STANDARD OPERATING PROCEDURE

Ref:	**SOP-0198-03-N-DEV**

Description:	**1DU** **Starpoint Technical Information**

THIS IS AN UNCONTROLLED DOCUMENT

AND IS SUPPLIED FOR INFORMATION ONLY

IT IS THE USERS RESPONSIBILITY TO ENSURE THAT THE MOST UP TO DATE DOCUMENT IS BEING USED BY CONTACTING STARPOINT ELECTRICS LTD

sales@starpoint.uk.com

Tel: +44 (0)208 391 7700 or Fax: +44 (0)208 391 7760

1DU Dice Mechanism

Starpoint Electrics Ltd.

Website: - www.starpoint.uk.com

Contact: - sales@starpoint.uk.com

Telephone: - +44 (0)20 8391 7700

Fax: - +44 (0)20 8391 7760

DISCLAIMER

1. Starpoint Electrics Limited ("**Starpoint**") has taken all reasonable care in preparing this technical information pack ("**Information Pack**") and has used all reasonable efforts to ensure the accuracy of the information contained in the Information Pack. However, the information contained in this Information Pack may be subject to change from time to time, and Starpoint shall have no liability whatsoever to any person arising out of or in connection with reliance on any information contained in this Information Pack.

2. Starpoint reserves the right at any time to amend or update the information contained in the Information Pack, or to withdraw the Information Pack in its entirety and/or to withdraw and/or replace the products referred to in the Information Pack, and Starpoint shall not be obliged to notify any person of any such changes. Before taking or implementing any action based on the information contained in the Information Pack, you must contact Starpoint at the address given above in order to ensure that the Information Pack is up-to-date.

3. The Information Pack contains confidential information of Starpoint, and you must not disclose the Information Pack (in whole or in part) to any person, without our prior written consent.

4. The products may vary slightly from their description in the Information Pack, and Starpoint accepts no liability for such variances.

CONTENTS

Introduction

The 1DU Dice Mechanism is a unit designed to provide the games designer with a means to portray a tumbling dice. This dice would appear to the player to be spinning in free space.

The motor is incremented by phase control of the motor windings, the order of the waveform step changes giving forward or reverse rotation. The start and stop sequence or ramp up, ramp down, need to be designed with care so that the appearance to the player of starting or stopping is real. The dice contains six facets, one of which is displayed every half revolution. Therefore all six facets will be displayed every three full revolutions of the stepper motor. The games design is able to control and monitor position by reference to the optic detector. The optic is only interrupted when facet #1 is correctly displayed.

The decals on the six faces of the dice are provided by adhesive backed PVC discs. It is possible to provide any picture a game designer may require.

CONDITIONS OF USE

1. 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.

2. Humidity

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

3. 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.

4. 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.

5. 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.

6. Tools & Installation

It is recommended that for ease of assembly and servicing, the Starpoint ‘Quick Release’ fixing feet are used when fixing the unit to a cabinet. Tools will therefore not be required for the installation or removal of the unit. For correct positioning of the fixing feet please refer to Starpoint Drawing G4G001-01-ZZZZ.

7. Handling

The mechanism gear assembly is factory set. When handling the unit it must always be held by the plastic stand or frame. If the unit is carried, lifted or turned by the plastic cup, it is possible to dislodge the gears and put the gear sequence out of step with the viewing faces.

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.

8. Warranty

A guarantee of 12 months from the shipment date is available for the dice 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 SPECIFICATIONS

1. Assembly

Starpoint Drawing G4G001-01-ZZZZ shows the General Assembly of the unit. The presentation of the viewing area of the dice may be through 0? to 90?. The unit will operate in any orientation but must be rigidly fixed to the cabinet with the viewing area in the correct orientation

2. Decals

The dice has been designed to accept any design of decal; a standard decal set is available on request, to enable customer design, the details of material, size and orientation pips are shown on Starpoint Drawing G6D011-01-ZZZZ Decals can be changed by carefully removing existing decals or adhering new decals over the top of the old ones, this process may only be carried once. After which the weight if the decals will not permit proper rotation of the dice. **N.B.** Extreme Care Must Be Taken Not To Turn The Unit, as per the warning label **"DO NOT TURN BY HAND"** Failure to do so could lead to the unit failing to operate correctly.

3. Gear Ratio

Three full revolutions of the motor will, via the gear ratio of the dice mechanism, cause all six faces of the dice to be viewed, i.e. every 24 motor steps moves the dice to a new face.
Starting from face #1 being presented (i.e. the tab is in the optic), with the motor turning clockwise, a new face will be presented in the following order:

1 → 3 → 5 → 6 → 4 → 2 → 1 → etc

ELECTRICAL SPECIFICATIONS

1. Electrical Connections

A circuit diagram for the unit is shown in Starpoint Drawing G5D001-01-ZZZZ. The unit is interfaced to the users product by means of a 15 way Molex connector type 7720S Series # 22-50-3155 (IDC Terminal) or 6471 Series #22-01-2155 (crimp terminal type: 4809)

2. Stepper Motor

The 1DU is supplied with a 12V 48 Step to drawing – A1C004-01-ZZZZ.

This motor is manufactured by NMB Japan.

3. Position Control Sensor

Position control is by a self-contained photo optic sub-assembly from Temic (AEG, Telefunken) manufacturers part # TYCS 5201. The sub-assembly is complete with built in Schmitt trigger and open collector output. A high level denotes the optic is interrupted. This is a plug in device and may easily be changed.

4. Red LED Indicator

The red LED, fitted in the interface connector, is a service facility to indicate the correct operation of the photo optic detector described in Section 3. This LED will illuminate when the optic is interrupted. Manufacturer Temic Part # TLRH4400, (12 volt version used with 5 volt logic for current conservation).

5. Stepper Motor Control

The unit is controlled by a 48-step 12-volt motor, which positions the dice facets in the pre-defined order. There are 24 motor steps from one dice face to the next. It is possible to obtain different visual effects by varying the ramp up and down values or the rotational speed. Appendix A contains recommended ramps for up, down and run speeds for 39rpm, 52rpm. It is not recommended to drive the 1DU at speeds greater than 52 RPM.

To limit heating effect and save motor supply current drain, it is advised that the power applied to the motor at standstill be pulsed or turned on and off. This provides the required holding torque at standstill and will prevent inadvertent dice movement. It is also recommended that a short delay of 500mS be used before commencing this switching procedure after the dice stopped and before starting the next spin cycle. The delays are to ensure that the on/off sequence does not influence the start and stop ramping. Overall duty cycle of 40%.

6. Stepper Motor Timing Diagram

Appendix C shows a schematic of the unit and an example of the motor pulse train diagram.

7. Motor Drive Software

a. Reset Procedure

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

?? Drive the motor approximately 39 RPM

?? Every motor step change, monitor the optic output. Immediately the tab is detected by the optic cease driving the motor.

?? Wait 500mS then power up the motor on the Black and Yellow windings.

?? Wait 500mS, this allows the dice to settle in position. Check the tab is in the optic. If not repeat above steps, if the tab is still not in the optic there is a fault.

?? The reel mechanism and the software are now initialised.

?? Now enter the standstill mode or resume the game in play, whichever is appropriate?

b. Optic Tab Monitoring During Rotation

During rotation or game play it is important to monitor the optic tab to confirm it is at the expected position. This can be achieved during rotation 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 the operational spin speeds. To confirm the dice is in synchronisation carry out the following tests in software.

1. When the dice is to stop on facet 1, 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.

2. To monitor the optic during rotation 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) 208 391 7700.

8. Motor Phase Setting

This adjustment may be required when due to exceptional circumstances the motor requires replacement or the gear train need re-alignment. If this adjustment is necessary, contact Starpoint to arrange a suitable repair or replacement.

ORDERING INFORMATION

The production build standard for the 1DU is defined in the specification sheet shown in Appendix B. It is most important to complete the specification sheet when ordering. If difficulty is experienced in completing the sheet, assistance can be obtained by contacting Starpoint on +44 (0) 20 8391 7700.

The following deals with each section in order down the specification sheet.

Motor

The only motor currently available is a 48 step, 12v DC NMB unit.

Dice Colour

The dice is available in the colours listed. Other colours may be available on request, contact Starpoint for colour options.

Receptacle Colour

The receptacle is available in the colours listed. Other colours may be available on request, contact Starpoint for colour options. The receptacle is the cup assembly that contains the dice.

Frame Type

The standard option of frame should be specified.

Base

The 1DU unit is available with either the standard base or without.

Loom

The 1DU unit is available with a standard loom. Details of pin out are shown in drawing G5D001-01-ZZZZ.

Decal Information

Decal set should be specified, either a standard Starpoint set, or this may be a customer defined set. Each of the six faces should be defined.

ORDERING INFORMATION - Continued

Set Position of Frame

This provides the angle the dice is to be set at when manufactured.

Comments

An area is available to highlight any special instructions.

Fixing Feet

If standard base is required then fixing feet 18S008-01-AFBK (1 off) & 18S009-01-AUBK (1 off) should also be ordered.

CARRIAGE AND DISTRIBUTION

All Starpoint 1DU mechanisms are individually packed in custom designed individual polystyrene packing. These in turn are packed into a cardboard outer box. The quantity per box is 30. The outer box dimensions are; -

Internal dimensions -	830 x 544 x 589 mm.
External dimensions (approx) -	840 x 565 x 605 mm.

Appendix A

Ramp Table Examples

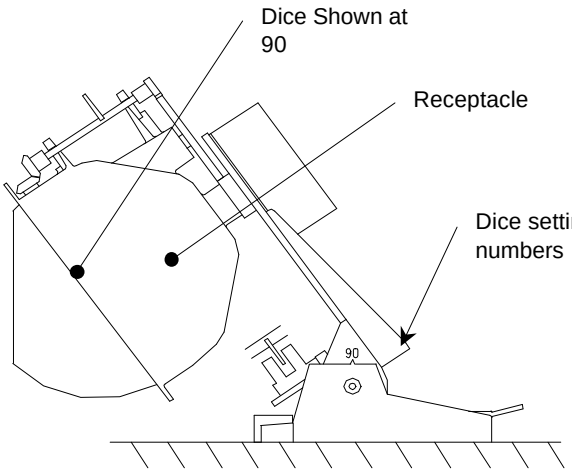
All values are in milliseconds and are the delays between phase changes.

39 RPM	UP	42 – 32 – 14 – 28
	RUN	32
	DOWN	34 – 32 – 36
52RPM	UP	34 – 30 – 24 – 26
	RUN	24
	DOWN	30 – 26 – 30

Examples of Ramp Tables to drive the various reel drum sizes at the different speeds are shown above. These Ramp Tables are nominal values, which should be optimised to meet individual requirements with regard to reel drive characteristics, such as soft stop or sharp stop of the reel drum. To obtain the same characteristics in reel drive for different width reel drums the Ramp Tables may require some modification.

APPENDIX B

1DU DICE MECHANISM SPECIFICATION SHEET



CUSTOMER: -

CUSTOMER PART NUMBER: -

DATE: -

COMMENTS: -

When Standard Base is required, fixing feet 18S008-01-AFBK & 18S009-01-AUBK should be ordered.

MECH	1DU DICE MECHANISM					NG
MOTOR	VOLTAGE/ STEP ANGLE	A 12V. 48 STEP NMB				A
DICE	COLOUR	B SOLID RED	J TRANSLUCENT RED	P SOLID WHITE		
RECEPTACLE	COLOUR	A BLACK	P WHITE			
FRAME	TYPE	1 STANDARD				1
BASE	TYPE	1 STANDARD	Z NOT FITTED			
LOOM	TYPE	A STANDARD				A
DECAL	SET TYPE	F STANDARD Red Background with White Dots	Can be 'CUSTOMER SPECIFIC', see information pack.			
SETTING	FRAME POSITION	ZZ NOT APPLICABLE NO BASE FITTED	FRAME AT POSITION 00 - 90			

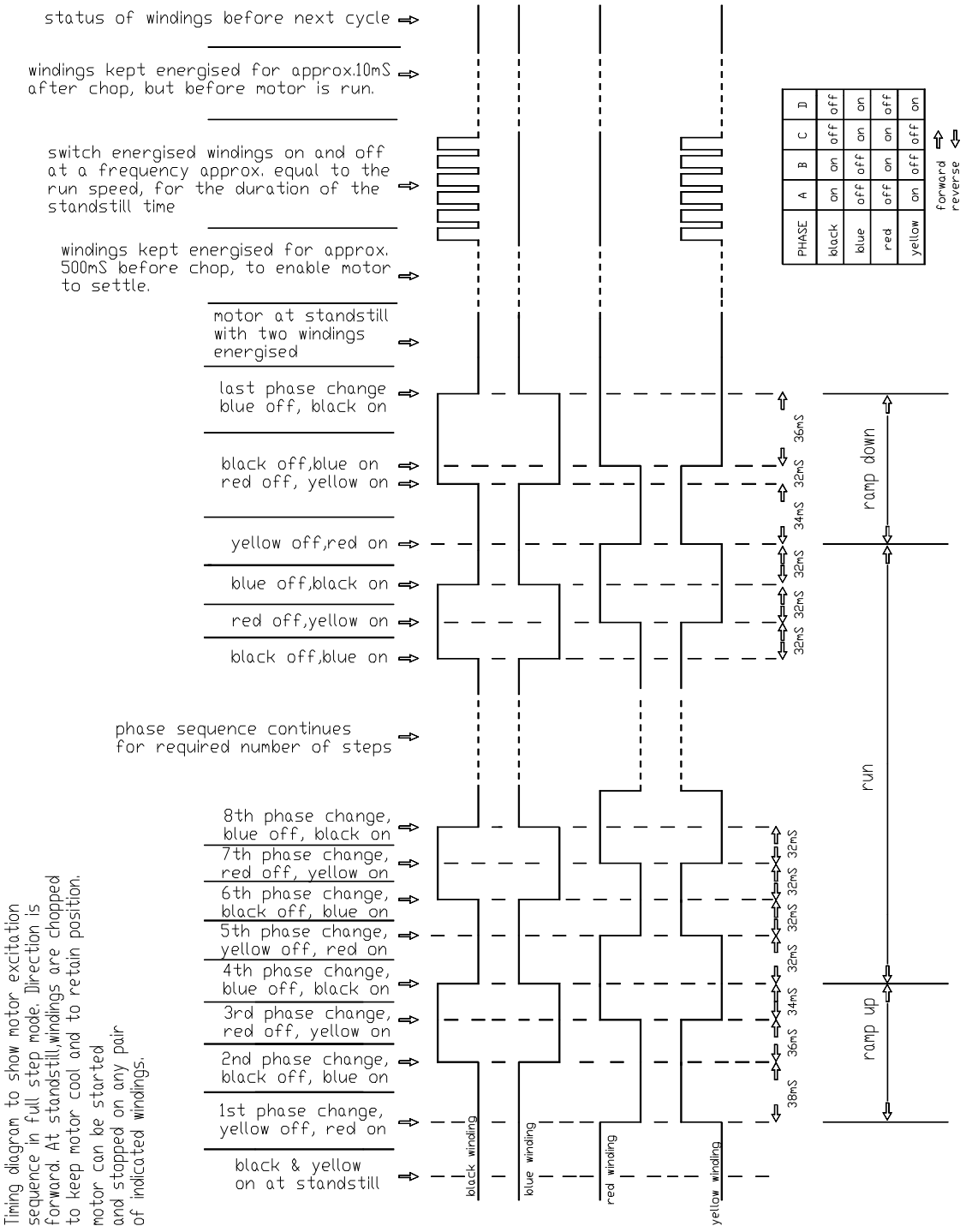
UNITS 1-5, KING GEORGES TRADING ESTATE, DAVIS ROAD, CHESSINGTON, KT9 1TT
TEL: +44 (020) 8391 7700 FAX: +44 (020) 8391 7760 E-MAIL: info@starpoint.uk.com

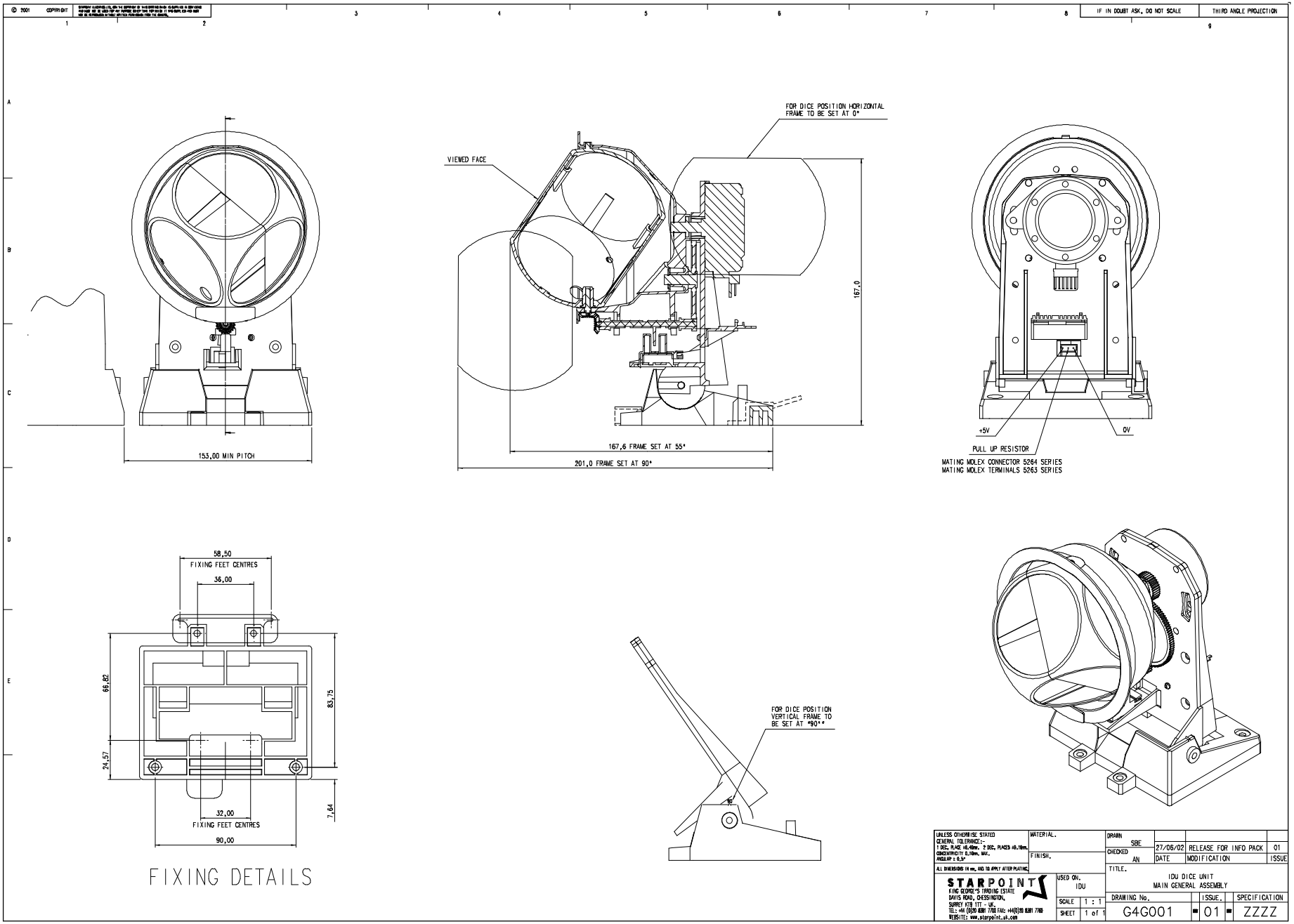
SOP Number:	SOPF-0162-00-N-DEV	DATE:	11.11.02

PLEASE ENSURE THAT MOST UP TO DATE SPECIFICATION SHEET IS USED - IF IN DOUBT CONTACT STARPOINT ON ABOVE NUMBER.

Appendix C

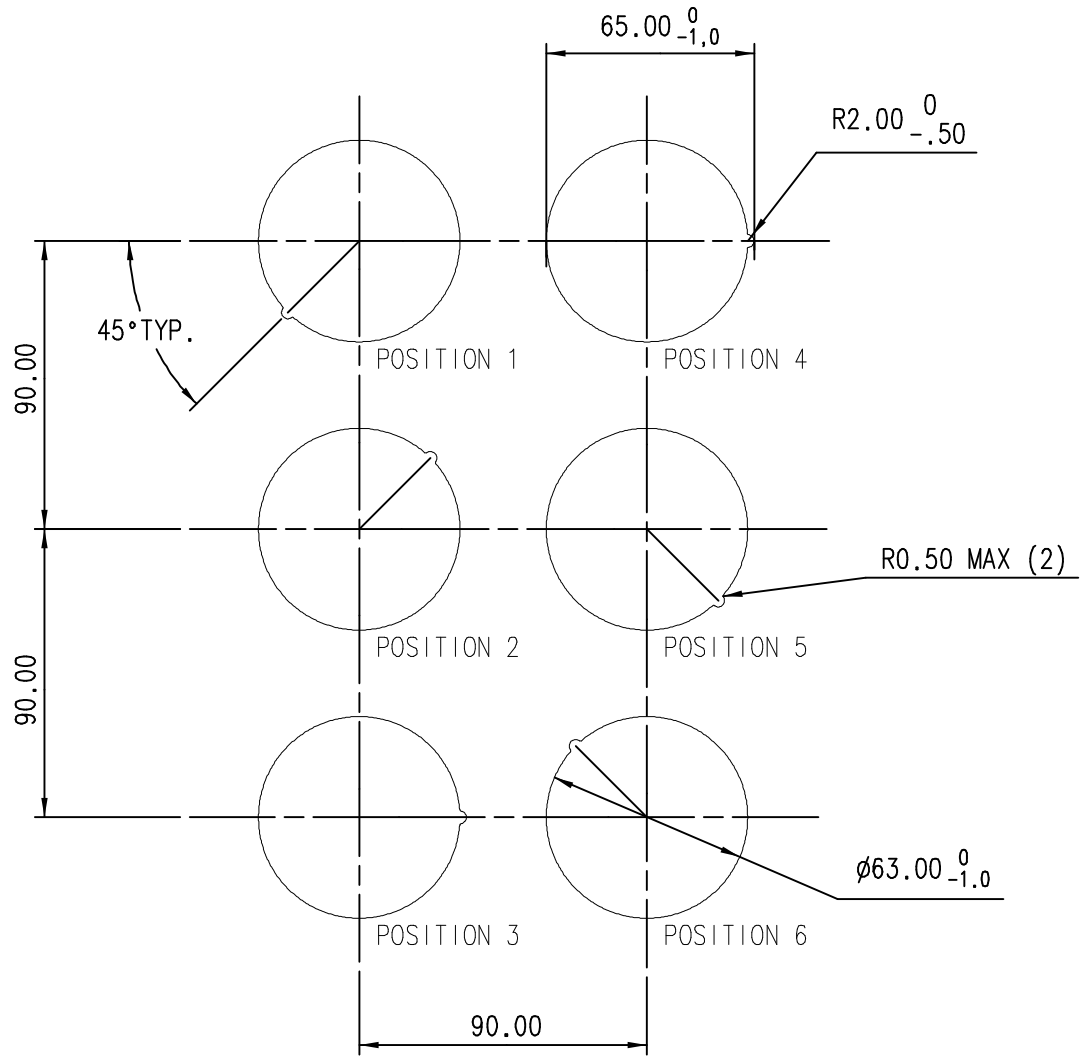
Timing Diagram




© 2001 COPYRIGHT
IF IN DOUBT ASK, DO NOT SCALE
THIRD ANGLE PROJECTION
153,00 MIN PITCH
FOR DICE POSITION HORIZONTAL
FRAME TO BE SET AT 0°
VIEWED FACE
167,0
167,6 FRAME SET AT 55°
201,0 FRAME SET AT 90°
+5V
0V
PULL UP RESISTOR
MATING MOLEX CONNECTOR 5264 SERIES
MATING MOLEX TERMINALS 5263 SERIES
58,50
FIXING FEET CENTRES
36,00
66,82
83,75
24,57
7,64
32,00
FIXING FEET CENTRES
90,00
FIXING DETAILS
FOR DICE POSITION
VERTICAL FRAME TO
BE SET AT 90°
UNLESS OTHERWISE STATED
GENERAL TOLERANCE:-
1 DEC. PLACE ±0.40mm. 2 DEC. PLACES ±0.10mm.
CONCENTRICITY 0.10mm. MAX.
ANGULAR ± 0.5°
ALL DIMENSIONS IN mm. AND TO APPLY AFTER PLATING.
MATERIAL.
FINISH.
DRAWN SBE
CHECKED AN
27/06/02 RELEASE FOR INFO PACK 01
DATE MODIFICATION ISSUE
TITLE.
IDU DICE UNIT
MAIN GENERAL ASSEMBLY
STARPOINT
KING GEORGE'S TRADING ESTATE
DAVIS ROAD, CHESSINGTON,
SURREY KT9 1TT - UK.
TEL: +44 (0)20 8397 7700 FAX: +44(0)20 8391 7700
WEBSITE: www.starpoint.uk.com
USED ON.
IDU
SCALE 1 : 1
SHEET 1 of 1
DRAWING No. G4G001
ISSUE. 01
SPECIFICATION ZZZZ

IF IN DOUBT ASK, DO NOT SCALE

THIRD ANGLE PROJECTION



NOTE :-

1. MATERIAL - 0.5 ±0.1mm THICK GLOSS P.V.C. INCLUDING ADHESIVE BACKING.
2. FOR IDENTIFICATION OF DECAL, POSITION NUMBER TO BE PRINTED BELOW DECAL.

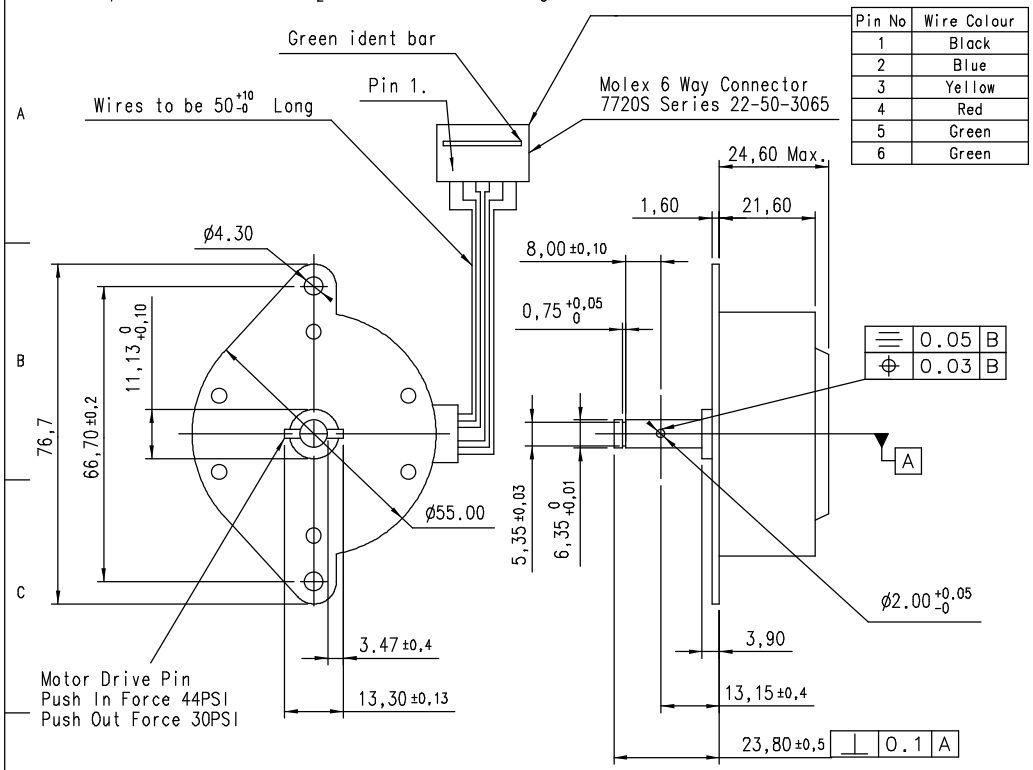
UNLESS OTHERWISE STATED GENERAL TOLERANCE:- 1 DEC, PLACE ±0.40mm. 2 DEC, PLACES ±0.10mm. CONCENTRICITY 0.10mm. MAX. ANGULAR ± 30'	MATERIAL. SEE NOTE 1	DRAWN AN			
	FINISH.	CHECKED CC	19/07/02	RELEASED	01
			DATE	MODIFICATION	
ALL DIMENSIONS IN mm, AND TO APPLY AFTER PLATING.		SCALE 1 : 2	TITLE. DICE DECALS SET OF SIX		

STARPOINT
KING GEORGE'S TRADING ESTATE
DAVIS ROAD, CHESSINGTON,
SURREY KT9 1TT - UK.
TEL: +44 (0)20 8391 7700 FAX: +44(0)20 8391 7760
WEBSITE: www.starpoint.uk.com

USED ON.	SHEET
1DU	of

DRAWING No.	ISSUE.	SPECIFICATION
G6D011	01	ZZZZ

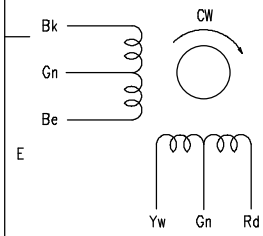
IF IN DOUBT ASK, DO NOT SCALE | THIRD ANGLE PROJECTION



Pin No	Wire Colour
1	Black
2	Blue
3	Yellow
4	Red
5	Green
6	Green

SPECIFICATION

Drive Voltage	: 11.5v
Phase on Method	: 2-2 (Phase On)
Magnet Material	: MS70
Step Angle	: 7.5°
Positional Error	: 0.5°
Max. Holding Torque	: 15.4cNm (1570g-cm)Min 383mA/Phase
Pull Out Torque	: 7.85cNm (800g-cm)Min 80PPS
Pull In Torque	: 7.65cNm (780g-cm)Min 80PPS
Max. No Load Response	: 230PPS Min.
Max. Slew Speed	: 260PPS Min.
Winding Resistance	: 30 ohms ±10%
Winding Inductance	: 30mH Ref 1KHz, 1Vrms
Insulation Resistance	: 100 MOhms Min. 500v DC
Dielectric Strength	: 500v AC 1 Min.
Temperature Rise	: ΔT = --° Max.
Class of Insulation	: Class E
Radial Play	: 0.05mm MAX 200g Load
End Play	: - mm Max - g LOAD
Rotar Inertia	: 66 g-cm² Ref
Detent Torque	: 1.74cNm (177g-cm) Ref.
Weight	: 275g Ref.
Ambient Temp.(Operating)	: -10°C to +50°C
Ambient Temp.(Storage)	: -30°C to +80°C
Life	: 30,000 Hours



EXCITATION SEQUENCE CW
looking at output shaft.

	1	2	3	4
BLUE	On	On		
BLACK			On	On
RED	On			On
YELLOW		On	On	

UNLESS OTHERWISE STATED
GENERAL TOLERANCE:-
1 DEC, PLACE ±0.40mm. 2 DEC, PLACES ±0.10mm.
CONCENTRICITY 0.10mm. MAX.
ANGULAR ± 0.5°

ALL DIMENSIONS IN mm, AND TO APPLY AFTER PLATING.

MATERIAL.

FINISH.

STARPOINT
KING GEORGE'S TRADING ESTATE
DAVIS ROAD, CHESSINGTON,
SURREY KT9 1TT - UK.
TEL: +44 (0)20 8391 7700 FAX: +44(0)20 8391 7760
WEBSITE: www.starpoint.uk.com

USED ON. 1DU

SCALE 1 : 1

SHEET of

DRAWN AN

CHECKED TJ

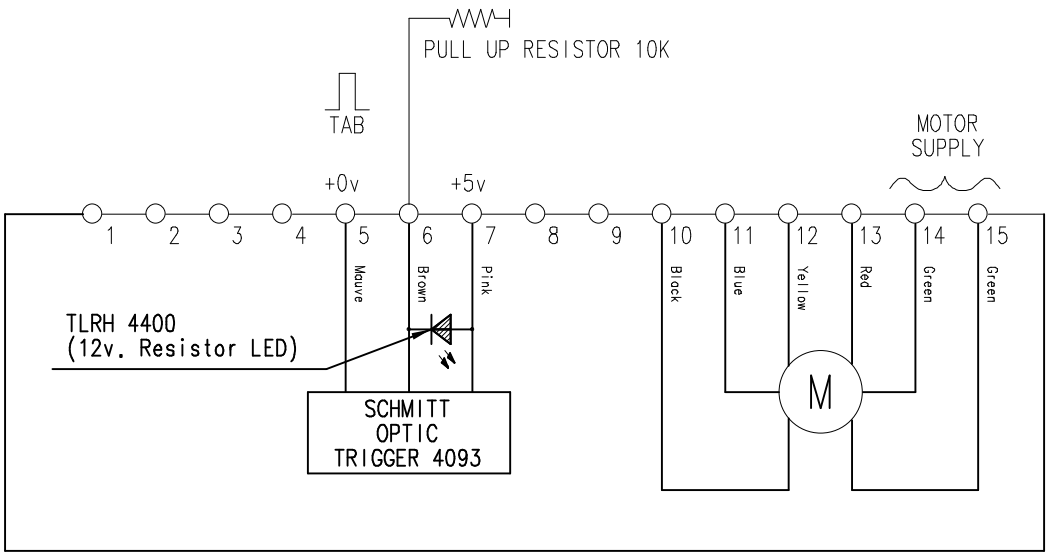
DATE	MODIFICATION	ISSUE
08/08/02	REDRAWN NEW Pt. No.	01

TITLE.
NMB MOTOR 12v 48 STEP
PM55L-048-SRA3

DRAWING No.	ISSUE.	SPECIFICATION
A1C004	01	ZZZZ

IF IN DOUBT ASK, DO NOT SCALE

THIRD ANGLE PROJECTION



STARPOINT
KING GEORGE'S TRADING ESTATE
DAVIS ROAD, CHESSINGTON
SURREY KT9 1TT - UK.
TEL: +44 (0)20 8391 7700
FAX: +44 (0)20 8391 7760
WEBSITE: www.starpoint.uk.com

UNLESS OTHERWISE STATED GENERAL TOLERANCE:-
1 DEC, PLACE ±0.40mm. 2 DEC, PLACES ±0.10mm.
CONCENTRICITY 0.10mm. MAX.
ANGULAR ± 0.5°

ALL DIMENSIONS IN mm, TO APPLY AFTER PLATING.

MATERIAL.

FINISH.

TITLE. CIRCUIT IDAGRAM

DRAWN AN	31/10/02	Drawing corrected	02	
CHECKED TJ	15/08/02	Redrawn was A2314	01	
	DATE	MODIFICATION	ISSUE	
SCALE 1 : 1	USED ON. 1DU/1CM		SHEET of	

DRAWING No.	ISSUE.	SPECIFICATION
G5D001	02	ZZZZ