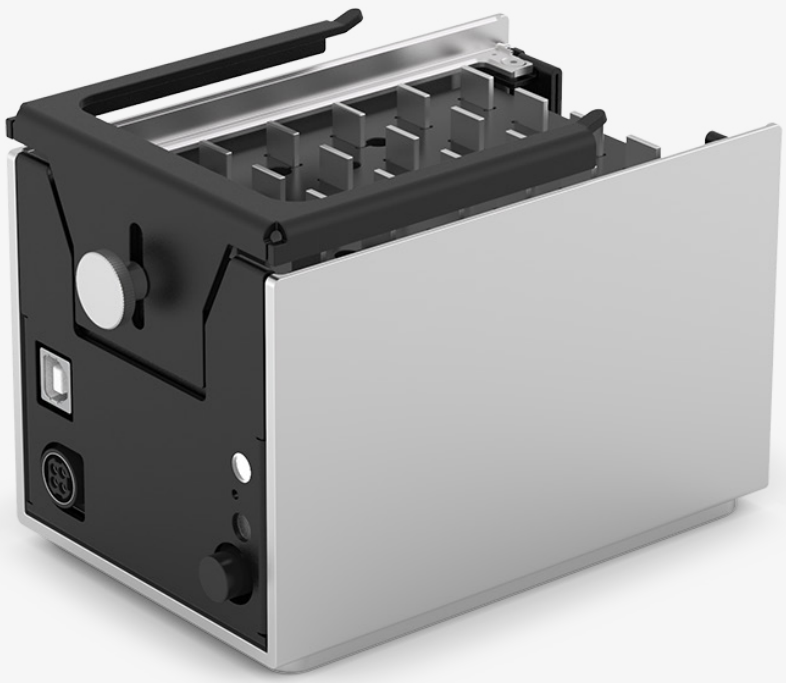
opentrons

WHITE PAPER

Magnetic Module for Bead-Based Extraction and Purification

Magnetic Plate to Engage and Disengage with Labware

Written by
Opentrons



SECTION 1

Product Description

The Opentrons Magnetic Module is a device that automatically engages and disengages high-strength neodymium magnets to seated well plates within the module housing. The module can readily be used with the Opentrons App. The Magnetic Module comes with two separate adjustable plate brackets for supporting standard and deep well labware. Users are able to remove and/or swap brackets by unscrewing the module's thumb screw.

The magnetic plate on the module supports many different magnetic bead products for extraction and purification of nucleic acids in the labware shown below. The brackets allow for support of protocols with standard or deep well 96 plates with volumes ranging from 10 µL to 2 mL. For more information in designing a protocol on the Magnetic Module, please refer to the **Nucleic Acid Purification Technical Note**.

Magnetic Module with 0.2 mL 96 well PCR plate

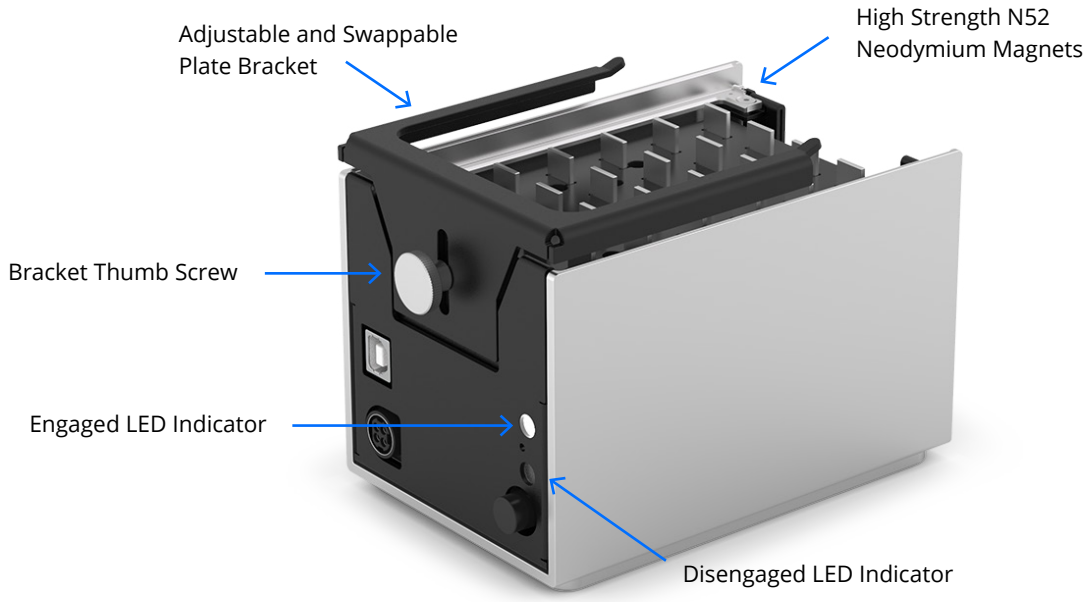
Magnetic Module with 2 mL Deep Well Plate

SECTION 2

Magnetic Module Overview

WELL PLATE COMPATIBILITY

The standard plate bracket supports 0.2 mL plate sizes up to 22 mm in vertical height. The deep well bracket can support deep well trays up to 47 mm in vertical height.



SECTION 3

Data

EVALUATION IN NEST FULL SKIRT 96 WELL PLATES

The Opentrons GEN2 Magnetic Module has been evaluated to determine the amount of time it takes for the supernatant to become clear. All trials took place at the default height (18mm) on the magnetic module for 8 bead types. Each test was performed in a NEST full skirt 96 well plate. For each bead type, 4 volumes were measured; 20 µl, 30 µl, 40 µl and 50 µl. At each volume, wells A1, A6, A12, D6, E7, H1 and H12 were filled to determine how pelleting changed across the plate. Starting from 0 minutes (Figure 1), images of the plate were taken in 1 minute increments and the wells were observed until all wells had a clear supernatant (Figure 2). The results for the extraction clean up beads can be seen in Table 1, the results for the NGS kit beads can be seen in Table 2 and the results for library preparation can be seen in Table 3.

FIGURE 1

96 well plate with no pelleting

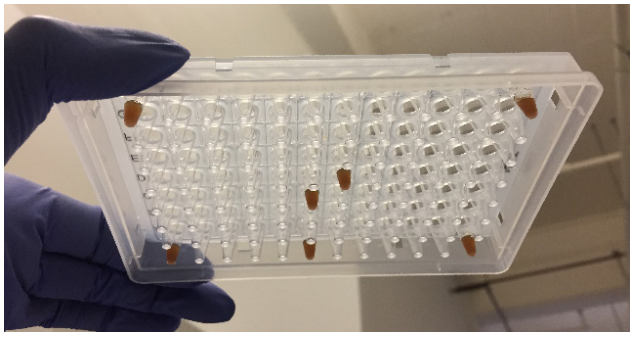
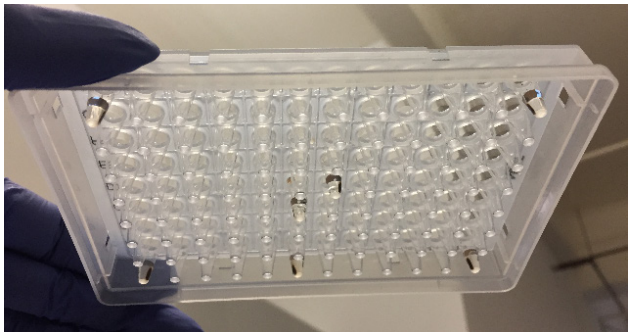


FIGURE 2

96 well plate with clear supernatant



EVALUATION IN NEST DEEP WELL PLATES

For the deep well plate experiments, 1 ml and 2 ml deep well plates were used. The same designated wells were used as before, in the 96 well plates on the Opentrons GEN2 Magnetic Module at the default height for each test. For these experiments, only Omega-Biotek's Mag-Bind HDQ beads were used. To prepare these beads, 400 µL HDQ Binding Buffer and 20 µL Mag-Bind® Particles HDQ were added to each well and pipetted repeatedly to mix well. As with the 96 well plate, starting from 0 minutes (Figure 3), images of the plate were taken in 1 minute increments and the wells were observed until all wells had a clear supernatant.

FIGURE 3

Nest 1 mL Deep well plate with beads fully suspended

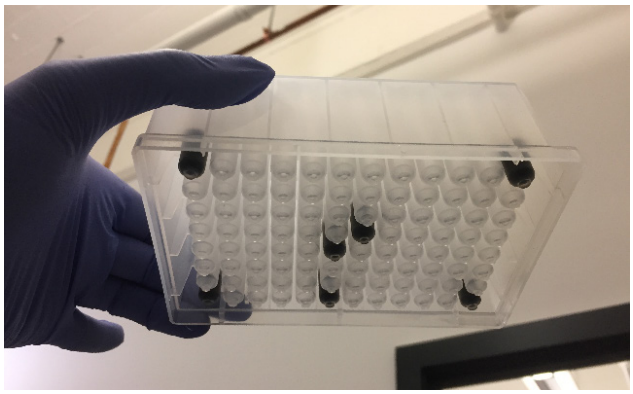


FIGURE 4

Nest 1 mL Deep well plate with clear supernatant

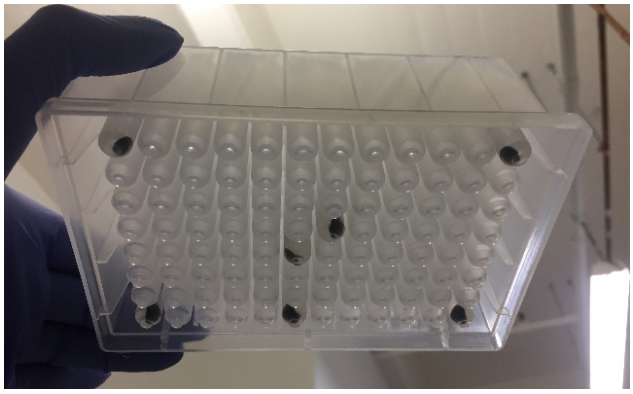


TABLE 1

Pelleting Times for Extraction Clean Up Beads at Default Height

COMPANY	BEADS	VOLUME	ENGAGE HEIGHT	TIME TO PELLET
Beckman Coulter	SPRISelect	20 µL	default	6 min
Beckman Coulter	SPRISelect	30 µL	default	6 min
Beckman Coulter	SPRISelect	40 µL	default	8 min
Beckman Coulter	SPRISelect	50 µL	default	8 min
Qiagen	Qiaseq	20 µL	default	5 min
Qiagen	Qiaseq	30 µL	default	5 min
Qiagen	Qiaseq	40 µL	default	5 min
Qiagen	Qiaseq	50 µL	default	7 min
Omega Bio-tek	Mag-bind RXNPure Plus	20 µL	default	5 min
Omega Bio-tek	Mag-bind RXNPure Plus	30 µL	default	5 min
Omega Bio-tek	Mag-bind RXNPure Plus	40 µL	default	6 min
Omega Bio-tek	Mag-bind RXNPure Plus	50 µL	default	8 min

TABLE 2

Pelleting Times for NGS Kit Beads at Default Height

COMPANY	BEADS	VOLUME	ENGAGE HEIGHT	TIME TO PELLET
Beckman Coulter	AMPure XP	20 µL	default	5 min
Beckman Coulter	AMPure XP	30 µL	default	5 min
Beckman Coulter	AMPure XP	40 µL	default	5 min
Beckman Coulter	AMPure XP	50 µL	default	6 min
Omega Bio-tek	Mag-Bind TotalPure NGS	20 µL	default	5 min
Omega Bio-tek	Mag-Bind TotalPure NGS	30 µL	default	5 min
Omega Bio-tek	Mag-Bind TotalPure NGS	40 µL	default	6 min
Omega Bio-tek	Mag-Bind TotalPure NGS	50 µL	default	8 min
Omega Bio-tek	Mag-Bind TotalPure NGS	20 µL	default	5 min
Omega Bio-tek	Mag-Bind TotalPure NGS	30 µL	default	5 min
Omega Bio-tek	Mag-Bind TotalPure NGS	40 µL	default	6 min
Omega Bio-tek	Mag-Bind TotalPure NGS	50 µL	default	8 min
BASE Prime	PureBASE NGS	20 µL	default	6 min
BASE Prime	PureBASE NGS	30 µL	default	6 min
BASE Prime	PureBASE NGS	40 µL	default	7 min
BASE Prime	PureBASE NGS	50 µL	default	7 min

TABLE 3

Pelleting Times for Library Preparation Beads at Defaut Height

COMPANY	BEADS	VOLUME	ENGAGE HEIGHT	TIME TO PELLET
iGenomix	Riptide High Throughput Rapid Library Prep	20 µL	default	4 min
iGenomix	Riptide High Throughput Rapid Library Prep	30 µL	default	6 min
iGenomix	Riptide High Throughput Rapid Library Prep	40 µL	default	7 min
iGenomix	Riptide High Throughput Rapid Library Prep	50 µL	default	8 min
illumina	Nextera DNA Flex Library Prep	20 µL	default	4 min
illumina	Nextera DNA Flex Library Prep	30 µL	default	4 min
illumina	Nextera DNA Flex Library Prep	40 µL	default	7 min
illumina	Nextera DNA Flex Library Prep	50 µL	default	6 min

TABLE 4

Deep Well Results

MAGNET	PLATE	COMPANY	BEADS	VOLUME	ENGAGE HEIGHT	TIME TO PELLET
N42	1 mL Deep Well	Omega Bio-tek	Mag-Bind HDQ	420 µL	default	1 min
N42	2 mL Deep Well	Omega Bio-tek	Mag-Bind HDQ	420 µL	default	1 min

CONSIDERATIONS

When using heavy beads such as Omega-Biotek's Mag-Bind HDQ beads, it is important to note that these beads are heavy and settle quickly when left to stand. Beads should be mixed thoroughly immediately prior to usage to prevent premature settling of the beads from the supernatant.

POWER USAGE

Module input: 36V, 2A
Power adapter input: 100-240VAC, 50/60Hz

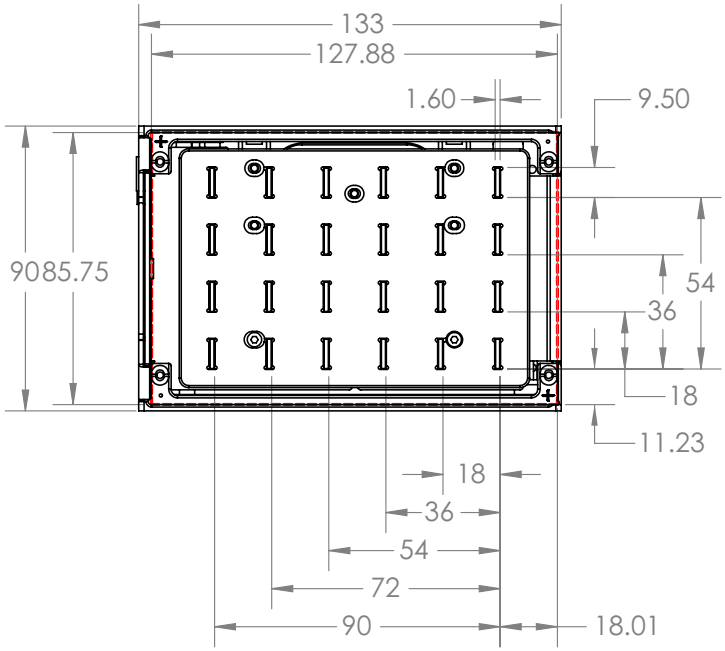
SECTION 4

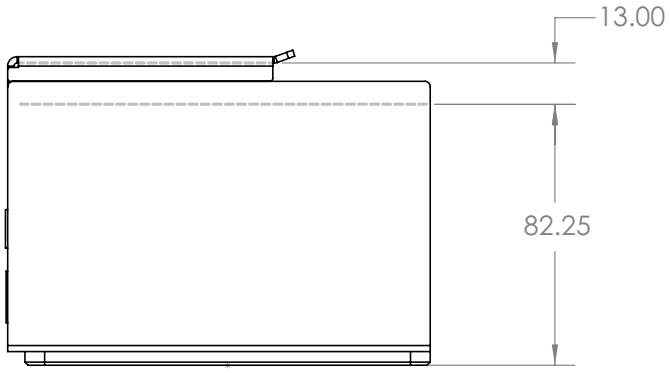
Dimensional Drawings

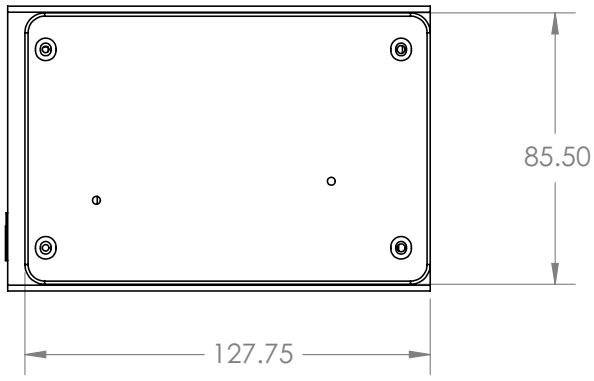
Standalone Magnetic Module Mass is 1.5kg.
Millimeter units are shown in all dimensional drawings.

DIMENSIONAL DRAWINGS

Magnetic Module

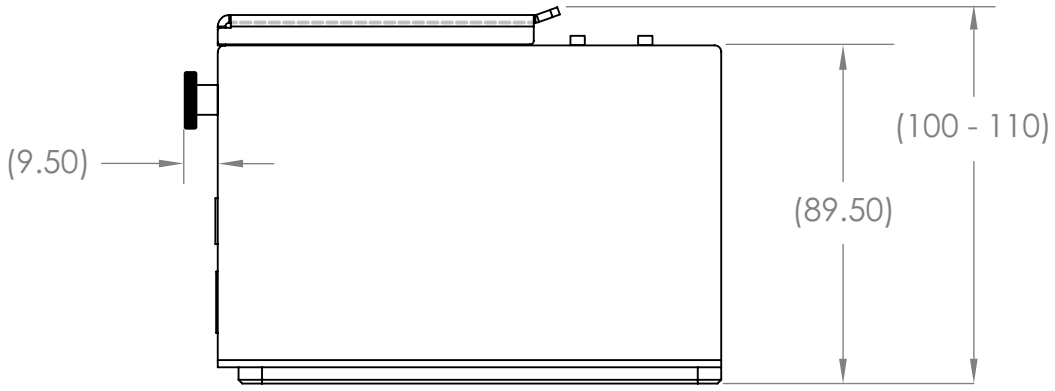






DIMENSIONAL DRAWINGS

Magnetic Module with Standard Plate Bracket



DIMENSIONAL DRAWINGS

Magnetic Module with Deep Well Plate Bracket