STANDARD OPERATING PROCEDURE

Ref:	**SOP-0199-03-N-DEV**

Description:	**1CM** **Starpoint Technical Information**

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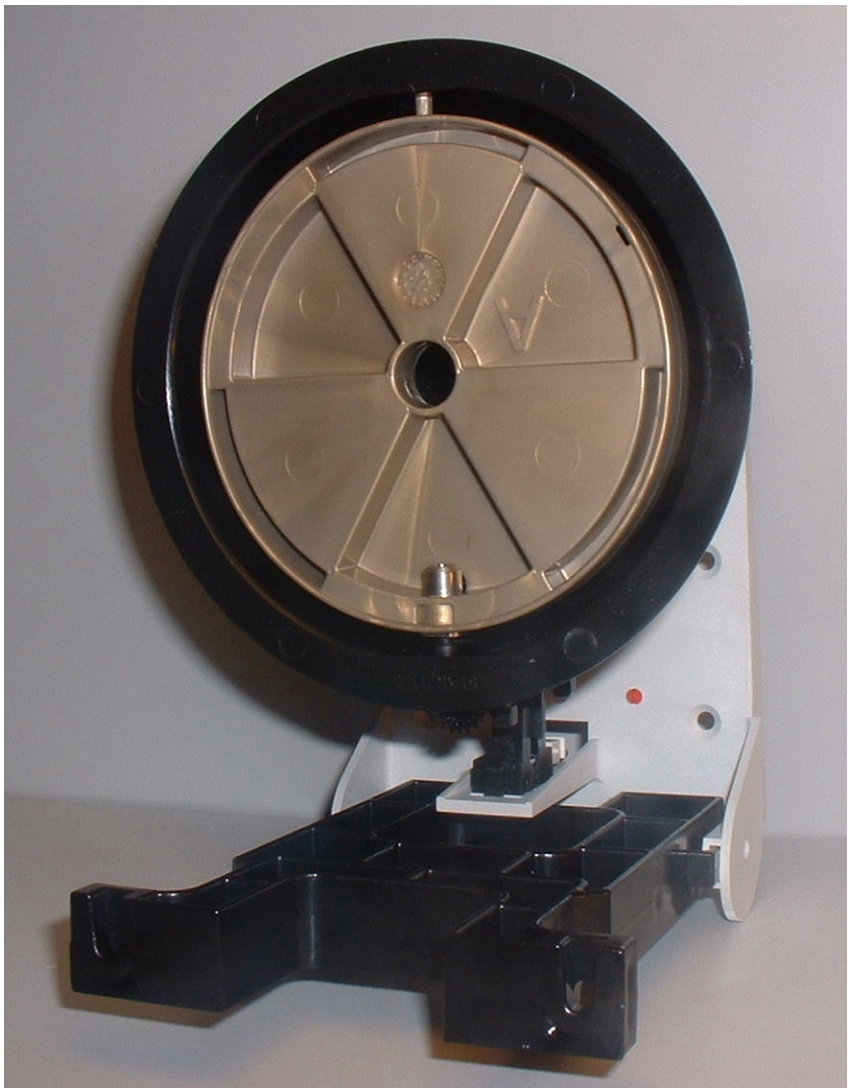
sales@starpoint.uk.com

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

1CM - Coin 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

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STARPOINT

CONTENTS

Introduction

The 1CM Coin Mechanism is a unit designed to provide the games designer with a means to portray a tumbling coin. This coin would appear to the player to be tumbling 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 decals on the two faces of the coin 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 coin to the player.

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, that either the Starpoint 'Quick Release' fixing feet or Starpoint `Glass Mounted' foot is 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 & glass mounted foot please refer to Starpoint Drawing G4G013-01-ZZZZ & G4G015-01-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 1CM 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 – Base or Glass Mounting

Starpoint Drawings G4G013-01-ZZZZ & G4G015-01-ZZZZ shows the General Assembly of the unit, mounted by base or glass mounted applications. When the unit is mounted on the base, the presentation of the viewing area of the coin may be adjustable through 0° to 90°. When glass mounted the unit is a fixed position. The unit will operate in any orientation but must be rigidly fixed to the cabinet with the viewing area in the correct orientation.

2. Coin Decals

The coin has been designed to accept any design of decal; to enable customer design, the details of material, size and orientation pips are shown on Starpoint Drawing G6D012-01-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 out once. After which the weight if the decals will not permit proper rotation of the coin. For identification, the two faces of the coin are marked with the letters A & B.

3. Gear Ratio

Three full revolutions (144 steps) of the motor will, via the gear ratio of the coin mechanism, cause both faces of the 1CM to be viewed, i.e. every 72 motor steps moves the 1CM to a new face. The games designer is able to control and monitor position by reference to the optic detector. The optic detector is only interrupted when face ‘A’ (as shown on drawings G4G013-01-ZZZZ and G4G015-01-ZZZZ) is correctly displayed.

4. Customer Cone Information

Starpoint drawings F4C015-01-ZZZZ & G6D013-01-ZZZZ show suggested examples of cone vacuum forming & cone decal, which customer’s may wish to use as a guide. Starpoint does not supply these.

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 No 22-01-2155 (crimp terminal type: 4809)

2. Stepper Motor

The 1CM 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 detector from Temic (AEG, Telefunken) manufacturers part # TYCS 5201 - Starpoint Part No. B2C001-01-ZZZZ. The optic detector is complete with built in Schmitt trigger and open collector output. A high level denotes the optic detector 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 as described in Section 3. This LED will illuminate when the optic is interrupted if the coin unit is functioning correctly. 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 locates the coin faces in the pre-defined position. There are 72 motor steps from one coin face to the next. Appendix A contains suggested ramps for up, down and run speeds for 39rpm, 52rpm. **Note**: - It is not recommended to drive the 1CM 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 coin movement. It is also recommended that a short delay of 500mS be used before commencing this switching procedure after the coin 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 timing diagram.

7. Motor Drive Software

a. Reset Procedure

This procedure is recommended at power on, or on occasion when the software identifies that the 1CM is out of step or in an incorrect position.

- Drive the motor approximately 39 RPM
- At every motor step change, monitor the optic output. Immediately the optic 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 1CM to settle in position. Check that the optic tab is central in the optic detector. If not repeat above steps, if the optic tab is still not in the optic detector, then there is a fault.
- The 1CM 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 optic 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 coin is in synchronisation carry out the following tests in software.

1. When the coin is to stop on face “A”, ensure the step sequence stops with the black and yellow windings energised. The optic tab will be in the optic detector. If the optic tab is not in the optic detector enter the reset procedure.

2. To monitor the optic tab during rotation create a window of 6 motor steps, within which the optic tab should interrupt the optic detector. 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 1CM 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.

Customer

Complete the purchasing Company's name.

Customer Part Number

Enter the Customer part number as this will be cross-referred to the Configuration / Specification Number. Both numbers are included on the order and invoice documents.

Date

Complete the date specification sheet is completed.

Comments

An area is available to highlight any special instructions.

Mechanism Type

This is pre-defined. NU refers to 1CM.

Motor

The only one option of motor available is a 48 step, 12v DC NMB unit.

Coin Colour

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

ORDERING INFORMATION - continued

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 coin.

Frame Type

The standard option of frame should be specified.

Base

The 1CM unit is available with either the standard base or without, for glass or customer's specific mounting.

Loom

The 1CM 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; this may be a customer defined set. Both of the faces should be defined in the Coin Face Reference box. Example; `A' face = heads, `B' face = tails.

Set Position of Frame

This provides the angle that the frame is to be set at when fitted onto a base during manufacture.

Fixing Feet

When standard base fixing is required, 1 off fixing foot 18S008-01-AFBK & 18S009-01-AUBK should be ordered as separate items, per unit. When glass mounting is required, 1 off mounting base 18S023-01-ANBK should be ordered as a separate item, per unit.

CARRIAGE AND DISTRIBUTION

All Starpoint 1CM 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

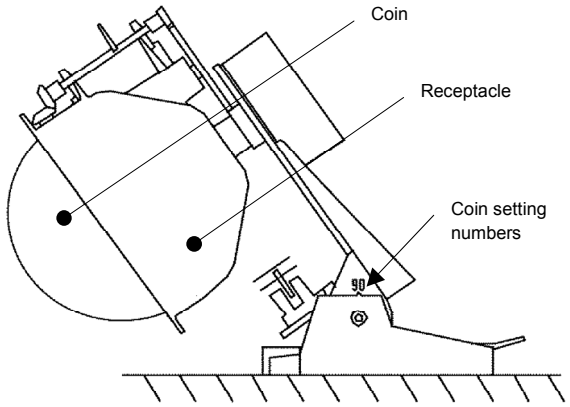
All values are in milliseconds (mS) and are the delays between phase changes.

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

These ramp tables are nominal values, intended as a guide for initial software development. Ramps should be optimised to meet individual requirements, depending on hardware/software drive methods.

Appendix B

1CM SPECIFICATION / QUOTATION SHEET



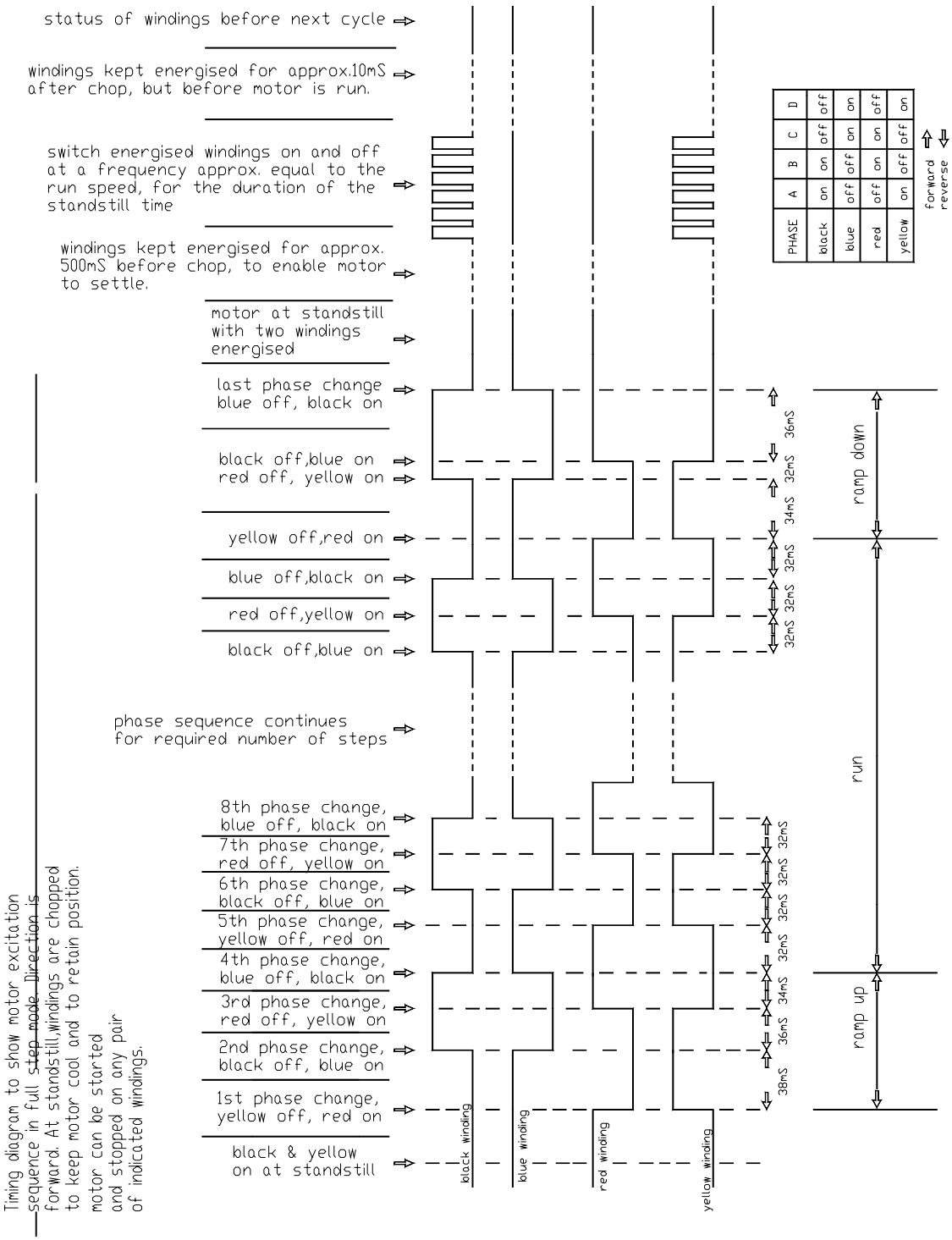
CUSTOMER:	
CUSTOMER PART NUMBER:	
DATE:	
QUOTATION REQUIRED:	**YES / NO**
QUANTITY REQUIRED:	**XXXX**
COMMENTS:	
COIN FACE A =	**COIN FACE B =**

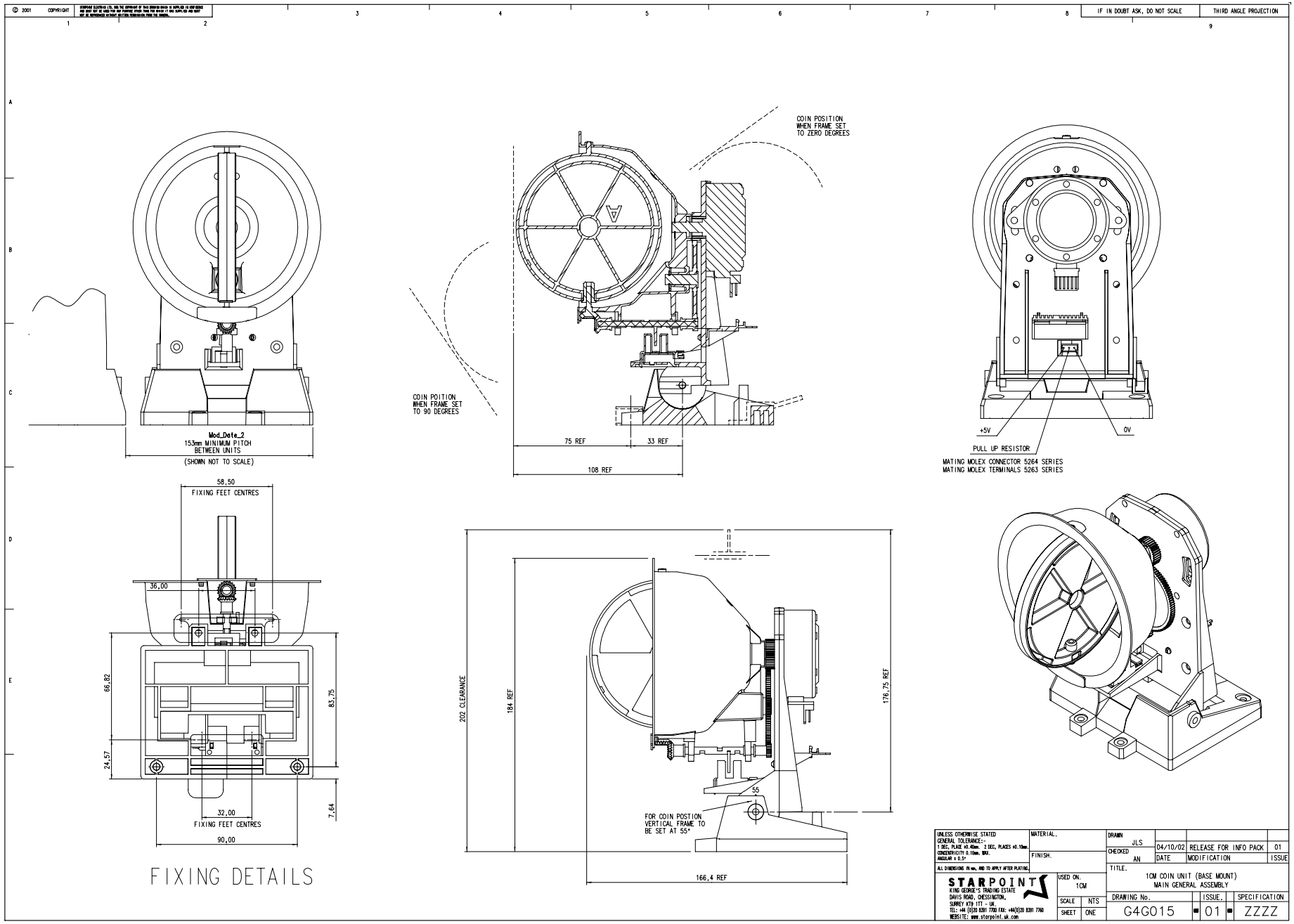
MECH	1CM COIN MECHANISM				**NU**
MOTOR	VOLTAGE/ STEP ANGLE	A 12V. 48 STEP NMB			**A**
COIN	COLOUR	Y GOLD	G CLEAR	A BLACK	
RECEPTACLE	COLOUR	A BLACK	P WHITE		
FRAME	TYPE	1 STANDARD			**1**
BASE	TYPE	1 STANDARD	Z NOT REQUIRED OR GLASS MOUNTED		
LOOM	TYPE	A STANDARD			**A**
DECAL	TYPE	ZZ NOT FITTED	XX CUSTOMER SPECIFIC		
SETTING	FRAME POSITION	ZZ N/A NO BASE REQUIRED OR GLASS MOUNTED	**0 - 90** (SEE PICTURE ABOVE)		

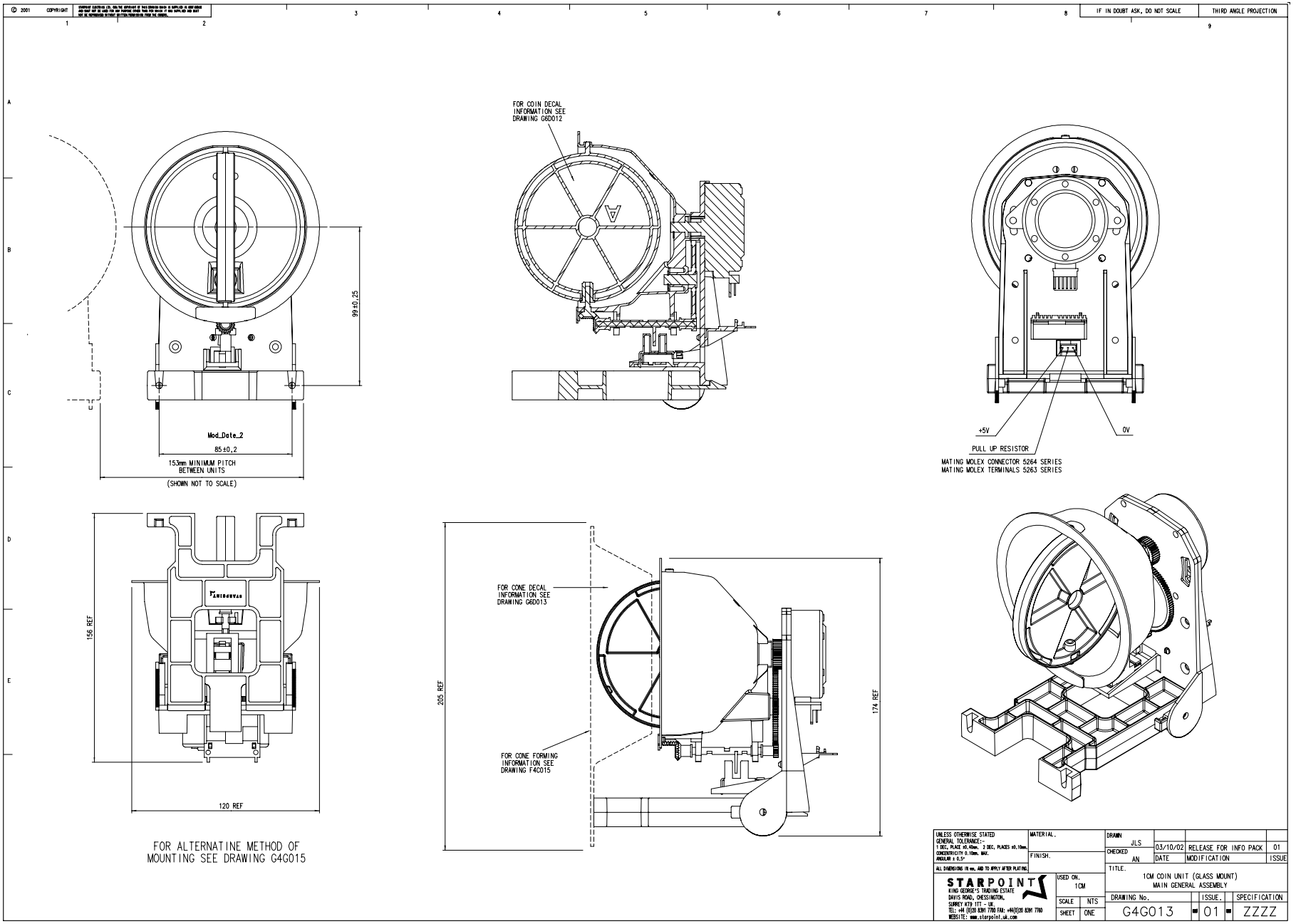
UNITS 1-5, KING GEORGES TRADING ESTATE, DAVIS ROAD, CHESSINGTON, KT9 1TT
TEL: +44 (0) 20 8391 7700 FAX: +44 (0) 20 8391 7760 E-MAIL: info@starpoint.uk.com

SOPF-0161-02-N-DEV

Appendix C


status of windings before next cycle
windings kept energised for approx.10mS after chop, but before motor is run.
switch energised windings on and off at a frequency approx. equal to the run speed, for the duration of the standstill time
windings kept energised for approx. 500mS before chop, to enable motor to settle.
motor at standstill with two windings energised
last phase change blue off, black on
black off,blue on
red off, yellow on
yellow off,red on
blue off,black on
red off,yellow on
black off,blue on
phase sequence continues for required number of steps
8th phase change, blue off, black on
7th phase change, red off, yellow on
6th phase change, black off, blue on
5th phase change, yellow off, red on
4th phase change, blue off, black on
3rd phase change, red off, yellow on
2nd phase change, black off, blue on
1st phase change, yellow off, red on
black & yellow on at standstill
black winding
blue winding
red winding
yellow winding
36mS
32mS
34mS
32mS
32mS
32mS
32mS
32mS
32mS
32mS
34mS
36mS
38mS
ramp down
run
ramp up
PHASE
A
B
C
D
black
blue
red
yellow
on
off
forward
reverse
Timing diagram to show motor excitation sequence in full step mode. Direction is forward. At standstill,windings are chopped to keep motor cool and to retain position. motor can be started and stopped on any pair of indicated windings.


© 2001 COPYRIGHT
IF IN DOUBT ASK, DO NOT SCALE
THIRD ANGLE PROJECTION
Mod_Date_2
153mm MINIMUM PITCH
BETWEEN UNITS
(SHOWN NOT TO SCALE)
COIN POSITION
WHEN FRAME SET
TO ZERO DEGREES
COIN POITION
WHEN FRAME SET
TO 90 DEGREES
75 REF
33 REF
108 REF
+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
202 CLEARANCE
164 REF
176,75 REF
55
FOR COIN POSTION
VERTICAL FRAME TO
BE SET AT 55°
166,4 REF
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.
1CM
SCALE NTS
SHEET ONE
DRAWN
JLS
04/10/02
RELEASE FOR INFO PACK
01
CHECKED
AN
DATE
MODIFICATION
ISSUE
TITLE.
1CM COIN UNIT (BASE MOUNT)
MAIN GENERAL ASSEMBLY
DRAWING No.
ISSUE.
SPECIFICATION
G4G015
01
ZZZZ


© 2001 COPYRIGHT
IF IN DOUBT ASK, DO NOT SCALE
THIRD ANGLE PROJECTION
99±0.25
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85±0,2
153mm MINIMUM PITCH
BETWEEN UNITS
(SHOWN NOT TO SCALE)
FOR COIN DECAL
INFORMATION SEE
DRAWING G6D012
+5V
0V
PULL UP RESISTOR
MATING MOLEX CONNECTOR 5264 SERIES
MATING MOLEX TERMINALS 5263 SERIES
156 REF
120 REF
FOR ALTERNATINE METHOD OF
MOUNTING SEE DRAWING G4G015
FOR CONE DECAL
INFORMATION SEE
DRAWING G6D013
FOR CONE FORMING
INFORMATION SEE
DRAWING F4C015
205 REF
174 REF
UNLESS OTHERWISE STATED
GENERAL TOLERANCE:-
1 DEC. PLACE ±0.4mm. 2 DEC. PLACES ±0.10mm.
CONCENTRICITY 0.10mm. MAX.
ANGULAR ± 0.5°
ALL DIMENSIONS IN mm, AND TO APPLY AFTER PLATING.
MATERIAL.
FINISH.
USED ON.
1CM
SCALE NTS
SHEET ONE
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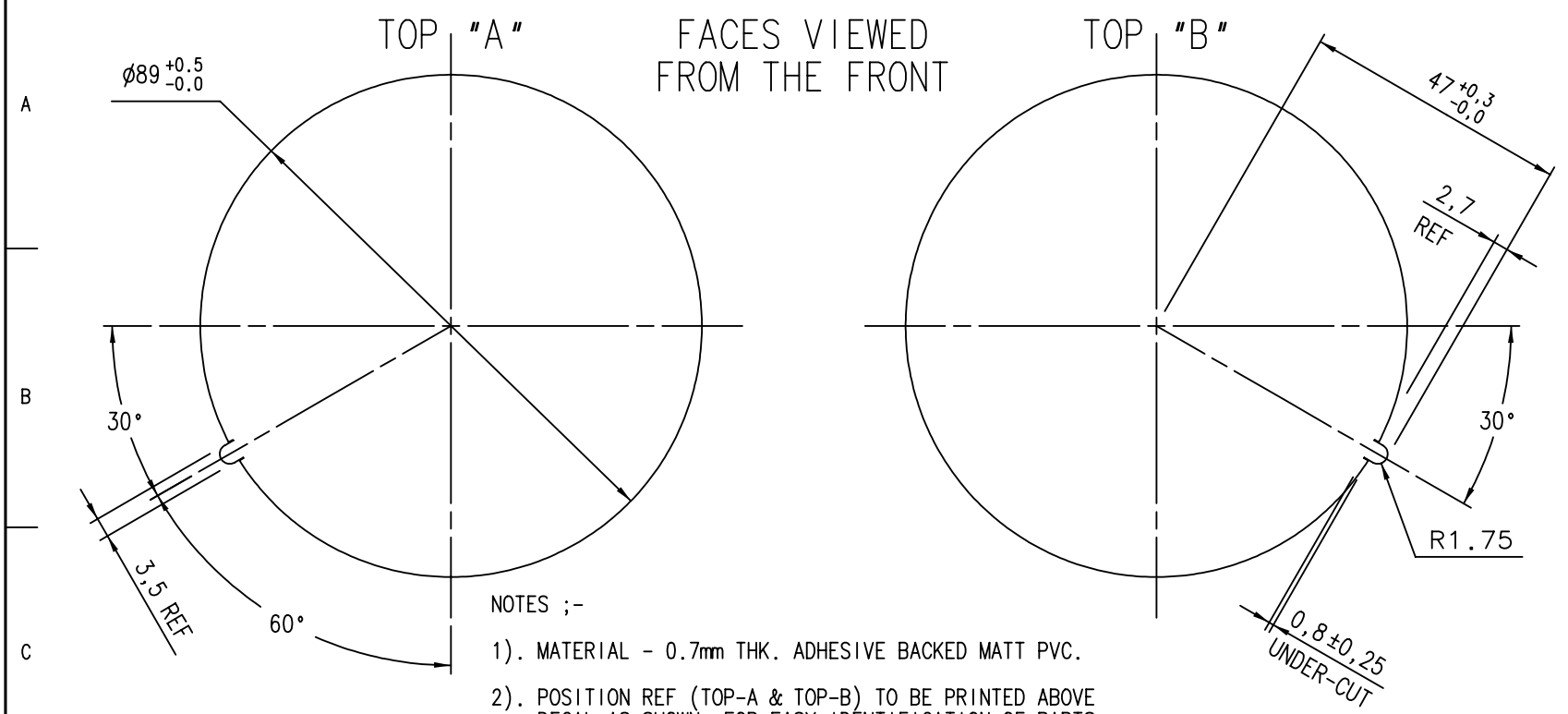
WEBSITE: www.starpoint.uk.com
DRAWN JLS
CHECKED AN
03/10/02 RELEASE FOR INFO PACK 01
DATE MODIFICATION ISSUE
TITLE.
1CM COIN UNIT (GLASS MOUNT)
MAIN GENERAL ASSEMBLY
DRAWING No. ISSUE. SPECIFICATION
G4G013 01 ZZZZ

IF IN DOUBT ASK, DO NOT SCALE

THIRD ANGLE PROJECTION



NOTES ;-

1). MATERIAL - 0.7mm THK. ADHESIVE BACKED MATT PVC.

2). POSITION REF (TOP-A & TOP-B) TO BE PRINTED ABOVE DECAL AS SHOWN, FOR EASY IDENTIFICATION OF PARTS.

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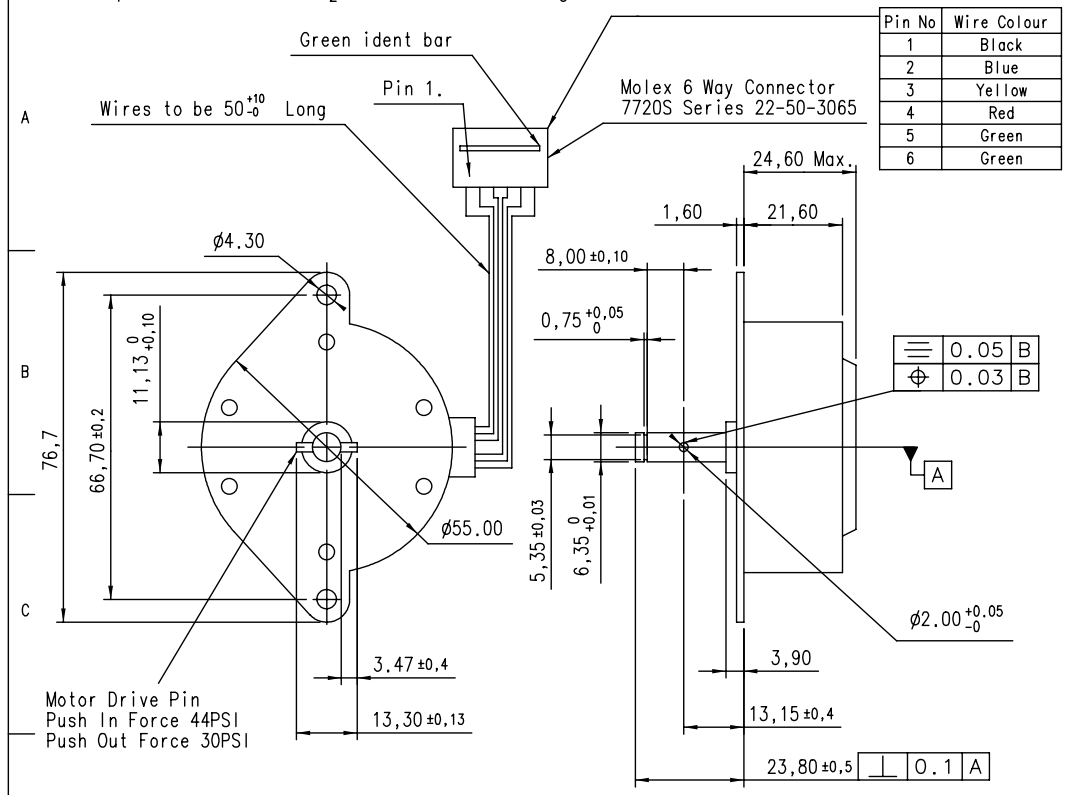
WEBSITE: www.starpoint.uk.com

UNLESS OTHERWISE STATED GENERAL TOLERANCE:- 1 DEC, PLACE ±0.40mm. 2 DEC, PLACES ±0.10mm. CONCENTRICITY 0.10mm. MAX. ANGULAR ± 0.5°	MATERIAL. SEE NOTES	DRAWN JLS			
		CHECKED AN	05/09/02	DRAWING RELEASED	01
	FINISH.		DATE	MODIFICATION	ISSUE
ALL DIMENSIONS IN mm, TO APPLY AFTER PLATING.	KEEP CLEAN	SCALE NTS	USED ON. 1CM		SHEET ONE
TITLE. COIN (93 DIA) DECAL INFORMATION		DRAWING No.	ISSUE.		SPECIFICATION
		G6D012	- 01 -		ZZZZ

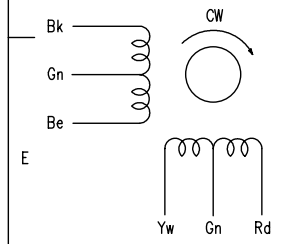
IF IN DOUBT ASK, DO NOT SCALE | THIRD ANGLE PROJECTION



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.

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WEBSITE: www.starpoint.uk.com

USED ON. 1DU

SCALE 1 : 1

SHEET of

DRAWN AN

CHECKED TJ

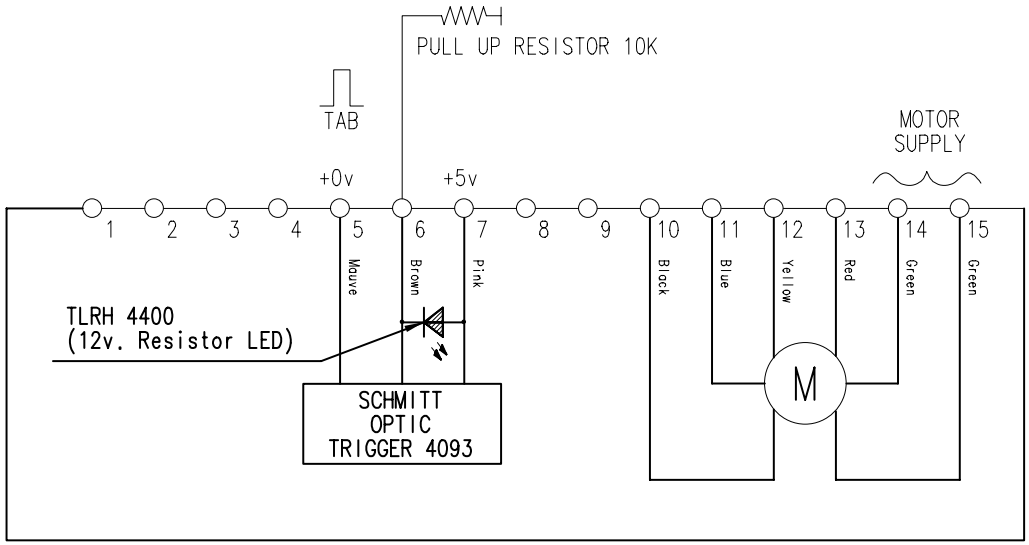
DATE	MODIFICATION	ISSUE
08/08/02	REDRAWN NEW Pt. No.	01

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



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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

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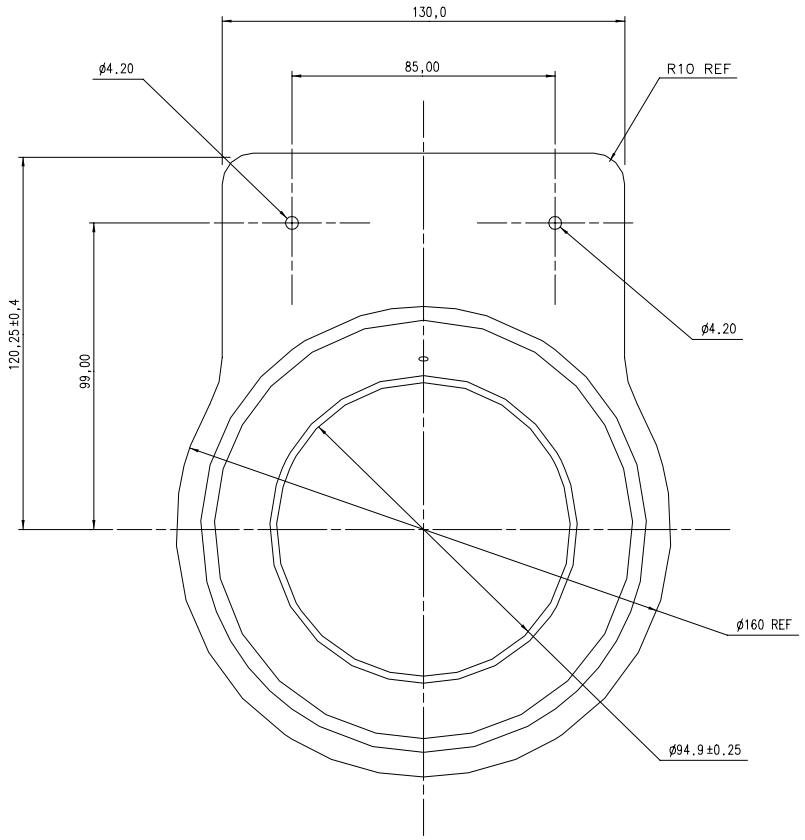
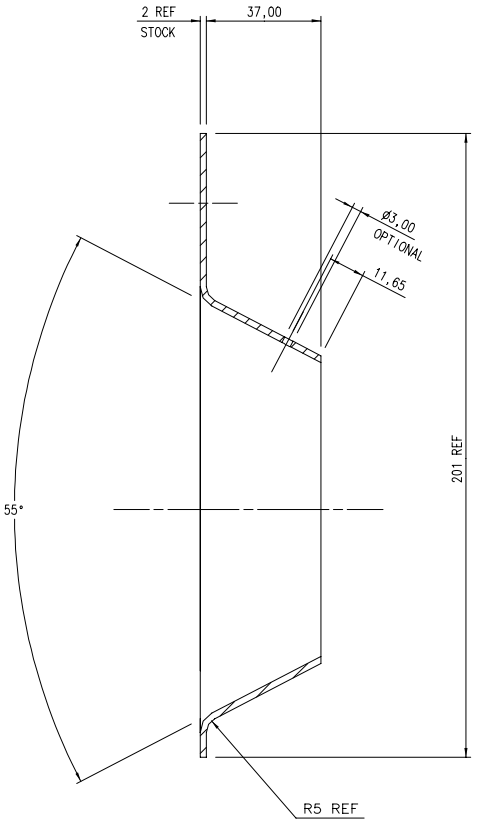
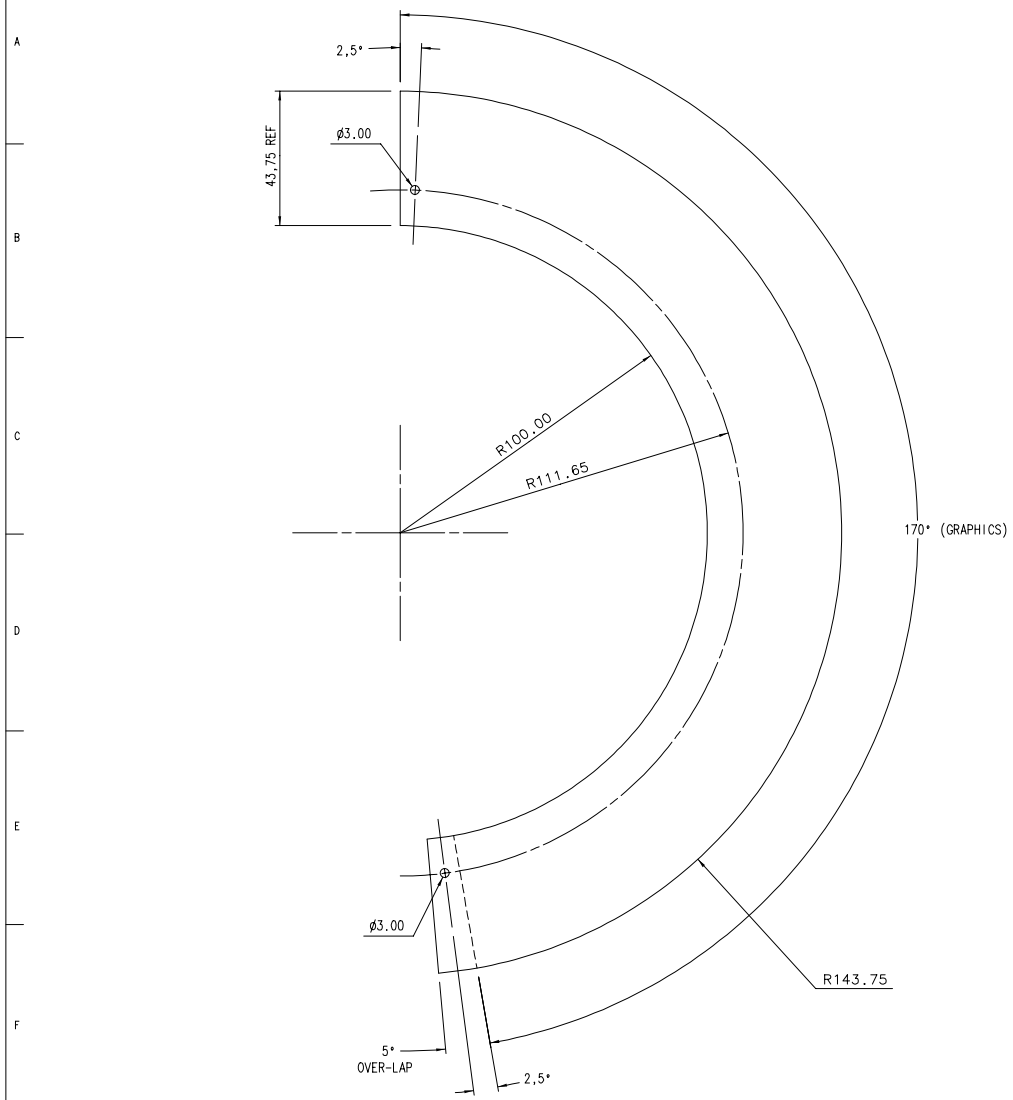




UNLESS OTHERWISE STATED GENERAL TOLERANCE:- 1 DEC. PLACE ±0.40mm. 2 DEC. PLACES ±0.10mm. CONCENTRICITY 0.10mm. MAX. ANGULAR ± 0.5°	MATERIAL. HIPS	DRAWN JLS		
	FINISH.	CHECKED AN	01/10/02 DATE	DRAWING RELEASED MODIFICATION 01 ISSUE
ALL DIMENSIONS IN mm, AND TO APPLY AFTER PLATING.	USED ON. 1CM	TITLE. CONE FORMING (CUSTOMER INFORMATION)		
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	SCALE NTS SHEET ONE	DRAWING No. F4C015	ISSUE. 01	SPECIFICATION ZZZZ

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



UNLESS OTHERWISE STATED GENERAL TOLERANCE:-
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CONCENTRICITY 0.10mm. MAX.
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MATERIAL.

FINISH.

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USED ON. 1CM

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DATE	MODIFICATION	ISSUE
01/10/02	DRAWING RELEASED	01

TITLE.
CONE DECAL
(CUSTOMER INFORMATION)

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