



# EDGE Motor Evaluation Kit Application Guide



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6,747,391; 6,661,153; 69838991.3; 6,384,515; 7,119,477; 7,075,211;  
69932359.5; 1186063; 7,211,929; 69941195.5; 1577961; 4813708; 6,879,085;  
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## Revision History

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|----------|--------------|---|
| 00/A     | July 2009    | New release   |
| NA       | Aug. 2012    | Administrative change – added patent information section in front matter. |
|          |              |   |
|          |              |   |



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## List of Abbreviations

|       |  |
|-------|--|
| IIC   | Inter-Integrated Circuit<br>Serial Communication Interface |
| ASIC  | Application Specific Integrated Circuit                    |
| AC    | Alternating Current  |
| DC    | Direct Current   |
| LED   | Light Emitting Diode                                       |
| RS232 | Serial Communication Protocol                              |
| PCB   | Printed Circuit Board                                      |

# 1 General

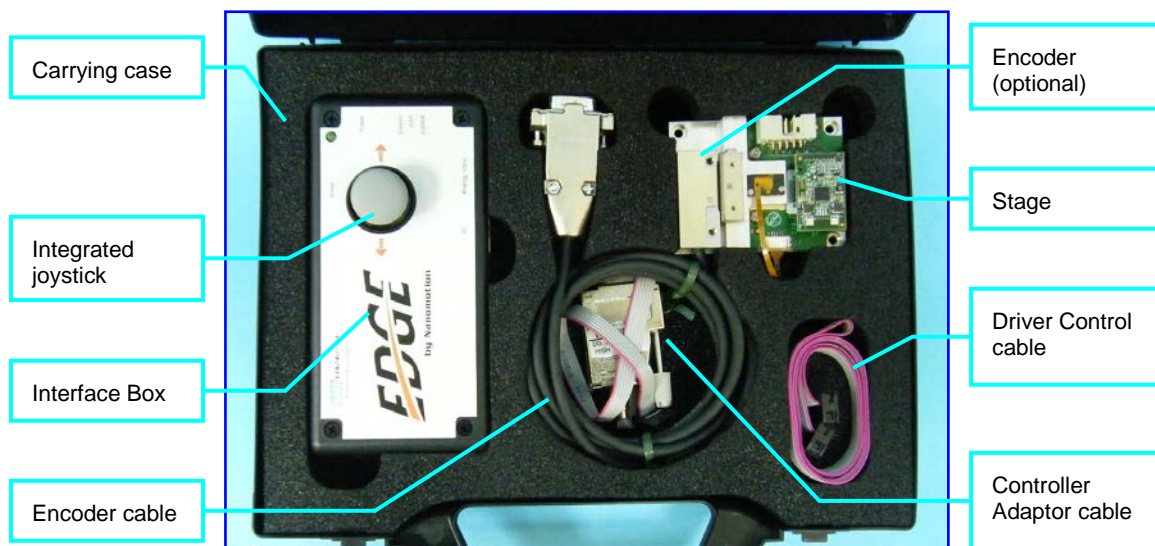
## 1.1 Introduction

The purpose of this application guide is to help the reader operate the EDGE Evaluation Kit.

The EDGE Evaluation Kit allows to operate and evaluate the Nanomotion EDGE motor characteristics in close loop or open loop. The Evaluation Kit consists of the EDGE motor, assembled on a Motion Module, together with the ASIC driver and of a multipurpose Interface Box. The EDGE Evaluation Kit is available in configurations of open/close loop and linear/rotary, see section 2.1.

## 1.2 EDGE Evaluation Kit Content

- Motion Module: EDGE motor + ASIC driver; linear / rotary slide; 0.1 $\mu$  encoder (optional).
- Interface Box (including four AAA batteries) with integrated joystick.
- 5VDC power supply (P/N: EAE000031): Stontronics - 3A-181WP05 - adaptor, multi plug, 18W, 5V. When connected, overruns the batteries power source. Does not recharge the batteries.
- Driver Control cable.
- Controller Adaptor cable.
- Carrying case.



**Figure 1: EDGE Evaluation Kit Content**

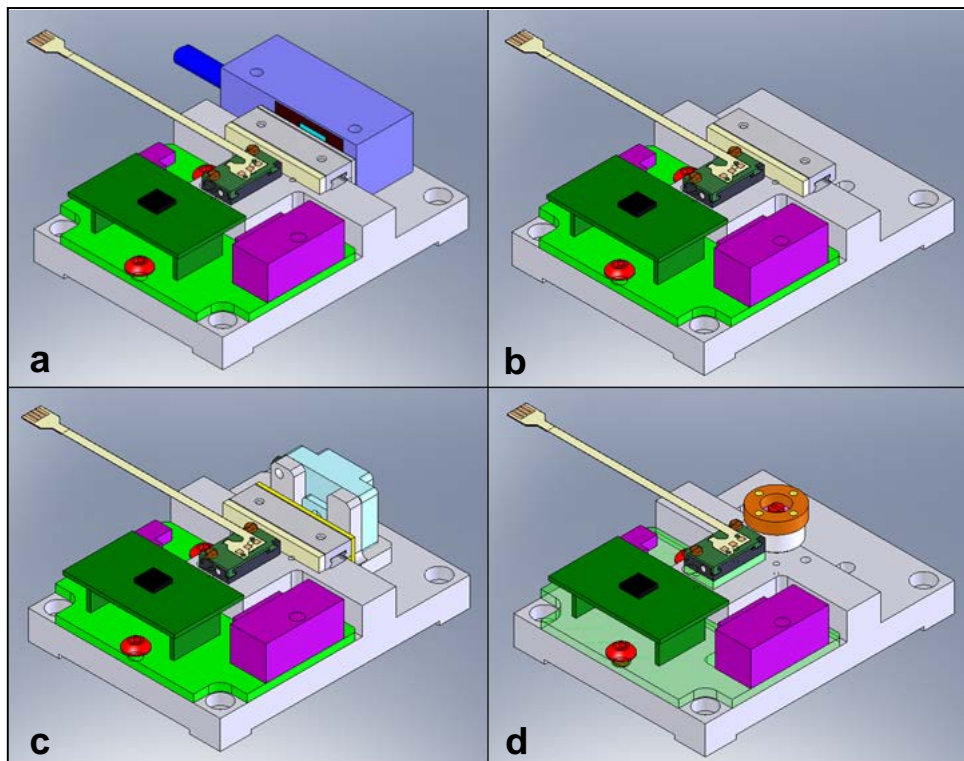
## 2 System Description

### 2.1 Configuration Options

EDGE Evaluation Kit is available in four configurations:

- a) EDGE Evaluation Kit with linear slide and 0.1 $\mu$  Renishaw encoder for close loop operation.
- b) EDGE Evaluation Kit with linear slide – for operation in open loop.
- c) EDGE Evaluation Kit with linear slide and Micro-E encoder adaptor for close loop operation.
- d) EDGE Evaluation Kit with rotary slide – for operation in open loop.

See chapter 5 for Ordering Information.



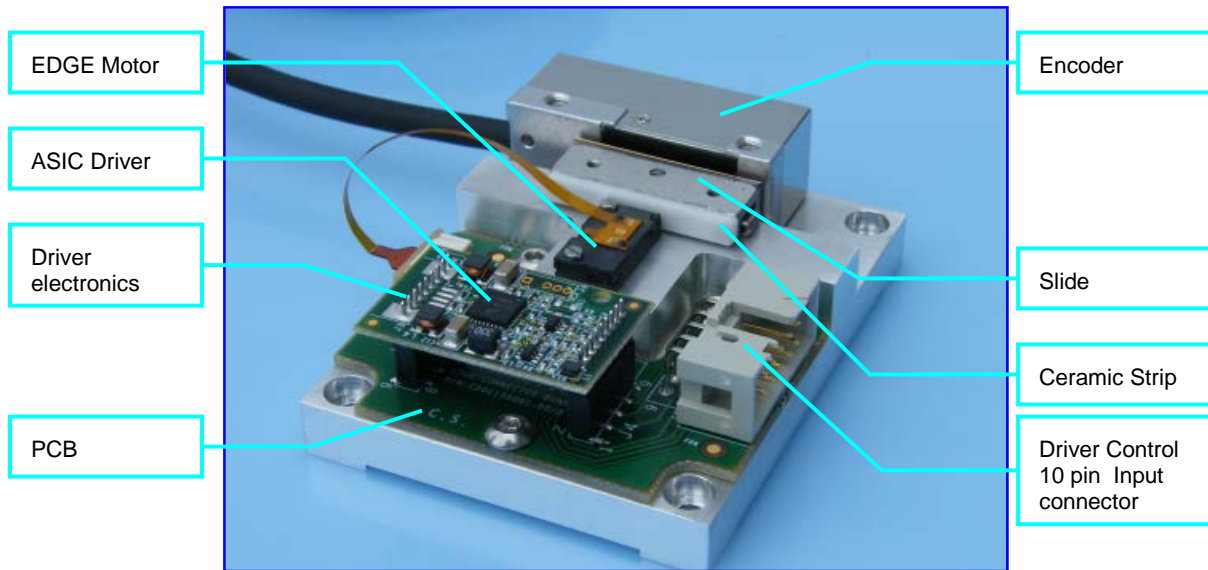
**Figure 2: Motion Module Configuration Options**

**Notes:**

- The Interface Box is compatible for all above mentioned Motion Module configurations.
- Configuration C is provided without the Micro-E encoder and encoder scale.

## 2.2 Motion Module

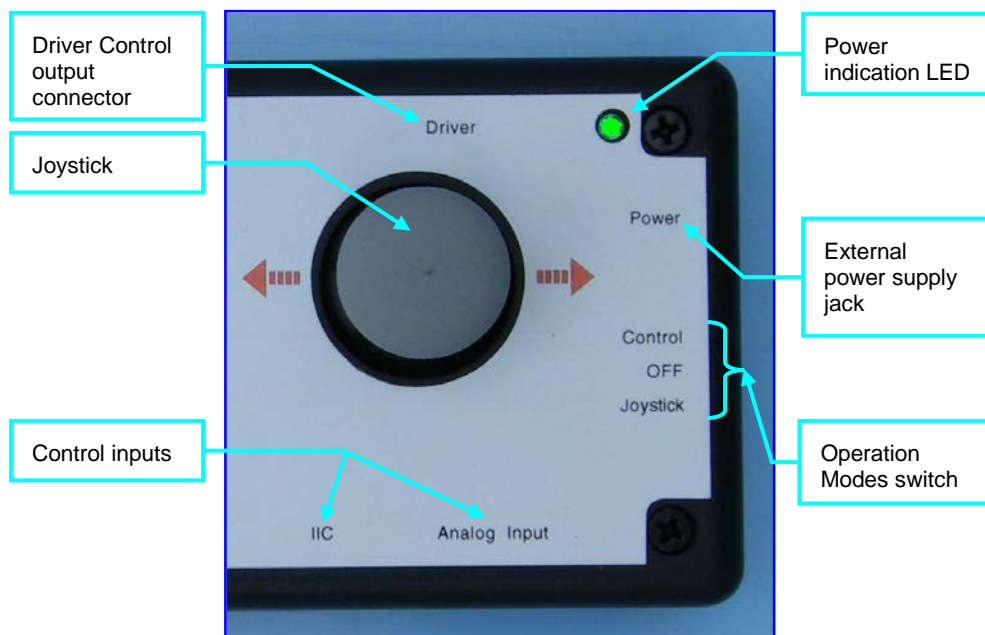
The motion module comprises of the EDGE motor driven by a custom ASIC driver PCB, which is connected to the stage, see Figure 3.



**Figure 3: Motion Module Setup**

The control signals and the power supply are provided from the Interface Box by means of Driver Control cable.

## 2.3 Interface Box



**Figure 4: Interface Box Controls**

The Interface Box integrates the following elements (refer to Figure 4):

- 'Driver' – 10 pin output connector for connecting the Interface Box to the Motion Module. Supplies Vcc of +4.2 V to the ASIC driver.
- 'Power' – 5VDC external power supply jack. When connected, overruns the batteries power source (four AAA cells), located inside the Interface Box.
- Operation Modes switch:
  - ◆ 'Control' – enables close loop control by using the Analog Input or IIC connection (for more details, see section 3.2 "Close Loop Operation Mode").
  - ◆ 'OFF' – switches power off.
  - ◆ 'Joystick' – enables manual control in open loop mode (for more details, see section 3.1 "Open Loop Operation Mode").
- 'IIC' / 'Analog Input' – provide the separate serial IIC connection or separate analog input connection for the user controller inputs (for more details, see sections 2.5 "Analog Input Connection" and 3.2 "Close Loop Operation Mode").

## 2.4 ASIC Driving Modes

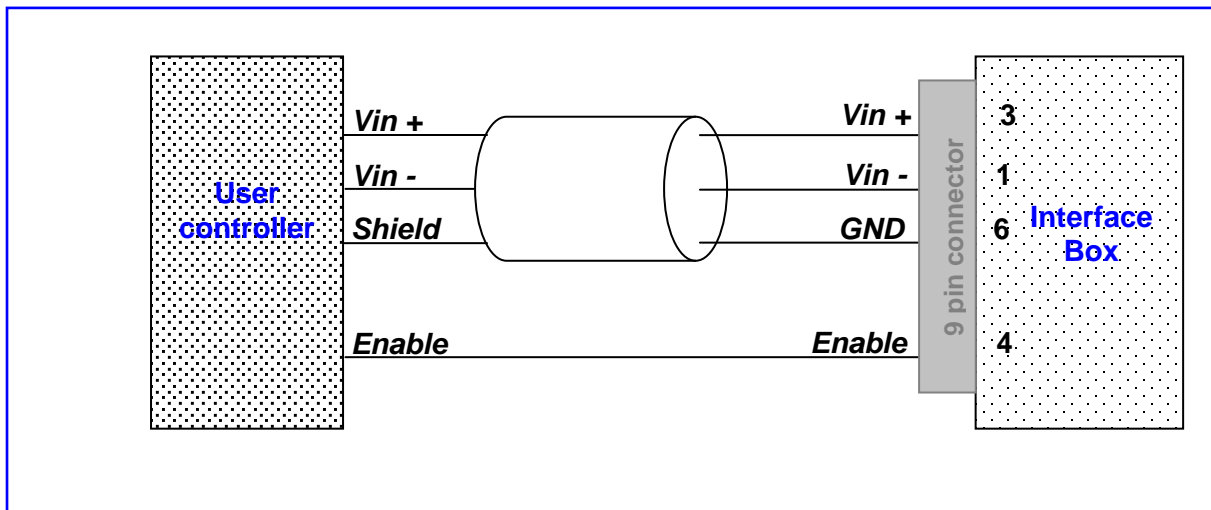
In close loop the ASIC Driver can drive the motor in two driving modes (refer to section 3.2 for Close Loop Operation Mode):

- **AB1A Driving Mode** – standard motor operation mode. In this mode the motor is motionless up to approximately  $\pm 1.5V$  command. Nanomotion motion algorithm enables the motor smooth motion as well as micron level movement. This drive mode is the default mode for open / close loop.
- **AB5 Driving Mode** – this mode facilitates a linear response of the motor from 0 (zero) command level. This mode is recommended for scanning applications and micron-level movements.

## 2.5 Analog Input Connection

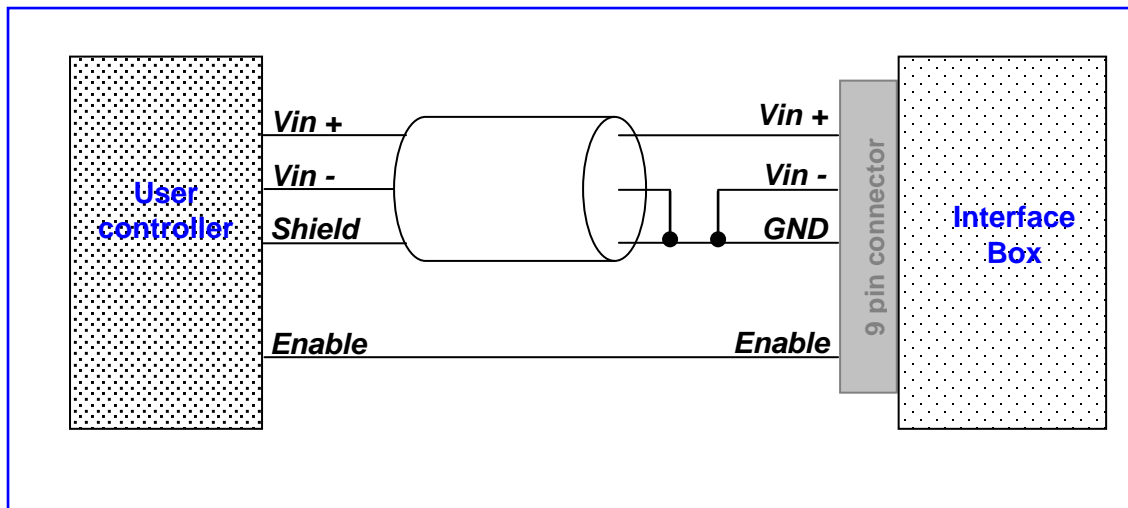
There are two options for the  $\pm 10V$  analog input connection:

- Differential connection:



**Figure 5: Differential Analog Input Connection**

- Single-Ended (Non-differential) Connection:



**Figure 6: Non-Differential (single-ended) Analog Input Connection**

**Note:**

- For Controller Adaptor cable pinout, refer to Table 1.

## 3 System Operation

The EDGE Evaluation Kit can be operated in two operation modes: Open Loop Mode and Close Loop Mode.

### 3.1 Open Loop Operation Mode

Open Loop Operation mode – allows manual control by using a joystick located on the Interface Box. For operating the motor in manual operation mode follow the steps below (refer to Figure 7 and Figure 8):

- 3.1.1 Connect the Driver Control cable between Interface Box 'Driver' output connector and Driver Control 10 pin input connector, located on the motion module, see Figure 7.



**Figure 7: System Connection**

- 3.1.2 Set the Operation Modes switch, located on the Interface Box, to 'Joystick' position, refer to Figure 8.
- 3.1.3 The system is now ready to operate, using the internal batteries' power. Alternatively, the user can connect the external power supply, refer to Figure 7.



**Figure 8: Interface Box**

3.1.4 Move the Joystick sideways according to the orange arrows marked on top of the Interface Box. The motor speed depends on the joystick direction and its tilt angle.

**Note:**

- Set the Operation Modes switch to 'OFF' after the operation is completed in order to save batteries.

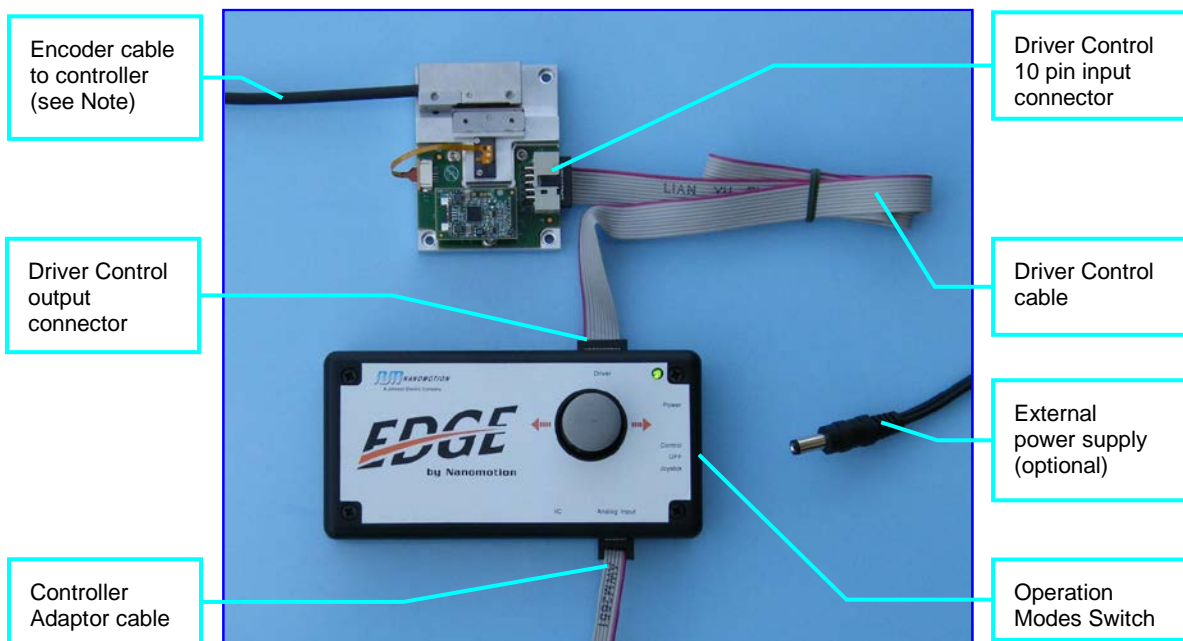


### 3.2 Close Loop Operation Mode

To achieve optimal close loop control over the system, it is advised to use the Nanomotion controller from the LK product family or other Nanomotion approved controllers, which support Nanomotion control algorithm.

For operating the motor in close loop follow the steps below (refer to Figure 8 and Figure 9):

- 3.2.1 Connect the Driver Control cable between Interface Box 'Driver' output connector and Driver Control 10 pin input connector, located on the motion module, see Figure 9.



**Figure 9: System Connection**

3.2.2 The close loop control can be executed by using either IIC or the Analog Input connection as follows (refer to Figure 9):

- ◆ For Analog Input: connect the Controller Adaptor cable between the 'Analog Input' connector and the controller. For details, see section 2.5.
- ◆ Alternatively, for IIC: connect the Controller Adaptor cable between the 'IIC' connector and the controller.

**Note:**

- For Controller Adaptor cable pinouts, refer to Table 1 and Table 2.

- 3.2.3 Connect the encoder cable to controller's encoder input connector.
- 3.2.4 Set the Operation Modes switch, located on the Interface Box, to 'Control' position.
- 3.2.5 The system is now ready to operate using the internal batteries' power. Alternatively, the user can connect the external power supply, refer to Figure 9.
- 3.2.6 Tune control parameters according to the user's specific Nanomotion controller manual.
- 3.2.7 Choose driving mode (refer to section 2.4 for more details):
  - ◆ The AB1A mode is default.
  - ◆ In order to operate the motor in AB5 mode, short pin 2 of the Analog Input Connector to ground, refer to Table 1 in section 4.1.

**Note:**

- *Set the Operation Modes switch to 'OFF' after the operation is completed in order to save batteries.*

## 4 Technical Data

### 4.1 Input Connectors' Pinouts

The close loop control is available by using either IIC or the Analog Input connection, as follows:

- 

| Pin # | Pin Name    | Function                                |
|-------|-------------|---|
| 1     | -Vin        | Input Analog voltage ( - )              |
| 2     | Driver Mode | AB1A default<br>Mode AB5 – short to GND |
| 3     | +Vin        | Input Analog voltage (+)                |
| 4     | Enable 1    | Enable<br>* Active – short to GND       |
| 5     | N.C.        | Not connected                           |
| 6     | GND         | Ground                                  |

**Table 1: Analog Input Connector Pinout**

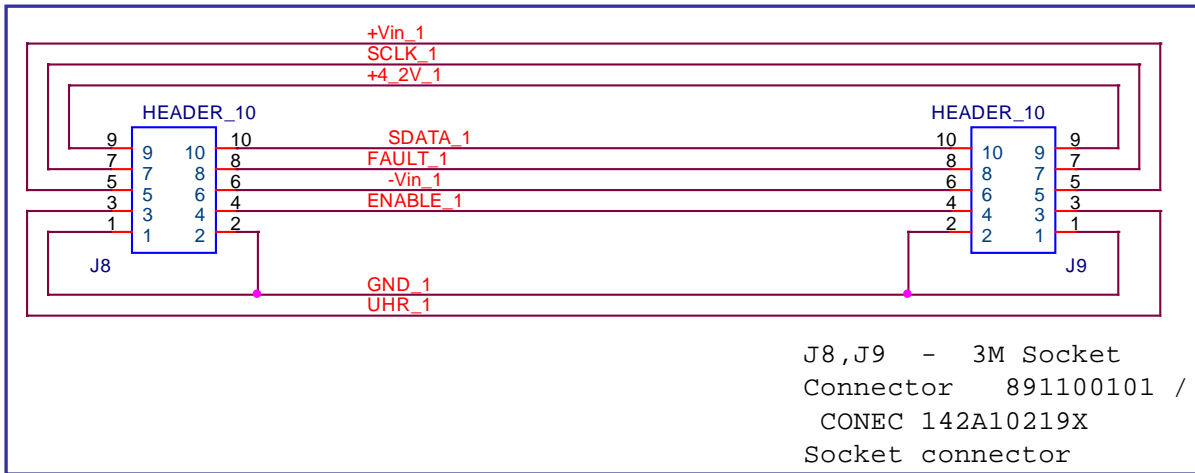
- IIC Connector Pinout

| Pin # | Pin Name | Function                          |
|-------|----------|-----------------------------------|
| 1     | SDATA    | IIC Serial Data                   |
| 2     | SCLK     | Serial Clock                      |
| 3     | + 5V     | Vcc for additional IIC (optional) |
| 4     | GND      | Ground                            |
| 5     | + 5V     | Vcc for additional IIC (optional) |
| 6     | GND      | Ground                            |

**Table 2: IIC Connector Pinout**

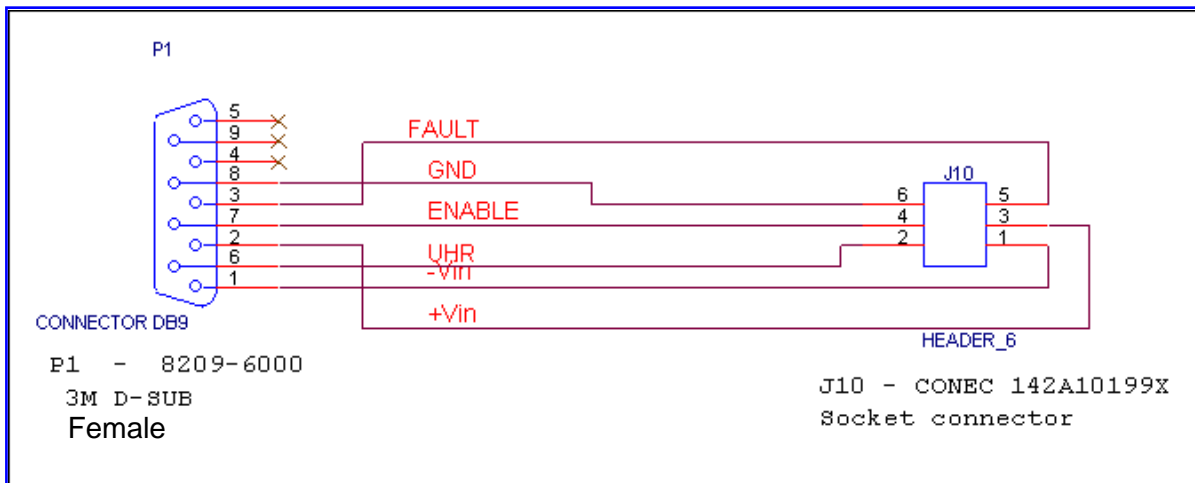
## 4.2 Cables' Layouts

- Driver Control cable layout:



**Figure 10: Driver Control Cable Layout**

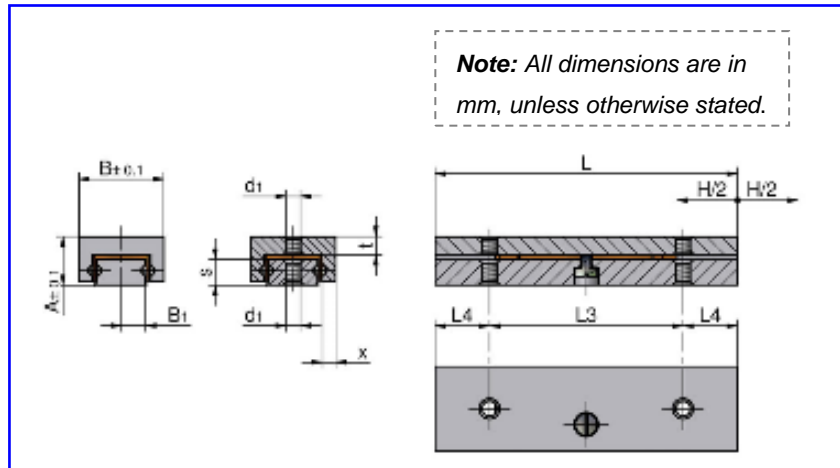
- Controller Adaptor cable layout:



**Figure 11: Controller Adaptor Cable Layout**

### 4.3 Load Mounting Interface

The user can mount a load on both linear and rotary slides as follows: vertical load of 100 gr., horizontal load of 10 gr. Refer to Figure 12 and Table 3 for mounting properties.

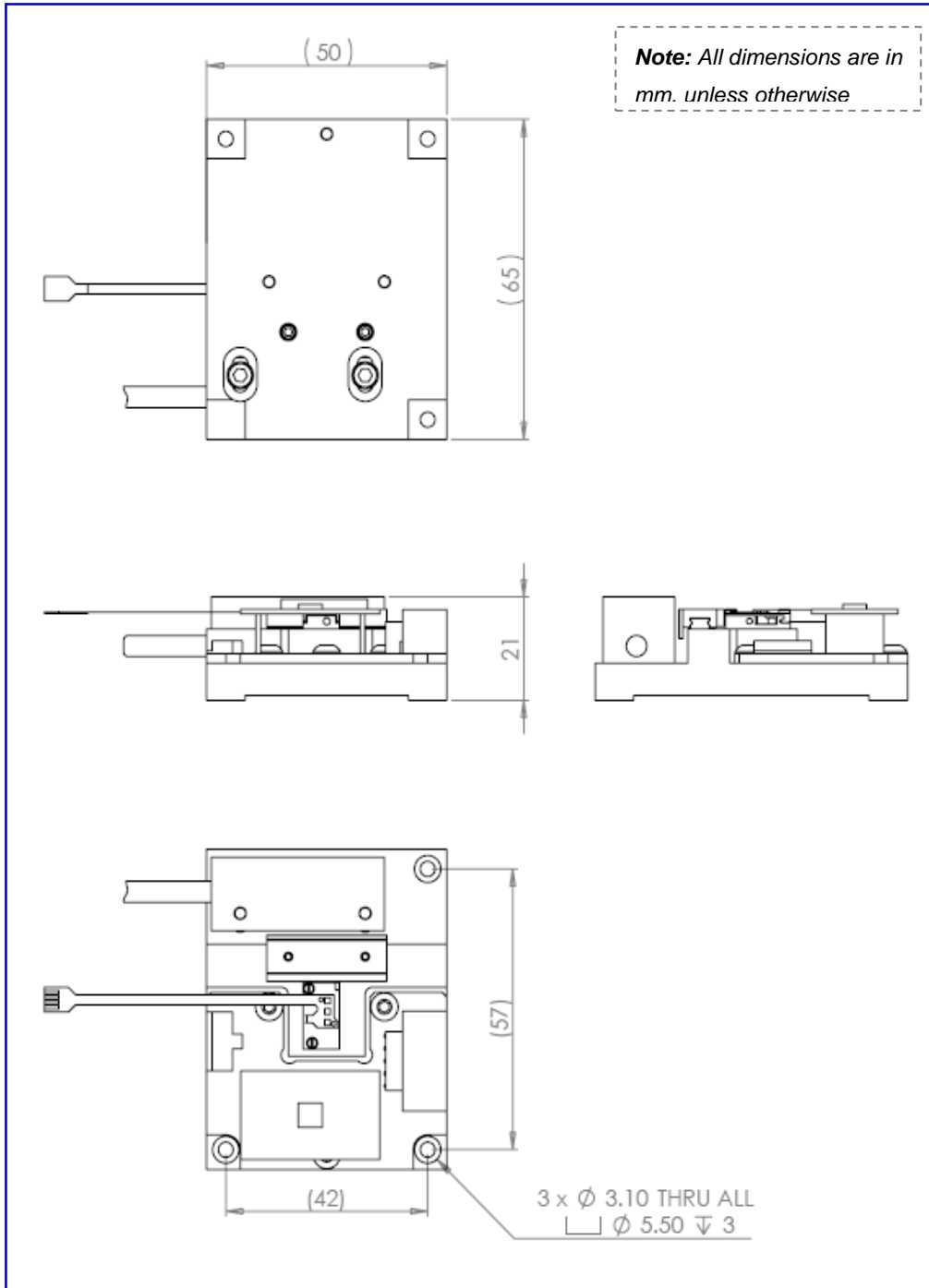


**Figure 12: Linear Slide Properties**

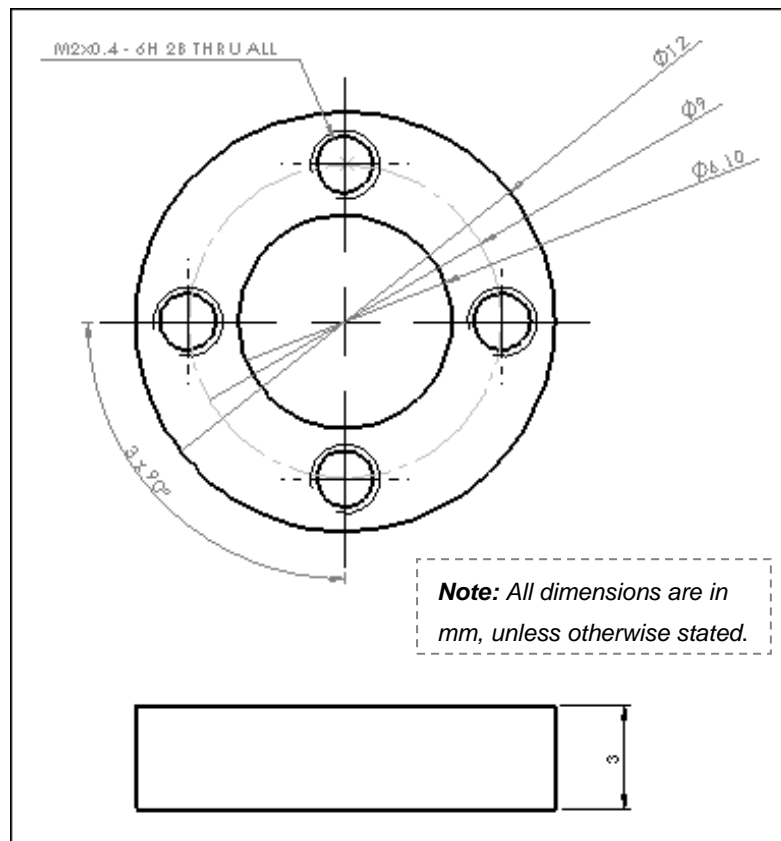
| Description    | Value |
|----------------|-------|
| B <sub>1</sub> | 4     |
| B              | 7     |
| A              | 4     |
| d <sub>1</sub> | M1.6  |
| H              | 20    |
| L              | 25    |
| L <sub>3</sub> | 1x16  |
| L <sub>4</sub> | 4.5   |
| s              | 2.1   |
| t              | 1.5   |
| x              | 1.1   |
| Weight in g    | 5     |

**Table 3: Linear Slide Properties Parameters**

## 4.4 Motion Module Layout



**Figure 13: Motion Module Layout**



**Figure 14: Rotary Mounting Ring for Motion Module**

## 5 Ordering Information

### 5.1 Part Numbering Scheme

There are four available configurations for the EDGE Evaluation Kit:

| Product             | Options               |   |
|---------------------|-----------------------|---|
| EDGE Evaluation Kit | Linear / Rotary Slide | Encoder   |
| EDGE-EVAL-          | LS<br>RS*             | RE = Renishaw 0.1µ encoder<br>ME = Micro-E encoder adaptor<br>0E = no encoder (open loop) |

**Note:**

- *RS configuration is available only with 0E option.*

### 5.2 Example Configurations

- EDGE Evaluation Kit with rotary slide - open loop.

|            |    |    |
|------------|----|----|
| EDGE-EVAL- | RS | 0E |
|------------|----|----|

- EDGE Evaluation Kit with linear slide and Micro-E encoder adaptor.

|            |    |    |
|------------|----|----|
| EDGE-EVAL- | LS | ME |
|------------|----|----|



## 6 Contact Information

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### 6.1 Customer Service

Contact your local distributor or email Nanomotion Ltd. Technical Support Department at [techsupport@nanomotion.com](mailto:techsupport@nanomotion.com), with detailed problem description, additions, corrections or suggestions.

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