

Overview

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This section documents all experiment protocols used for freely-walking optomotor experiments on the G3 LED arena.

1 What is a Protocol?

A protocol is a MATLAB script that defines a complete experimental session, including:

- **Timing parameters:** Acclimation periods, trial durations, inter-stimulus intervals
- **Stimulus conditions:** Which patterns to show, at what speeds, in what order
- **Data logging:** Video recording, temperature monitoring, metadata collection

2 Protocol Overview

Protocol	Description	Patterns	Conditions
Protocol_v1	Circadian optomotor experiments	2	0
Protocol_v10_all_tests	Testing spatial frequencies, speed, and trial lengths	4	8
protocol_10	Testing spatial frequencies, speed, and trial lengths	0	0
protocol_11	Protocol_v11	2	0
protocol_12	Short, all high contrast, replacing flicker with all ON	2	0
protocol_13	Very long num_trials_per_block (20, 40, 60)	2	0
protocol_14	Different interval stimuli - flicker, static gratings, ON/OFF	2	0
protocol_15	Testing skinny bars (4ON 12OFF) (12ON 4OFF)	3	3
protocol_16	Testing skinny bars (2ON 6OFF)	3	3
protocol_17	2ON 14OFF grating stimulus, flicker x4	2	0
protocol_18	Based on protocol 10 with curtain ON/OFF stimuli	3	6
protocol_19	Curtain ON/OFF and 2ON 14OFF stimuli	6	12
protocol_20	Shifted centre with 60deg patterns	3	6

Protocol	Description	Patterns	Conditions
protocol_21	Follow-up protocol 1 after protocol 19 screen	5	10
protocol_22	Follow-up protocol 2 - bar fixation, reverse phi	8	8
protocol_23	Test different contrast values for ON/OFF bars	2	2
protocol_24	Screen Protocol 1 - multi-stimulus	10	10
protocol_25	Short protocol for testing individual flies	4	4
protocol_26	Test different curtain stimuli (32 pixels)	6	4
protocol_27	Screen Protocol 2 - comprehensive stimulus set	12	12
protocol_28	Test reverse phi modifications	2	0
protocol_29	Screen Protocol 3 - with CW/CCW intervals	12	12
protocol_30	Different contrasts test	3	7
protocol_31	60deg and 15deg gratings - 4 speeds	8	10
protocol_32	60deg and 15deg gratings - long trials	7	5
protocol_33	Low luminance 60deg grating and flicker	4	2
protocol_r4	Reverse v4 - different switch intervals	2	0
protocol_v2	All high contrast optomotor patterns	2	0
protocol_v3	Optomotor stimulus one direction only	2	0
protocol_v4	Different switch intervals - short to long	2	0
protocol_v5	Short, all high contrast, for individual fly	2	0
protocol_v6	Optomotor with shifted centre of rotation	1	0
protocol_v7	Different speeds	2	0

Protocol	Description	Patterns	Conditions
protocol_v8	Optomotor freely walking with 4 pixel stripes	2	0
protocol_v9	Different spatial frequencies	6	0

3 Protocol Structure Reference

3.1 Timing Parameters

Parameter	Description	Typical Value
<code>t_acclim_start</code>	Dark acclimation before stimuli	300s (5 min)
<code>t_acclim_end</code>	Dark acclimation after stimuli	30s
<code>t_interval</code>	Inter-stimulus interval	15-30s
<code>t_flash</code>	Calibration flash duration	5s
<code>t_pause</code>	Command pause (hardware timing)	0.01s

3.2 Condition Array Format

The `all_conditions` matrix has 7 columns:

Column	Field	Description
1	<code>pattern_id</code>	Pattern number to display
2	<code>interval_id</code>	Pattern for inter-stimulus interval
3	<code>speed_patt</code>	Speed for main pattern (fps)
4	<code>speed_int</code>	Speed for interval pattern (fps)
5	<code>trial_dur</code>	Trial duration (seconds)
6	<code>int_dur</code>	Interval duration (seconds)
7	<code>condition_n</code>	Condition number

3.3 Speed Values

Speed Value	Approximate Rate
0	Static (no motion)

Speed Value	Approximate Rate
1	Minimal (fixation)
8	~4 Hz
32	~16 Hz
64	~32 Hz
127	Maximum (~63 Hz)

4 Data Output

Each protocol run generates:

- **Video:** UFMF format via SimpleBiasCameraInterface
- **LOG.mat:** Trial timing, conditions, temperature, metadata
- **Google Sheets:** Optional export for experiment tracking

Output folder structure:

```
project_data_folder/
  YYYY-MM-DD/
    protocol_name/
      strain/
        sex/
          HH-MM-SS/
            LOG_YYYYMMDD_HHMMSS.mat
            video.ufmf
```

5 Protocol Categories

5.1 Screen Protocols (Comprehensive)

These protocols include a wide variety of stimuli for characterizing visual responses:

- **protocol__24:** Screen Protocol 1 - Original comprehensive protocol
- **protocol__27:** Screen Protocol 2 - Updated March 2025, includes reverse phi
- **protocol__29:** Screen Protocol 3 - With intervals between CW/CCW

5.2 Versioned Protocols (Development Series)

Early development protocols used for establishing experimental parameters:

- **Protocol_v1 - v10:** Progressive refinement of experimental design
- Focus on different spatial frequencies, speeds, and trial structures

5.3 Numbered Protocols (Specific Experiments)

Purpose-specific protocols for particular experiments:

- **protocol_10-13:** T4T5 experiments with varying parameters
- **protocol_15-16:** Skinny bar gap testing
- **protocol_18-19:** Curtain stimuli
- **protocol_30-33:** Contrast and luminance variations

6 Adding a New Protocol

When you create a new experiment protocol, follow these steps to add it to this documentation:

6.1 Step 1: Create the Protocol File

Create your protocol in the `freely-walking-optomotor/protocols/` directory.

Your protocol should follow this structure:

```
% protocol_XX.m - Brief description
%
% Includes:
% - List of stimuli types
% - Key parameters

clear

% Initialize temperature recording
d = initialize_temp_recording();

% Protocol parameters
t_acclim_start = 300; % seconds
t_interval = 20;      % seconds
t_pause = 0.01;
```

```
% Conditions: [pattern_id, interval_id, speed, speed_int, trial_dur, int_dur, condition_n]
all_conditions = [
    9, 47, 127, 1, 15, t_interval, 1; % 60 deg gratings - 4Hz
    % Add more conditions...
];

% ... rest of protocol
```

6.2 Step 2: Generate Documentation

From the freely-walking-optomotor directory, run:

```
cd /path/to/freely-walking-optomotor
pixi run -e default --manifest-path python/freely-walking-python/pixi.toml \
    python docs_generator/generate_protocol_docs.py \
    protocols/protocol_XX.m
```

This will:

1. Parse the protocol file and extract metadata
2. Create a .qmd documentation page in reiser-documentation/Freely-walking/

6.3 Step 3: Preview and Deploy

```
cd /path/to/reiser-documentation
quarto preview
```

Once satisfied, commit and push to deploy.

7 Regenerating All Protocol Documentation

To regenerate documentation for all protocols:

```
cd /path/to/freely-walking-optomotor
pixi run -e default --manifest-path python/freely-walking-python/pixi.toml \
    python docs_generator/generate_protocol_docs.py
```