straight line segments and defined with multiple points

Custom Images

The source affinity designer files are included in github for use in creating new images

1. Final Format: 24-bit BMP file (240x240)
2. Place in SD card root directory
3. Filename is case-sensitive

**Default naming**: If no custom image specified, device looks for <spellname>.bmp (e.g., ignite.bmp)

Reloading Changes

1. Power off device
2. Update spells.json on SD card
3. Power on device
4. Changes loaded during startup

Adding New Spells

Adding through the spells.json file

Entirely new spells can be added to the device. Be sure to pick patterns that are distinct enough from the built in patterns to not cause false matches. For example, a square drawn as shown has a high likelihood of being mistaken for the Raise spell
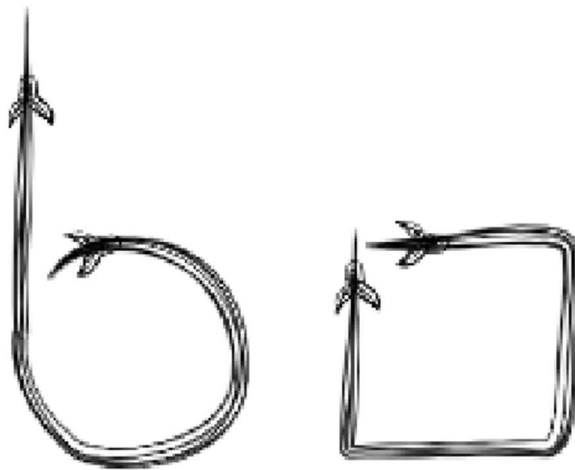
Compare the desired new spell patterns to all existing spell patterns before adding them to make sure they're unique enough to be accurately detected.

New Spell example. To create a diamond shape, you would add the following to the spells.json file

File: spells.json

```
{
 "custom”: [
  {
   "name": "Diamond",
   "imageFile": "diamond.bmp",
   "pattern": [
    {"x": 512, "y": 100},
    {"x": 600, "y": 200},
    {"x": 700, "y": 400},
    {"x": 600, "y": 600},
    {"x": 512, "y": 700},
    {"x": 400, "y": 600},
    {"x": 300, "y": 400},
    {"x": 400, "y": 200},
    {"x": 512, "y": 100}
   ]
  }
 ]
}
```

Fields:

- name: Name of new spell (required)
- imageFile: name of image to be displayed with spell match (optional)
- pattern: Array of {x, y} coordinates (optional)
  - Use a grid of X: 0-1024 Y: 0-768
  - 0,0 is the upper left, 1024,768 is the lower right

Images

The source affinity designer files are included in github for use in creating new images
4. Final Format: 24-bit BMP file (240x240)
5. Place in SD card root directory
6. Filename is case-sensitive

Pattern Design Tips

1. **Coordinate scale**: Use a design grid of X: 0-1024 Y: 0-768. The pattern and traced spells are normalized in size at run time, so using a smaller grid to define the path won't change matching.

2. **Point count**: 10-20 points works well, use less points for patterns with straight lines, use more for patterns with curves

3. **Distinctive shapes**: Avoid patterns that are too similar to other existing spells in order to reduce false positives in matching.

4. **Test and iterate**: Adjust based on recognition accuracy

Spell Pattern Examples

See CUSTOM_SPELLS.md in github for detailed examples and advanced configuration options.

Troubleshooting

WiFi Won't Connect

Symptoms: Stuck in AP mode

Solutions:

1. Verify WiFi password is correct
2. Check WiFi is 2.4GHz (ESP32 doesn't support 5GHz)
3. Move device closer to router
4. Try accessing web portal at 192.168.4.1
5. Reset WiFi settings in web portal

Spells Not Recognized

Symptoms: Always shows "No Match"

Solutions:

1. Point wand IR LED directly at camera
2. Hold still longer in ready position
3. Draw pattern more slowly
4. Adjust tuning parameters in web portal:

SD Card Not Detected

Symptoms: "SD Card: fail" during setup

Solutions:

1. Verify SD card is formatted FAT32
2. Try changing allocation size when formatting, 4096bits is a safe option
3. Check SD card is inserted fully
4. Try different SD card (max 32GB recommended)

Appendix: Built-in Spells

1. **Unlock**

   Pattern: Clockwise circle + line down

2. **Terminate**

   Pattern: Z-shape

3. **Ignite**

   Pattern: Triangle

4. **Gust**

   Pattern: V-shape

5. **Lower**

   Pattern: Arc 12→7 clockwise + line down

6. **Raise**

   Pattern: Arc 6→10 counter-clockwise + line up

7. **Levitate**

   Pattern: Arc 9→3 counter clockwise + line down

8. **Silence**

   Pattern: Arc 3→9 clockwise + line down

9. **Halt**

Pattern: Capital Letter M

10. **Resume**

Pattern: Capital Letter W

11. **Move**

Pattern: Number 4 drawn from bottom of vertical line

12. **Illuminate**

Pattern: Star shape

13. **Dark**

Pattern: X shape with left side joined with a vertical line

Quick Reference Card

Button Controls

Action	Result
Button 1 - Single Click	Toggle nightlight (normal mode)
Button 2 - Double Click	Enter settings menu
Button 2 - Long Press	Exit settings menu
Settings: Button 1	Select/Confirm setting
Settings: Button 2	Navigate/Change value

LED Indicators

Color	Meaning
Solid Yellow	WAND DETECTED: waiting for stillness
Solid Green	READY: Wand is still and device is ready to track
Solid Blue	RECORDING - Drawing gesture
Random Effect	Spell matched successfully
Solid Red	No match / Error
Soft White	Nightlight mode active

Web Portal Quick Links

- Portal: http://glyphreader.local
- AP Mode: http://192.168.4.1

For more information, see:

- Source code: github.com/futilitydesigns/glyphReader

Support: Support@futilitydesigns.com

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