STANDARD OPERATING PROCEDURE

Ref:	**SOP-0298-01-N-DEV**

Description:	**Double Feature Mechanism (DFM) Starpoint Technical Information**

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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

Double Feature 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

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CONTENTS

Introduction

The '***Double Feature Mechanism'*** (DFM) follows the Starpoint tradition of innovative products to enhance the options available to the games designer for the presentation of new ideas. Utilising Starpoint's proven technology of stepper motor drives, and using NMB 12v 48 step motors, the DFM offers two independently driven reels housed in one robust assembly. The DFM is capable of being mounted directly onto the glass, thus eliminating costly brackets, and saving on assembly time. Each independently driven reel is designed to accept either twelve or sixteen symbol reel bands, and is capable of being driven in any direction at varying speeds. Three-symbol illumination is available on each reel, this being provided by the host machine as part of the standard lighting loom. Positional reference for both reels is obtained through the use of two standard optic devices fitted to the main housing. The DFM can be supplied fully tested with the reel bands fitted, giving further savings in both cost and assembly time.

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.

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. Installation

The unit is to be screwed using tamper proof screws directly to the glass using the four mounting holes provided.

7. Handling

The unit is of robust construction, but care is required to ensure that the optic device and connector pins are not damaged.

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 DFM, 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

The Double Feature Mechanism (DFM) is supplied as two single reel 'demi' units that have been snapped together as a double unit, and can be supplied with or without a band fitted. The two demi half units are identical in construction, and can also be supplied with or with out reel bands. For overall dimensions see GA drawing number G4G031-01-ZZZZ on page 19.

2. Optic device

The optic devices have been designed for easy access by Service Engineers should there ever be a need for replacement.

3. Reel Band Fixing Procedure

To fit the reel bands remove the reel drum from the unit, by removing the clip, line up the rivet holes in the band with the corresponding holes in the reel drum, so that the edge which has the optic tab printed is facing towards the open edge of the drum – hence will not be visible to the player - Wrap the band around the drum and fix in place with 2 snap rivets type RICHO SR 2642B. The drum can then be fitted back onto the unit using the clip to fix in place.

ELECTRICAL SPECIFICATIONS

1. Electrical Connections

Connection to the motors is made via a 6 way Molex 6471 series or 7720S series type connector. Connection to the optic detector is via an AMP 3 way housing, part number 175778-3. Details can be seen on drawing G5D037-01-ZZZZ on page 21.

2. Stepper Motor

Each demi unit uses the same 12v 48-step motor – 400 mA per phase.
Manufactured by NMB of Japan. Part number A1C004-01-ZZZZ.

3. Position Control Sensor

Each demi unit uses the same position control sensor. It is 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. A 5v pull up resistor is required on the host machine. The output sink current is 20 mA absolute max. The optic detector provides a high level output when covered by the tab on the reel band.

4. Stepper Motor Control

The unit is controlled by a 48-step 12-volt motor. There are 4 steps per symbol for the 12-symbol version and 3 steps per symbol for the 16-symbol version.
Appendix A contains suggested ramps for up, down and run speeds for the unit.

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 reel movement. It is also recommended that a short delay of 500mS be used before commencing this switching procedure after the reel has 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.

5. Stepper Motor Timing Diagram

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

6. Motor Drive Software

a. Reset Procedure

This procedure is recommended at power on, or on occasion when the software identifies that the DFM 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 DFM 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 DFM 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 DFM is in synchronisation carry out the following tests in software.

- When the DFM is to stop, 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.
- 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.

7. Motor Phase Setting

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

8. Illumination

There are facilities in the unit to be illuminated. This is to done by via the loom in the host machine. The unit has the facility to accept 3 off 5 mm lamp holders.

ORDERING INFORMATION

The production build standard for the DFM 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.

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

An area is available to highlight any special instructions.

Mechanism Type

This is pre-defined. NF refers to DFM.

Unit

If Starpoint fit reelbands, the unit will be supplied packaged as a complete assembly ready for installation.

If Starpoint do not fit reelbands the unit will be supplied packaged as two half (DEMI) Units in order to allow the user to fit their own reelbands.

Housing

This is pre-defined. The housing is white in colour.

ORDERING INFORMATION - Continued

Symbols / illumination

The unit can be set to accept one of the 3 options available.

12 Symbols = Illumination Pillboxes are mounted in 12 symbol position.
16 Symbols = Illumination Pillboxes are mounted in 16 symbol position.
0 Symbols = Illumination Pillboxes are not fitted.

Reel bands

The bands can be fitted with either horizontal or vertical printed band sets depending on the orientation of the unit in the machine, in both 12 & 16 symbol versions.

If you select the customer specific option XXXX, please contact the Starpoint Sales Department regarding the band details to be supplied.

If you do not require reelbands to be fitted please select option ZZZZ

CARRIAGE AND DISTRIBUTION

The DFM's are shipped in returnable cardboard and plastic packaging. The DFM will be packed as 4 complete units to a box, or 8 demi units to a box.

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

Appendix A

Ramp Table Examples

For 125 RPM

UP	14, 12
RUN	10
Down	12, 20

Examples of Ramp Tables 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

SPECIFICATION SHEET

STARPOINT

DFM SPECIFICATION / QUOTATION SHEET

DFM shown as complete assembly with vertical reelbands fitted

'Demi Unit' shown with vertical reelband fitted for illustration only

CUSTOMER:	
CUSTOMER PART NUMBER:	
DATE:	
QUOTATION REQUIRED:	**YES /NO**
QUANTITY REQUIRED:	**XXXX**
COMMENTS:	

MECH	DOUBLE FEATURE MECHANISM				**NF**
UNIT	ASSEMBLY OPTIONS	1 UNIT SUPPLIED AS COMPLETE ASSEMBLY WITH BAND FITTED	2 UNIT SUPPLIED AS TWO DEMI (HALF) UNITS NO BAND FITTED	3 DEMI UNIT NO BAND FITTED	
HOUSING	COLOUR OF HOUSING	A WHITE			**A**
SYMBOLS / ILLUMINATION	OPTIONS	12 12 SYMBOLS INTERNAL ILLUMINATION PILLBOXES FITTED AT 12 SYMBOL POSITION	16 16 SYMBOLS INTERNAL ILLUMINATION PILLBOXES FITTED AT 16 SYMBOL POSITION	ZZ NO INTERNAL ILLUMINATION PILLBOXES FITTED	
REELBANDS	BAND FITTING/TYPE	XXXX CUSTOMER SPECIFIC REELBAND SUPPLIED FITTED		ZZZZ NO BAND REQUIRED	
		0001 STARPOINT 12 SYMBOL SET HORIZONTAL	0002 STARPOINT 12 SYMBOL SET VERTICAL	0003 STARPOINT 16 SYMBOL SET HORIZONTAL	0004 STARPOINT 16 SYMBOL SET VERTICAL

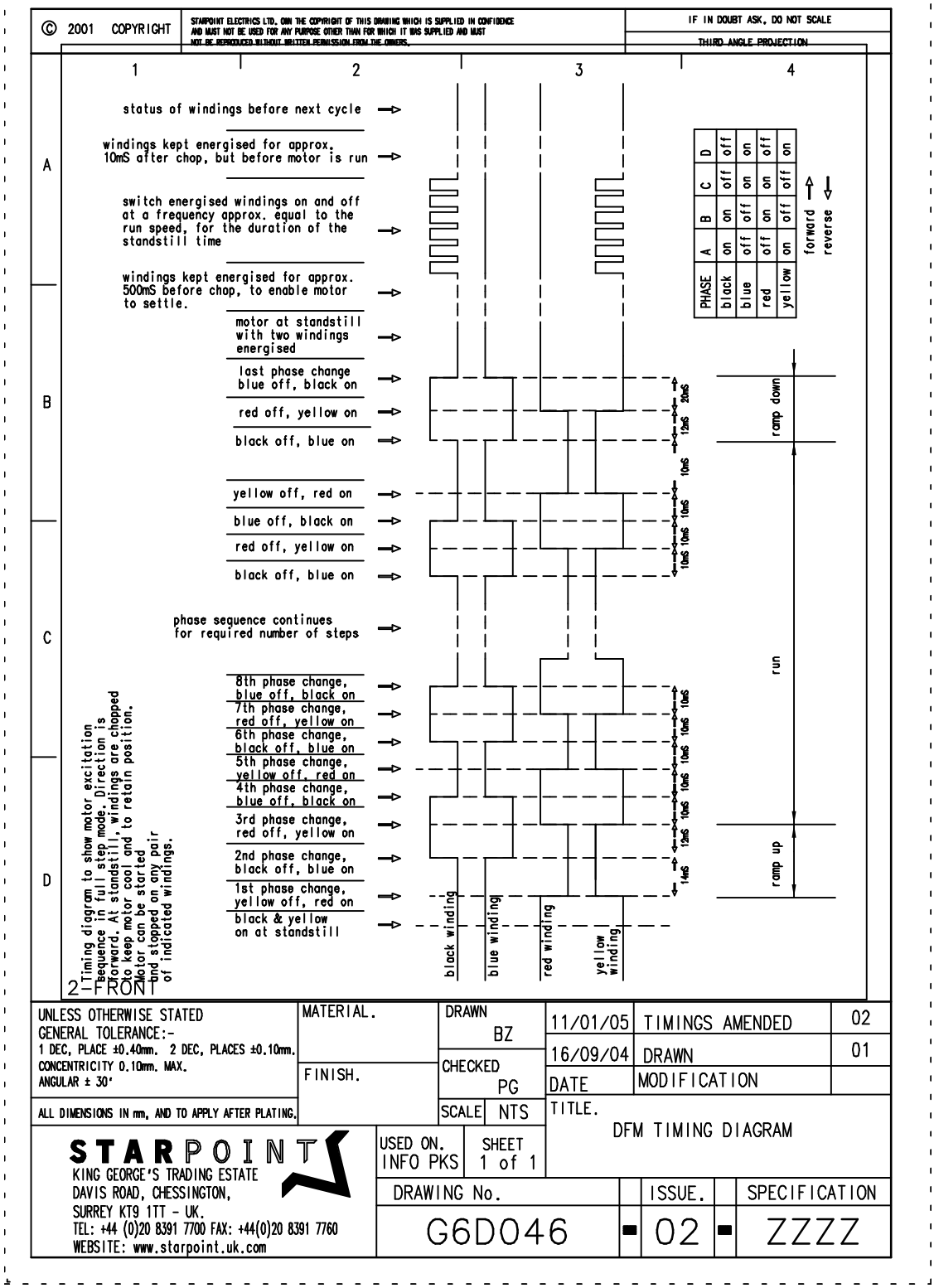
STARPOINT

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

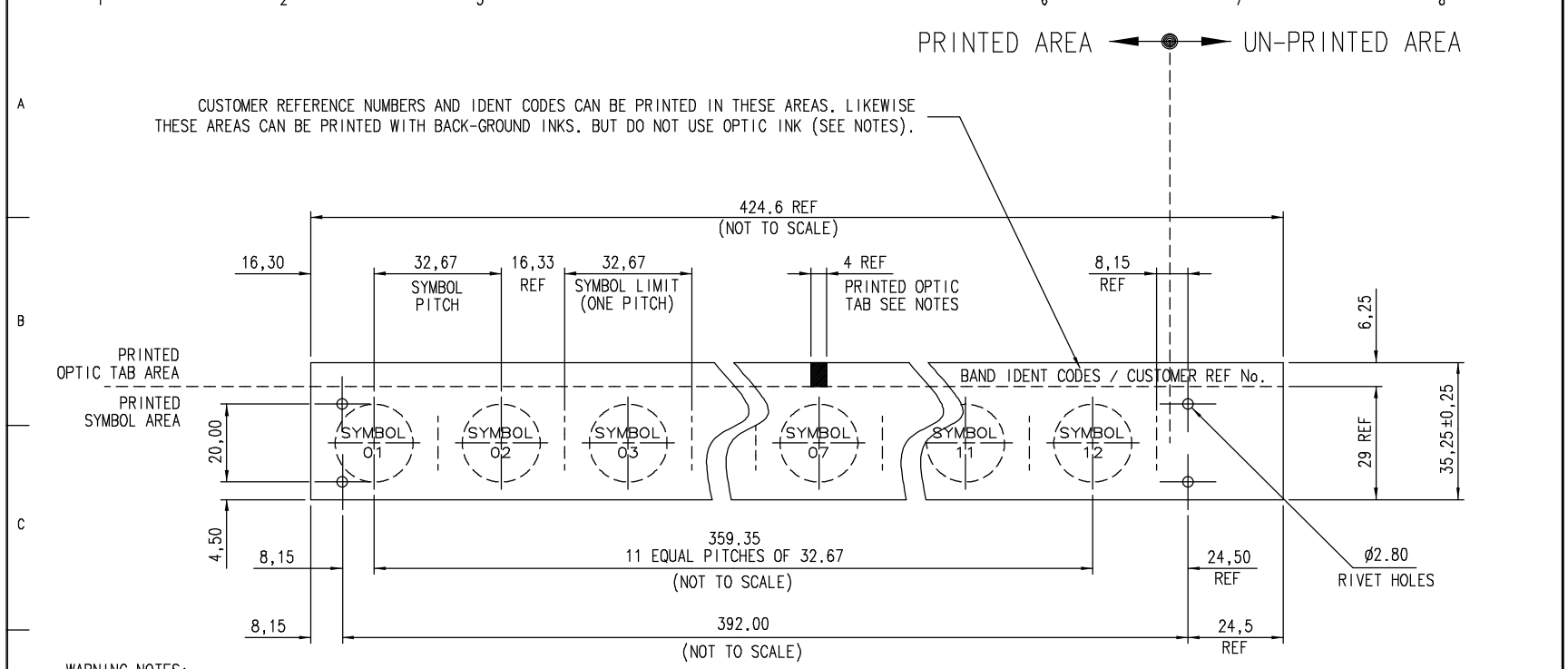
SOPF-0203-03-N-DEV

Appendix C

Timing Diagram



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



WARNING NOTES:

1). CARE MUST BE TAKEN WHEN PRODUCING THESE ARTWORKS, AS THE SECOND DEMI-UNIT OF THIS PRODUCT IS PRESENTED 180 DEGREES FROM THE FIRST. WHICH MAY RESULT IN THE GRAPHIC'S BEING SEEN UP-SIDE-DOWN AND/OR RUNNING THE WRONG WAY ROUND IN THE "GAME-PLAY".

2). CALCULATIONS ARE BASED UPON 0.2mm THICK MATERIAL (PLUS INK).

3). BAND MATERIAL - HEAT STABILISED POLYESTER "MELENEX ST525".

4). SYMBOL AND TAB PRINTING CAN APPEAR ON EITHER SIDE OF THE BAND (SUBJECT TO CUSTOMER REQUIREMENTS).

5). OPTIC TABS TO BE PRINTED USING "SEICOL" POLYPLAST BLACK INK OR AN EQUIVALENT. DO NOT USE UV BLACK OR COMBINATIONS OF CYAN AND MAGENTA UV INKS SINCE THIS WILL NOT HAVE THE REQUIRED DENSITY.

2-FRONT

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. SEE NOTES
FINISH. KEEP CLEAN
USED ON. DFM
SCALE NTS
SHEET ONE

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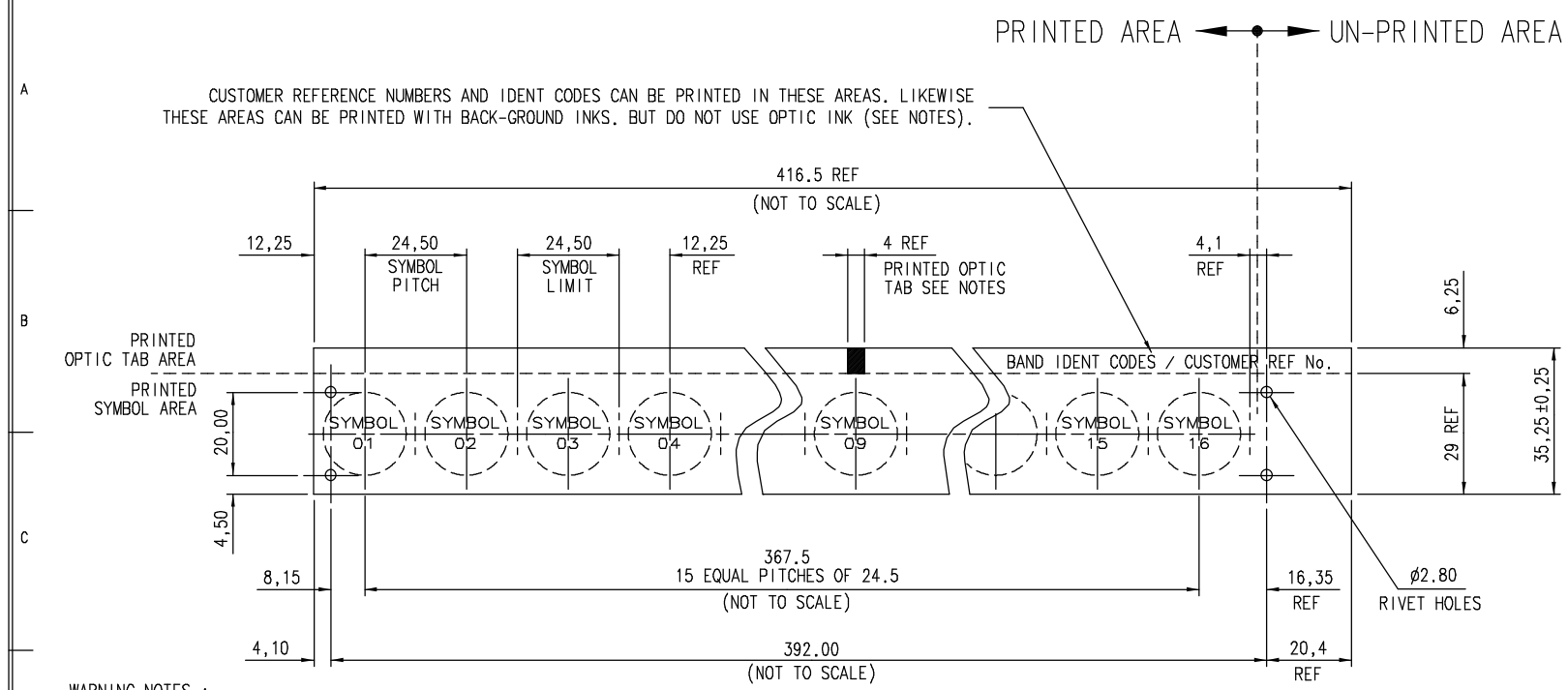
DRAWN JLS	28/04/04	SEE ECN G6D025-04	04
CHECKED JLS	30/03/04	SEE ECN G6D025-03	03
	DATE	MODIFICATION	ISSUE

TITLE. DFM - 12 SYMBOL BAND DETAILS CUSTOMER INFORMATION

DRAWING No.	ISSUE.	SPECIFICATION
G6D025	04	ZZZZ

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



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ANGULAR ± 0.5°
ALL DIMENSIONS IN mm. AND TO APPLY AFTER PLATING.

MATERIAL. SEE NOTES
FINISH. KEEP CLEAN
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DRAWN	DATE	MODIFICATION	ISSUE
JLS	28/04/04	SEE ECN G6D026-04	04
CHECKED JLS	30/03/04	SEE ECN G6D026-03	03

TITLE. DFM - 16 SYMBOL BAND DETAILS CUSTOMER INFORMATION

DRAWING No.	ISSUE.	SPECIFICATION
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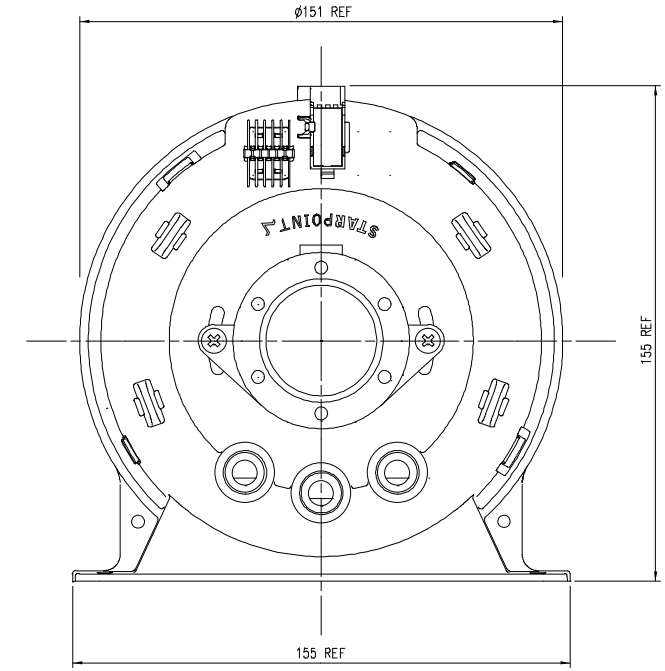
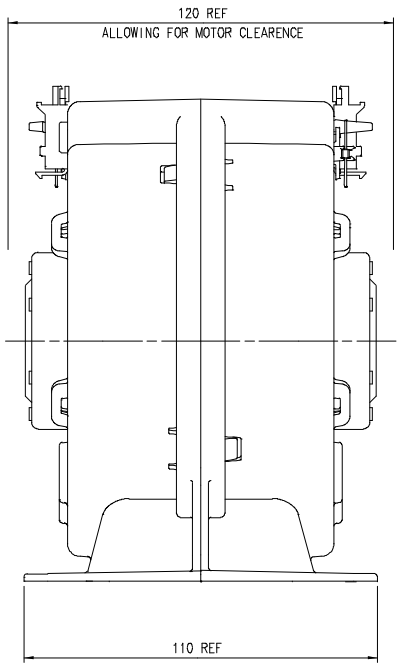
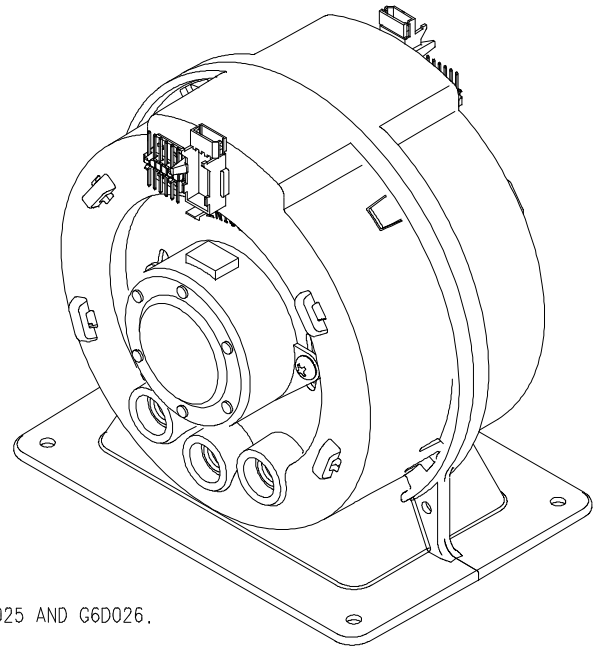
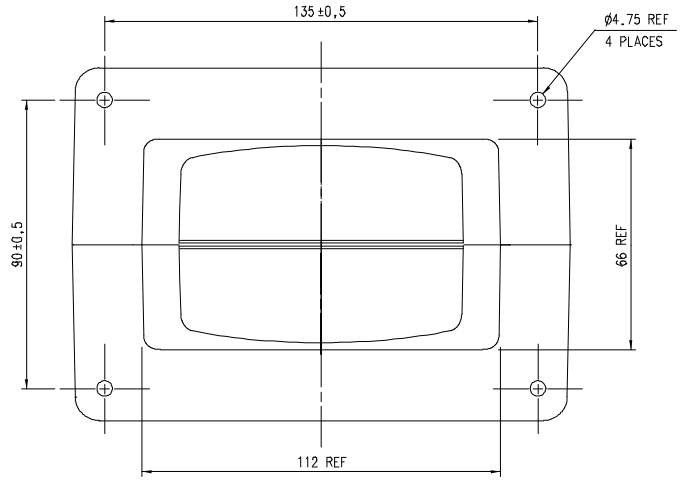
IF IN DOUBT ASK, DO NOT SCALE | THIRD ANGLE PROJECTION







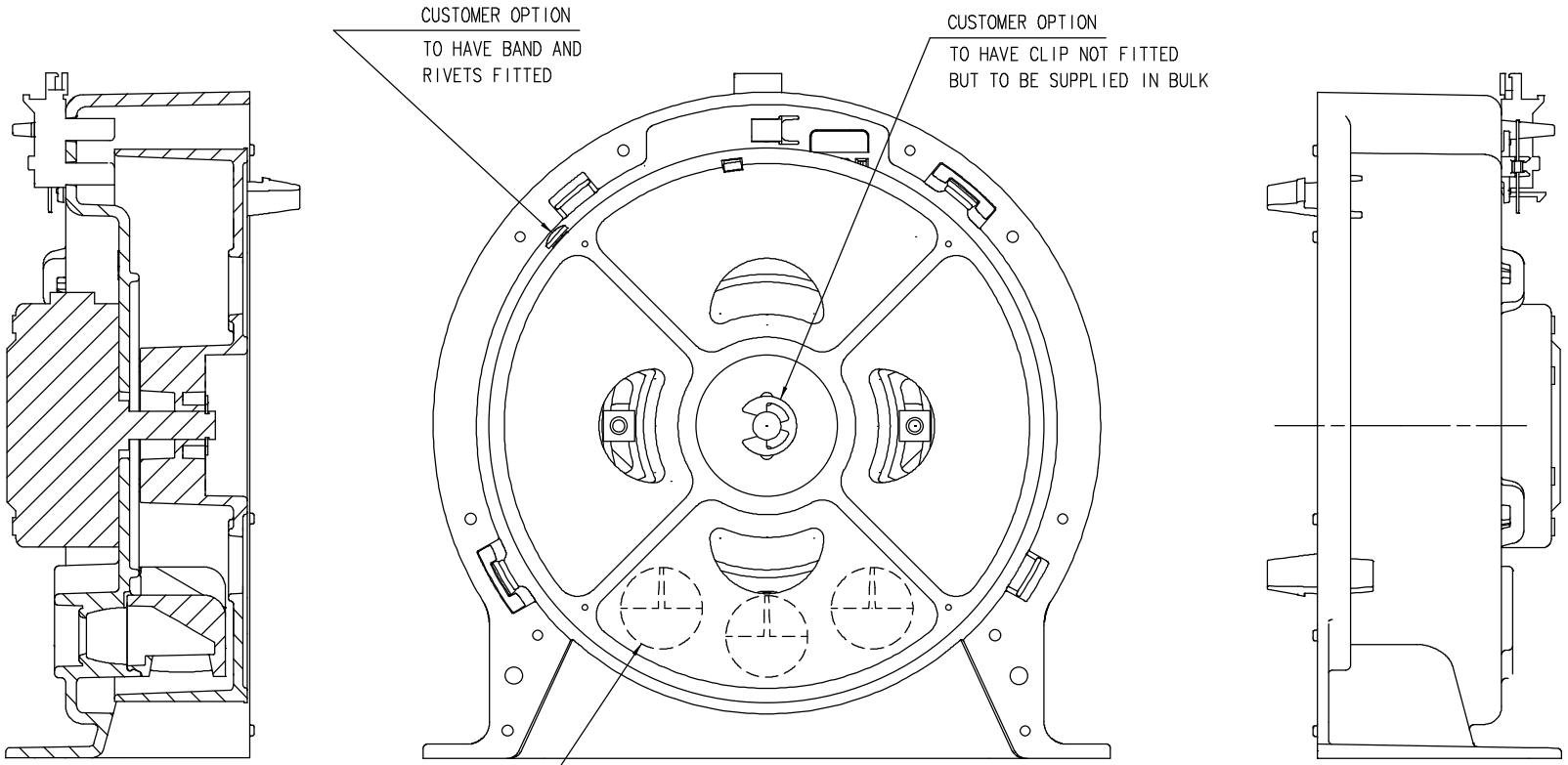


NOTES:

1). FOR BAND INFORMATION SEE DRAWINGS G6D025 AND G6D026.

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. SEE XKO PARTS LIST	DRAWN JLS			
	FINISH. KEEP CLEAN	CHECKED JLS	20/08/03 DATE	DRAWING RELEASED MODIFICATION	01 ISSUE
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. DFM	TITLE. DOUBLE FEATURE MECH. GENERIAL ASSEMBLY			
	SCALE NTS	DRAWING No.	ISSUE.	SPECIFICATION	
	SHEET ONE	G4G031	01	ZZZZ	

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



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ANGULAR ± 0.5°

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USED ON. DFM

SCALE NTS

SHEET ONE

DRAWN			
JLS	20/08/03	DRAWING RELEASED	01
CHECKED JLS	DATE	MODIFICATION	ISSUE

TITLE.
DFM - DEMI UNIT
SUB-ASSEMBLY

DRAWING No.	ISSUE.	SPECIFICATION
G4G030	01	ZZZZ

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

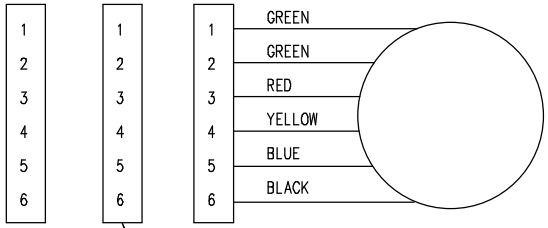
CONNECTOR - C3C016
6 WAY IDC CONNECTOR 0.1"
MOLEX 7720S SERIES
22-50-3065

OR

CONNECTOR - C3C017
MOLEX 6471 SERIES
22-01-2065 &

CRIMP TERMINAL - C4C022
MOLEX 4809 SERIES
08-50-0114

USER HALF



MOTOR PART No A1C004

LEOTRONICS 6 WAY SIL HEADER
PT No. 2556P06TL56
STARPOINT PT No. A8C041

CONNECTOR - MOLEX 3 WAY HOUSING
5264 SERIES 50-37-5033
(1 OFF)

AND

CRIMP TERMINAL - MOLEX
5263 SERIES 08-70-1039
(3 OFF)

OPTO DEVICE

STARPOINT PART No B2C001
TEMIC PART No TCYS-5201

COMMON WIRING FOR BOTH MOTORS AND BOTH OPTO DEVICES.

EXITATION SEQUENCE (FULL STEP)
CLOCKWISE FACING REEL END OF MOTOR

COLOUR	ø1	ø2	ø3	ø4
YELLOW	1	0	0	1
BLACK	1	1	0	0
RED	0	1	1	0
BLUE	0	0	1	1

MOTOR IS ALIGNED SO THAT THE OPTO DEVICE IS COVERED WHEN BLACK AND YELLOW PHASES ARE ENERGISED AND SYMBOL 1 IS IN THE CENTRE OF THE WINDOW.

UNLESS OTHERWISE STATED
GENERAL TOLERANCE:-
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CONCENTRICITY 0.10mm. MAX.
ANGULAR ± 0.5°

ALL DIMENSIONS IN mm, AND TO APPLY AFTER PLATING.

MATERIAL.

FINISH.

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USED ON. DFM

SCALE NTS

SHEET ONE

DRAWN SPP (JLS)	21/01/04	SEE ECN - G5D037-02	02
	03.07.03	DRAWN	01
CHECKED TJ (PG)	DATE	MODIFICATION	ISSUE

TITLE.
CIRCUIT DIAGRAM

DRAWING No.	ISSUE.	SPECIFICATION
G5D037	02	ZZZZ

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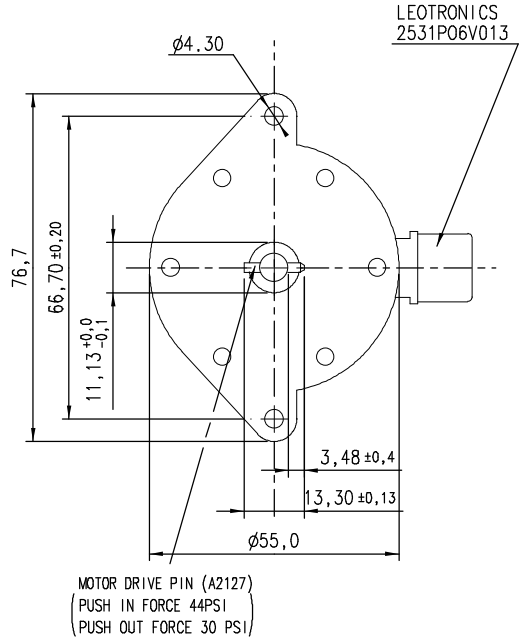
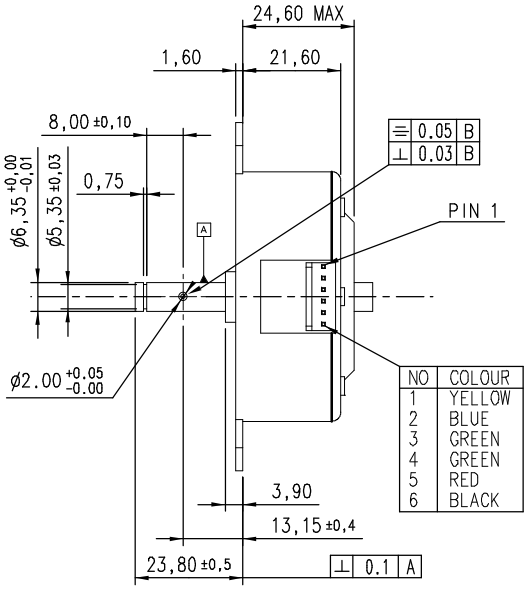
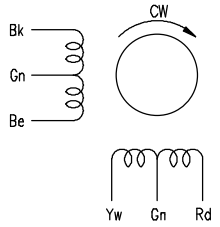




NO	COLOUR
1	YELLOW
2	BLUE
3	GREEN
4	GREEN
5	RED
6	BLACK

SPECIFICATION

DRIVE VOLTAGE	:	12v.
PHASE ON METHOD	:	2-2 (PHASE ON)
MAGNET MATERIAL	:	MS70M
STEP ANGLE	:	7.5°
POSITIONAL ERROR	:	0.5°
MAX. HOLDING TORQUE	:	16.2cNm(1652g-cm) MIN. 383mA/PHASE
PULL OUT TORQUE	:	8.40cNm (856g-cm) MIN. 80 PPS
PULL IN TORQUE	:	8.20cNm (836g-cm) MIN. 80 PPS
MAX. NO LOAD RESPONSE	:	270 pps MIN.
MAX. SLEW SPEED	:	290pps MIN.
WINDING RESISTANCE	:	30 ohms ±10%
WINDING INDUCTANCE	:	27mH REF. 1KHz, 1Vrms
INSULATION RESISTANCE	:	100 MOhms MIN. 500v.DC
DIELECTRIC STRENGTH	:	500vAC. 1MIN.
TEMPERATURE RISE	:	Δ T = --° MAX.
CLASS OF INSULATION	:	CLASS E
ROTAR INERTIA	:	33.2 g-cm² REF.
DETENT TORQUE	:	1.91cNm (195g-cm) 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 1 of 1

	DRAWN	DATE	MODIFICATION	ISSUE
	DJW	09/04/03	SEE EC 0000088	02
	CHECKED	07/04/03	REDRAWN ON IDEAS	01

TITLE.
24v STEP NMB MOTOR PM55L-048-SRA3
(OLD PART No. B998)

DRAWING No.	ISSUE.	SPECIFICATION
A1C004	02	ZZZZ