



# **STANDARD OPERATING PROCEDURE**

<b>Ref:</b>	<b>SOP-0333-01A-N-DEV</b>
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<b>Description:</b>	<b>2DM – Starpoint Technical Information</b>
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## 2DM Disc Mechanism





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## INTRODUCTION

The 2DM is a compact modular disc product that encompasses all of the benefits incorporate in 19RM.

The 2DM is electrically and software compatible with the 17RM 19RM & 20RM. Minor adjustment to the ramp tables for the motor may be necessary to allow for the smaller diameter disc.

The features of the 2DM are:

- i] Simple push-on / lift-off mounting to it's foot providing electrical and mechanical connection in one action.
- ii] Dual purpose carrying locking handle.
- iii] Reliable instant electrical connection.
- iv] Individual mounting foot, using the push-on/lift-off mounting and locking system.

The 2DM benefits also include:

- i] Simple to drive stepper motor.
- ii] Small unit with 150mm diameter disc.
- iii] Disc position detection by a single optic device mounted on the motor mount.

The unique 2DM foot provides a number of functions:

- i) Latch and guidance for secure Disc Mechanism mounting.
- ii) The mounting foot holds the mating half of the Disc Mechanism connector and provides routing for efficient cable management.

## CONDITIONS OF USE

### Temperature Range

The mechanism will operate satisfactorily in the temperature range from 0°C to 50°C, provided there is an unrestricted flow of air and proper motor control is exercised.

### Humidity

The unit will operate in the range of 0% to 95% - relative humidity.

### Continuous Use

There is no practical limit to continuous use assuming normal motor temperature control procedures are followed. It is expected that normal operation is a minimum 12-hour day.

### Operational Environment

It is recommended that the unit is not operated in an exposed environment if the public are present. The most suitable method of operation should be behind a glass or screen with a shroud around the cup assembly to hide the mechanism and present the dice to the player. The mechanism must be mounted on a horizontal platform, should it be necessary to mount the unit in another plane, please refer to Starpoint on +44 (0) 20 8391 7700.

### Operational Life

The units have been subjected to various accelerated life tests and a minimum operational life in excess of one million cycles is assumed.

### Installation

The 2DM Disc Mechanism is mounted in the cabinet on its custom designed foot. The unit is removed / replaced from the cabinet by use of the push / pull locking handle.



### Handling

It is recommended to only handle the unit by the frame or handle.

**It is not recommended that the power connection be removed from the unit while the unit is in operation. Failure to remove power will most likely result in damage to the devices in the unit.**

### Warranty

A guarantee of 12 months from the shipment date is available for the mechanism, subject to Starpoint's standard terms and conditions. This guarantee is offered irrespective of the number of operations of the unit during this period, but subject to operation within the environmental conditions specified above. A unit, which may require return under guarantee, should be returned directly to Starpoint or the local distributor.

## MECHANICAL SPECIFICATION

### Construction

The mechanism and mounting foot size and shape are shown in Drawing No G4G041-01-ZZZZ.

### Cabinet Mounting

The 2DM is in a family of Disc Mechanisms, which are a complete unit of mechanism and mounting foot, which incorporates the mating half of the electrical connector. The foot can be fixed to the cabinet by using either fixing screws or bolts. The 2DM can then be inserted & removed without the use of any tools, and can be securely located in place by use of the unique locking handle.

The mounting foot must be ordered separately, the part number is 18S017-01-AERD.



## ELECTRICAL SPECIFICATION

### Electrical Connections

A circuit diagram for the unit is shown in Drawings 20197. The unit is interfaced to a users product using a 15-way Molex connector type 7720S Series ? : 22-50 (the same as 19RM). The mechanism can be obtained in two lamp drive configurations - Sinking and Sourcing. See Drawing 20197. The lamps are diode connected. The diodes in series with the lamps provide the option of matrixing the lamps with other lamps in the cabinet thus reducing driver circuits and wire harness sizes. If rear illumination is required, connection to the lamp loom is made via a 10 way connector 7720S series 22-26-9102. For pin out information see Drawing No. 20197.

### Stepper Motor

The 2DM is available with the standard 48 step 12 or 24 volt DC stepping motor. The supplying company is NMB of Japan and drawing A1C001-025-ZZZZ & A1C002-01-ZZZZ shows the full specification.

### Position Control Sensor

The position control sensor is a self-contained photo optic sub-assembly that is complete with built in schmitt trigger and open collector output. A high level denotes that the optic is interrupted. The optic device is mounted onto the motor mount, which is positioned at zero on the frame scale, with the optic tab being an integral part of the disc.

### Stepper Motor Control

The disc is driven by a 48 step 12 or 24 volt DC stepping motor. Examples of ramp tables are shown in Appendix B. The ramp tables shown are nominal values, which could be optimised to meet individual customer requirements with regards to disc drive characteristics, such as soft stop or sharp stop. If difficulty is experienced in achieving the required effect or speed of rotation, please call Starpoint on +44 (0)20 8391 7700

When the mechanism is at rest and full power is applied to the motor, it is possible for the motor temperature to rise unnecessarily causing a loss of torque and in exceptional circumstances overheating. To avoid this situation it is strongly recommended the following controls are applied. Failure to do this could invalidate the warranty.

To limit the heating effect and maintain high motor torque, it is advised that the power applied to the motor at standstill be pulsed or turned on and off. The switched power should be in the ratio of 50:50 mark space, based on the running timing. This provides the required holding torque at standstill and will prevent inadvertent disc movement. It is also recommended that a short delay of 500mS be used before commencing this switching procedure after the disc has stopped and before starting the next spin cycle. The delays are to ensure that this on/off sequence does not influence the start and stop ramping.

## Disc Illumination

The 2DM can be supplied with or without illumination. If rear illumination of the disc is required it can be supplied with a vacuum forming fitted to the main frame and incorporate an 8 lamp harness. The individual lamps are diode configured. Diode connections allow matrixing possibilities thus saving on drive circuits power and wire harness size.

## Motor Drive Software

### a] Re-set Procedure

This procedure is recommended at power on, or when the software identifies that the disc is out of step or in an incorrect position.

- i] Drive the motor at approximately 50RPM.
- ii] Every motor step change, monitor the optic output. Immediately the tab is detected by the optic cease driving the motor.
- iii] Wait 500mS then power up the motor on the Black and Yellow windings.
- iv] Wait 500mS, this allows the motor/disc to settle in position. Check the tab is in the optic. If not repeat steps i] to iv], if the tab is still not in the optic there is a fault.
- v] The disc mechanism and software are now initialised.
- vi] Now enter the standstill mode or resume the game in play, whichever is appropriate.

### b] Optic Tab Monitoring During Disc Spin

During disc spin or game play it is important to monitor the optic tab to confirm it is at the expected position. This can be achieved during disc spin as long as a window is set around the time the tab is expected to be seen. This window is to allow for ramping up or down of the motor and variation in operational spin speeds. To confirm the disc is in synchronisation carry out the following tests in software.

- i] When the disc is to stop on the master symbol, ensure the step sequence stops with the black and yellow windings energised. The optic tab will be in the optic. If the optic tab is not in the optic enter the reset procedure.
- ii] To monitor the optic during disc spins create a window of 6 motor steps, within which the optic tab should interrupt the optic. This window is dependant on users software and may need development to an optimum size. If difficulty is experienced with this monitoring please contact Starpoint on +44 (0)20 8391 7700.

## ADJUSTMENTS AND CALIBRATION

### Motor Phase setting

The disc mechanism construction is such that adjustment of the motor mounting, or lamp array position do not interact with each other, therefore, secondary adjustments are not necessary.

The stepper motor has a cross pin in the shaft which is used to ensure consistent drive of the disc. This pin must be aligned to the optic sensor and this adjustment is called the "phase setting adjustment".

The optic tab position is fixed on the disc and directly relates to the artwork win line due to the physical position of the optic detector.

The above settings are to be carried out at the time of manufacture. If adjustment is necessary then please call the customer help line to arrange suitable repair or replacement.

### Art work fixing Procedure

It is recommended that the artwork is printed on a separate piece of film & then adhered to the disc. To position the film in the required orientation use the 2 notches in the disc. See drawing 30103 A4C003-02-ZZZZ.



## ORDERING INFORMATION

This section deals with how to complete the Specification / Quotation Sheet (see Appendix A) SOPF-0333-01-N-DEV. The document is unique for each application and the specification sheet identifier contains the configuration information, which Starpoint will use for manufacture of the 2 DM.

This ordering information covers the specifying of the 2DM, a separate order must also be placed for the mounting base, (Part Number 18S017-01-AERD – See Cabinet Mounting on page 8 for details).

The Spec Sheet contains a series of options across the page with a corresponding clear box on the right hand side. Once the selection of option is made the letter corresponding to the required option should be entered in the right hand box. The total combination of completion of all the empty boxes creates a unique build standard coding.

The following deals with each section of the spec sheet.

**CUSTOMER** – Fill in with Company Name

**CUSTOMER PART NUMBER** -The Customer Part Number will be recorded in this area and within Starpoint cross-referenced to the customer's part number. Both numbers are included on the order and invoice documents.

**DATE** – Date of completion

**QUOTATION REQUIRED** – Please indicate by deleting either the YES or NO if a formal quotation is required.

**QUANTITY REQUIRED** – If a quotation is required, please add the qty to the box.

**COMMENTS** – Space for any specific comments

**MECH** – This is pre-defined, NB denotes 2DM.

**MOTOR** - Select the motor required, and enter the corresponding letter in the right hand box.

### LAMP ARRAY

**Type of Lamp array** – Select from either 8 lamp or no illumination.

**Wiring type** – This will automatically be selected from the option above.

**Lamp Type** - Select the desired lamps from those available in the table. Care must be taken when selecting the higher wattage lamps, because if the lamps are illuminated for long periods when the disc has not moved, damage may occur to the printed symbol band disc due to the heat.



## CARRIAGE AND DISTRIBUTION

All Starpoint Mechanisms are shipped in returnable cardboard packaging. Individual mechanisms are located in layer cards with cutouts to prevent movement in transit. There are 6 mechanisms per layer and the standard build is 30 per box.

The packaging is designed to use the minimal space when empty **and should be returned to Starpoint after use.**

## APPENDIX A

STARPOINT		2DM SPECIFICATION / QUOTATION SHEET			
		CUSTOMER:			
		CUSTOMER PART NUMBER:			
		DATE:			
		QUANTITY REQUIRED:		YES / NO	
		QUANTITY REQUIRED:		XXXX	
		COUNTRY:			
MECH	MOTOR MECHANISM				NB
MOTOR	FACE/ANGLE	A	W. 48 NMB	B	24V. 48 STEP NMB
LAMP ARRAY	TYPE LAMP ARRAY	Z			NO LAMP ARRAY REQUIRED
	WIRING TYPE	A	Z	NON ILLUMINATED	
	LAMP TYPE	01	02	04	0
		05	ZZ		
<p>UNITS 1-5, KING GEORGES TRADING ESTATE, DAVIS ROAD, CHESSINGTON, KT9 1TT</p> <p>TEL: +44 (0) 20 8391 7700      FAX: +44 (0) 20 8391 7760      E-MAIL: info@starpoint.uk.com</p> <p>SOPF-0225-01-N-DEV</p>					

## APPENDIX B

### EXAMPLES OF RAMPS FOR NMB 48 STEP MOTOR

Motor warm, supply ? 10%. All values in millisecs and are the delays between phase changes.

100 RPM	UP	35 - 22 - 12.5 - 16
	RUN	12.5
	DOWN	26

#### NOTE :-

Examples of Ramp Tables to drive the disc are shown above. These ramp tables are nominal values, which could be optimised to meet individual customer requirements with regards to disc drive characteristics, such as soft stop or sharp stop.

## APPENDIX C

### Timing Diagram













