



STANDARD OPERATING PROCEDURE

Ref:	SOP-0204-02-N-DEV
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Description:	12 RM RMS Starpoint Technical Information
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12RM RMS Technical Information





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Contents

	Subject	Page No:
	Introduction	5
	Conditions of Use	
	Temperature Range	6
	Humidity	6
	Continuous use	6
	Operational Environment	6
	Operational Life	6
	Tools & Installation	6
	Handling	7
	Reel band Construction	7
	Warranty	7
	Mechanical Specifications	
	Construction	8
	Lamp Array Adjustment	8
	Adjustment & Calibration	8
	Reel Band Fixing Procedure	9
	Electrical Specifications	
	Connections	10
	Stepper Motor	10
	Position Control Sensor	10
	Stepper Motor Control	11
	Reel Band Illumination	11
	Motor Drive Software	12
	Motor Phase Setting	13
	Ordering Information	14 / 15
	Carriage & Distribution	16
	Appendix	
A	Specification Sheet	17
B	Ramp Tables	18
C	Reel Drum Variations	19
D	Symbol / Motor Step Position	20
E	Timing Diagram	21
	Drawings & Specification Sheets	
	General Assembly – G4G010-01-ZZZZ	22
	Circuit Diagram – G5D013-02-ZZZZ	23
	Band Details – G6D007-01-ZZZZ	24
	Motor 12v 200 Step – A1C016-01-ZZZZ	25
	Motor 24v 200 Step – A1C020-01-ZZZZ	26
	RMS Optic band drawing – F3C060-01-ZZZZ	27
	RMS Optic band drawing – F3C061-01-ZZZZ	28
	RMS Optic band drawing – F3C062-01-ZZZZ	29



INTRODUCTION

The high security “Reel Movement Sensing” (RMS) system has been developed as an enhancement to the standard 12RM reel mechanism.

The RMS feature utilises encoder strip technology to detect any movement of the reel by external forces, there by offering high levels of security. The reel is driven by a 12v or 24v 200 step NMB motor, with a choice of reel widths from 56mm, 66mm, 79.5mm or 90mm.

There are three detection band types available:

- 1) 12/24 symbol
- 2) 20/25 symbol
- 3) 16/18/22 symbol

A unique Starpoint “quick release foot” system is available for fixing the mechanism to the cabinet. This allows for easy removal of the unit without the aid of tools.

CONDITIONS OF USE

1. Temperature Range

The Mechanism will operate satisfactorily in the temperature range 0°C to 50°C provided there is an unrestricted airflow 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.

5. Operational Life

The units have been subjected to various accelerated life tests and a minimum operational life 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 G4G010-01-ZZZZ.



7. Handling

Whilst the 12RM RMS is of a robust plastic construction it is **not** recommended that the mechanism be handled by the periphery of the reel drum, always use the stand assembly when handling the reel mechanism.

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. Reel Band Construction

Details of reel band sizes and symbol pitches can be found in Drawing G6D007-01-ZZZZ. See MECHANICAL SPECIFICATION, Section 4 for information on how to fit the reel band to the reel drum. The symbols on the reel band must be printed on an equidistant pitch as indicated on the drawing G6D007-01-ZZZZ on page 24. There is a pre-determined symbol stop position in relation to the steps of the motor (see Appendix D).

9. Warranty

A guarantee of twelve months from the shipment date is available for the reel 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 the guarantee, should be returned direct to Starpoint or your local distributor.

MECHANICAL SPECIFICATION

1. Construction

Overall dimensions of the 12RM RMS are shown in Drawing G4G010-01-ZZZZ fixing feet positions are also shown in this drawing. The position of the win line can be set to the customer's requirement defined in the specification sheet, see section 2. This setting is in the range from 0° to 359° pre set by production during assembly of the mechanism, section 2 details how to adjust the win line when required. The unit will operate in any orientation but must be rigidly fixed to the cabinet with the viewing area in the correct position.

2. Lamp Array Adjustment

The lamp array is fully adjustable through 360° of movement. A graduated scale is used to position the lamp array in the required position relative to the frame. Each graduation represents an angular movement of 1°. The scale is marked from the 0 (at the bottom) to 180 (at the top) and the lamp array can be set to any position. The angle setting required can be specified by looking at the pointer on the lamp array / motor housing and noting the position. It is important that as well as stating the angular position; a positive or negative direction is stated when ordering the units. When a positive value is given the lamp array will be in the reverse position.

Releasing the centre screw at back of the frame and moving it to the desired position and then retightening the screw make adjustment to the lamp array. This adjustment will not affect the motor phase setting.

3. Adjustments & Calibration

The reel mechanism construction is such that the adjustments 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 reel drum. This pin must be aligned to the optic sensor and this adjustment is called the "phase setting adjustment". The lamp array may be moved to a position between + or - 0° to 359° to align with game win line. The encoder band is designed so that it can only be fitted to the reel drum in one orientation. The band is printed with a scale that provides detection of movement of the reel drum from external forces. Movement will be detected if the reel is moved more than 2 motor steps in either direction. A home position is printed on the band and is used to determine the win line and phase set position.

4. **Reel Band Fixing Procedures**

The design of the reel drum allows a choice for the method of fixing the reel band onto the drum. This can be achieved by the use of plastic rivets or double sided adhesive tape.

a. **Method for fixing reel band using rivets**

The reel band and artwork must be designed such that there is an overlap on the band as shown on Drawing G6D007-01-ZZZZ. The area of band, which is decided as being below the overlap, should be clear of print. Position the clear band with the two punched holes over the corresponding holes in the reel drum. Carefully bring the band round the drum so that the end of the band punch holes aligns with the drum. Insert plastic rivets. Suitable rivets can be obtained from a number of suppliers. One recommended supplier is Richo International, snap rivet part number SR 2632.

b. **Method for fixing reel band using adhesive tape**

- i) The reel band artwork must be designed such that there is a small overlap sufficient to bond the two ends of the reel band together using double-sided adhesive tape.
- ii) A clear area of band must be on the under lap area of the band.
- iii) Carefully align the clear areas on the band with the centre line of the reel spoke as shown on Drawings G6D007-01-ZZZZ. Bond the end of the tape to the reel drum using double-sided adhesive tape.
- iv) Carefully bring the reel band round the drum until the end of the band for overlap is in position. Bond into position using the double-sided adhesive tape.

ELECTRICAL SPECIFICATIONS

Electrical/electronic devices are situated on, or connected to, the 12RM RMS reel module PCB located on the frame as follows: -

1. **Connections**

Connections to the user interface and the motor and lamps are contained on the reel module PCB as illustrated on Circuit Diagram G5D013-02-ZZZZ.

The machine connections are via a 15-way 0.1-inch pin pitch plug connector type:-
 MOLEX KK 6471 Series 22-01-2155
 77205 Series 22-50-3155
 77205 Series 38-00-2105

Or

AMP	CST 100	1-770602-5
	MTA 100	1-640623-5
		1-640621-5

2. **Stepper Motor**

The motor connections are routed via a 6-way board connector through to the output connector as designated above. The motor is available as 200 step 12v. or 24vDC and the supplying company is NMB of Japan.

Motor details are contained on Drawings:

A1C016-01-ZZZZ 12v 200 steps
 A1C020-01-ZZZZ 24v 200 steps

The motor is positioned so that when powered up on specified phases, the win line identifier (encoder band home position) is centralised in the optic detector. This is normally a Starpoint manufacturing procedure but for information on how to carry out this adjustment see page 13. Phase sequence tables for motor control are on motor circuit diagrams, as are winding resistance's and current requirements.

3. **Position Control Sensor**

The position control sensor is a self-contained photo optic sub-assembly complete with built in Schmitt trigger and open collector output (Manufactured by Omron type EE – SX 3239) . A low level denotes the optic is detected.

4. Stepper Motor Control

The reel drum is driven by the 200-step motor, which positions the reel band. Recommended symbols per reel band can be 12, 16, 18, 20, 22, 24 or 25. Examples of Ramp Tables for various reel drum sizes are shown in Appendix B. If difficulty is experienced in achieving the required effect or speed of rotation, please call Starpoint on +44 (0) 20 8391 7700.

With the mechanism at rest and full power 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 be applied. **Failure to do this could invalidate the warranty.**

To limit heating effect and maintain high motor torque, it is advised that the power applied to the motor at standstill be pulsed or turned on & off. The switched power should be in the ratio of 50 : 50 mark space, based on the running time. 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 & before starting the next cycle spin. The delays are to ensure that this on / off sequence does not influence the start and stop ramming.

5. Reel Band Illumination

Lamps may be fitted to illuminate the reel band symbols with options to cover a different number of symbol conditions. The individual lamps can be fitted with or without diode. Diode connections allow matrixing possibilities and therefore saving on drive circuit power and wire harness size.

Different lamp looms can be specified to allow for common diode (sourcing) or common lamp (sinking) drive methods. Single row (3 lamp) or double row (6 lamp) arrays can be supplied to cover different widths of reel bands. There are also options for 6, 12 and 24-volt bulbs in a range of wattage ratings, Appendix A contains details of the options available. The lamp array connections are routed from the output connector via tracking to a 5-way plug.

6. Motor Drive Software

a) Reset Procedure

This procedure is recommended at power on or on occasion when the software identifies that the reel band is out of position.

- i) Drive the motor forward at 50RPM (6mS full step rate).
- ii) Every 1ms, monitor the optic output. Immediately the widest tab is detected, cease driving the motor.
- iii) Step the motor in reverse so that the widest tab is central about the opto device, and blue & yellow winding are energised.
- iv) Now enter standstill mode or resume the game in play, as appropriate.

b) Optic Tab Monitoring During Standstill (Reel Movement Detection)

The encoder strip feature enables reel movement detection in standstill mode. The encoder strip is designed so that the device is uncovered on all symbol positions. The reel band sizes & symbol positions can be found on drawing G6D007-01-ZZZZ

Appendix D shows the motor step positions for each symbol on the reel band. Sufficient holding torque must be provided in standstill mode so that, detent torque position can be overcome, so preventing inadvertent movement between full power & reduced power mode at standstill. The duty ratio at standstill should therefore be greater than 40%, this also has a heat limiting effect on the motor and maintains motor torque levels.

Reel movement can be detected via the opto device, if the reel is moved by an external force greater, than a distance of 3.6° degrees (two motor steps). The opto device output will change from a high to a low logic level if movement is detected

7. **Motor Phase Setting**

This adjustment may be required when due to exceptional circumstances the motor requires replacement.

Tools required: - Crosshead Screwdriver
12vdc 1.5A Power Supply

Method: -

- a. Loosen motor fixing screws in the motor housing moulding, 4 off screws shown on drawing G4G010-01-ZZZZ.
- b. Rotate reel so that the widest tab is central in the optic device.
- c. Apply 0V to the Yellow and Blue phases of the motor via pins 11 and 14 on the 15-way edge connector. Apply +12vDC to the motor common via pin 15 on the 15-way edge connector.
- d. Tighten motor fixing screws
- e. Disconnect supply from the mechanism.

The reel mechanism is now phase set and ready for use.

NB This phase setting method is part of Starpoint Manufacturing procedure.

ORDERING INFORMATION

This section deals with how to complete a Specification Sheet Appendix A. The document contains configuration information, which Starpoint uses for manufacture of the 12RM RMS.

The Specification Sheet contains a series of options across 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 correct box. The total combination of completion of all the empty boxes creates a unique build standard coding

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 spec sheet 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

Enter any comments if required

MECHANISM TYPE

This is pre-defined. AQ refers to 12RM RMS.

MOTOR TYPE

The motor options available should be selected according to the application. Having decided on the motor type required, enter the letter corresponding to your selection in the right hand box. Note: The set up phase setting is standard with Blue and Yellow windings energised.

ORDERING INFORMATION - continued

PCB TYPE

This is a pre-defined option.

REEL WIDTH

The reel drum width is defined in this section; care must be taken to select the correct number of bars on the drum so that the bar does not affect the symbol illumination. A 5 bar is used on reel bands with 20 or 25 symbols and 8 bars on bands for 12, 16 and 24 symbols. A 5 bar can also be used for 18 & 22 symbols although bars will cross symbols & therefore is recommended always in clear material. See Appendix C, all reels are clear material allowing all symbols on reels.

LAMP ARRAY

This is broken down into 5 sections

i) Number of Symbols – Optic Band

The number of symbols on the band must be defined to determine the type of optic band fitted, calibrated to the relevant number of symbols.

ii) Number of Symbols – Lamp Array Cover

The number of symbols on the band must be defined to enable the correct selection of the lamp array cover, which controls the illumination to suit the symbols on the band. The number of lamps supplied can be 0, 3 or 6.

iii) 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 reels have not moved, damage may occur to the reel band due to the heat.

iv) Wiring Type

This option is shown on the Specification Sheet in the connection diagram and provides the option of which polarity the lamps are commoned together. The top lamp position can be +, - or none.

v) Lamp Array Pointer Position

This setting is for the win line position on the gaming machine.



CARRAIGE & DISTRIBUTION

All Starpoint reel mechanisms are shipped in returnable cardboard packaging. Individual reel mechanisms are located in cutouts in layer cards to prevent movement in transit. There are 6 reel mechanisms per layer with the total number of mechanisms varying dependant on reel width.

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

Appendix B

**12RM RMS REEL MECHANISM
EXAMPLES OF RAMPS FOR NMB 200 STEP MOTOR**

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

FULL STEP

100 RPM	UP	14 - 10 - 9 - 3 - 6 - 6 - 6 - 6
	RUN	3
	DOWN	6 - 3 - 3 - 6 - 3 - 6 - 6 - 12 - 15

HALF STEP

100 RPM	UP	1.5 - 7.5 - 1.5 - 7.5 - 1.5 - 7.5 - 1.5 - 1.5 - 1.5 - 4.5 - 1.5 - 4.5 - 1.5 - 4.5
	RUN	1.5
	DOWN	4.5 - 1.5 - 1.5 - 1.5 - 1.5 - 1.5 - 4.5 - 1.5 - 1.5 - 1.5 - 4.5 - 1.5 - 4.5 - 1.5 - 7.5 - 1.5 - 13.5 - 1.5
60 RPM	UP	2.5 - 7.5 - 2.5 - 12.5 - 2.5 - 7.5 - 2.5 - 2.5 - 2.5 - 7.5 - - 2.5 - 2.5 - 2.5 - 7.5
	RUN	2.5
	DOWN	7.5 - 2.5 - 2.5 - 2.5 - 2.5 - 2.5 - 7.5 - 2.5 - 2.5 - 2.5 - 7.5 - 2.5 - 7.5 - 2.5 - 7.5 - 2.5 - 20 - 2.5

NOTE: -

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 C

12RM RMS REEL MECHANISM

DRUM VARIATIONS

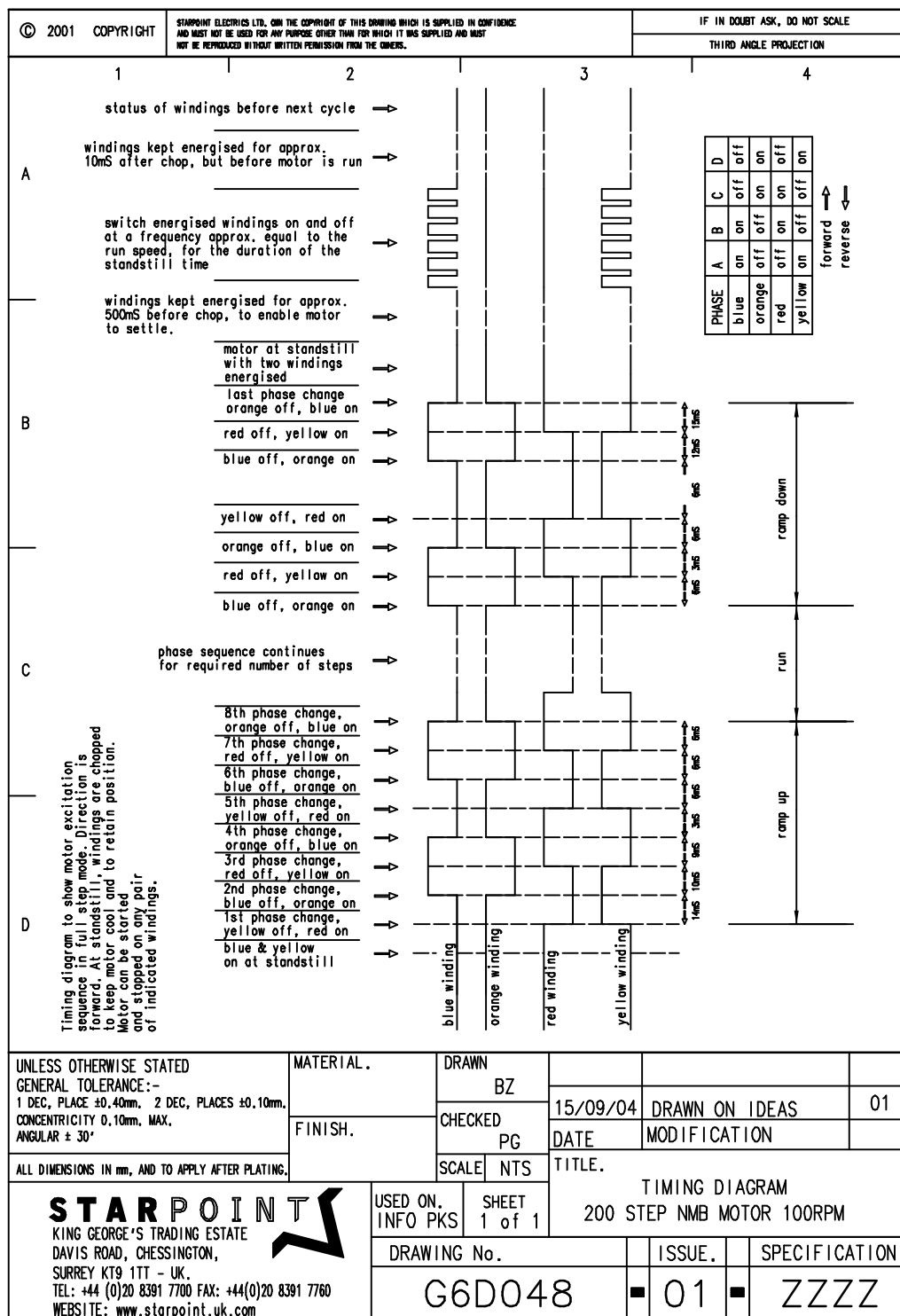
Reel Drum Width	Number of Support Bars	Reel Drum Diameter in mm	Number of Symbols on Band	Number of Lamps per Symbol	Matrix Diode Available
56mm	5	229.5	20,22,25	1	Yes
66mm	8	229.5	16,22, 24	1	Yes
79.5mm	5	229.5	20,22,25	1	Yes
79.5mm	8	229.5	16, 24	1	Yes
90mm	5	229.5	20,22,25	2	Yes
90mm	8	229.5	16, 24	2	Yes

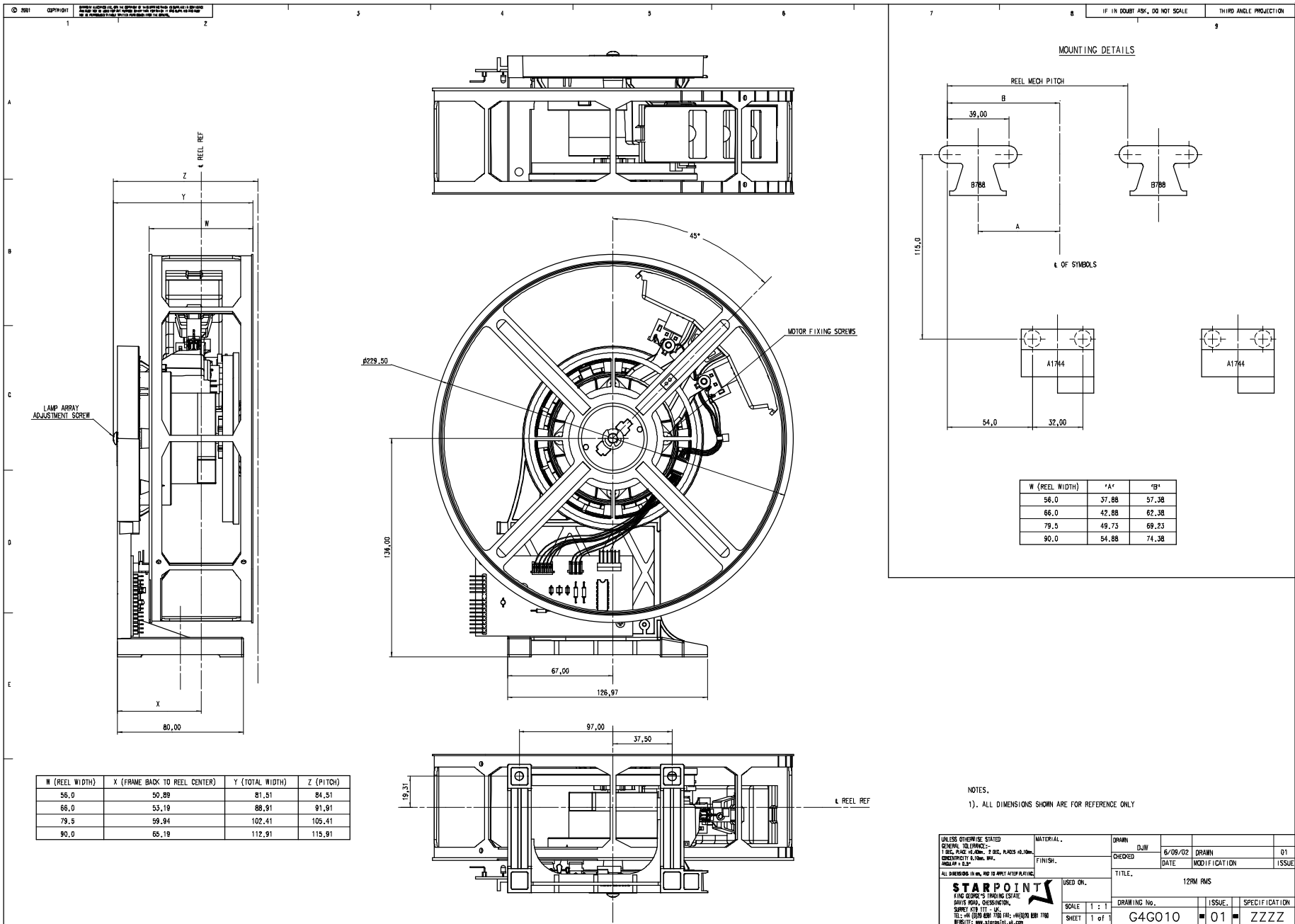
Appendix D

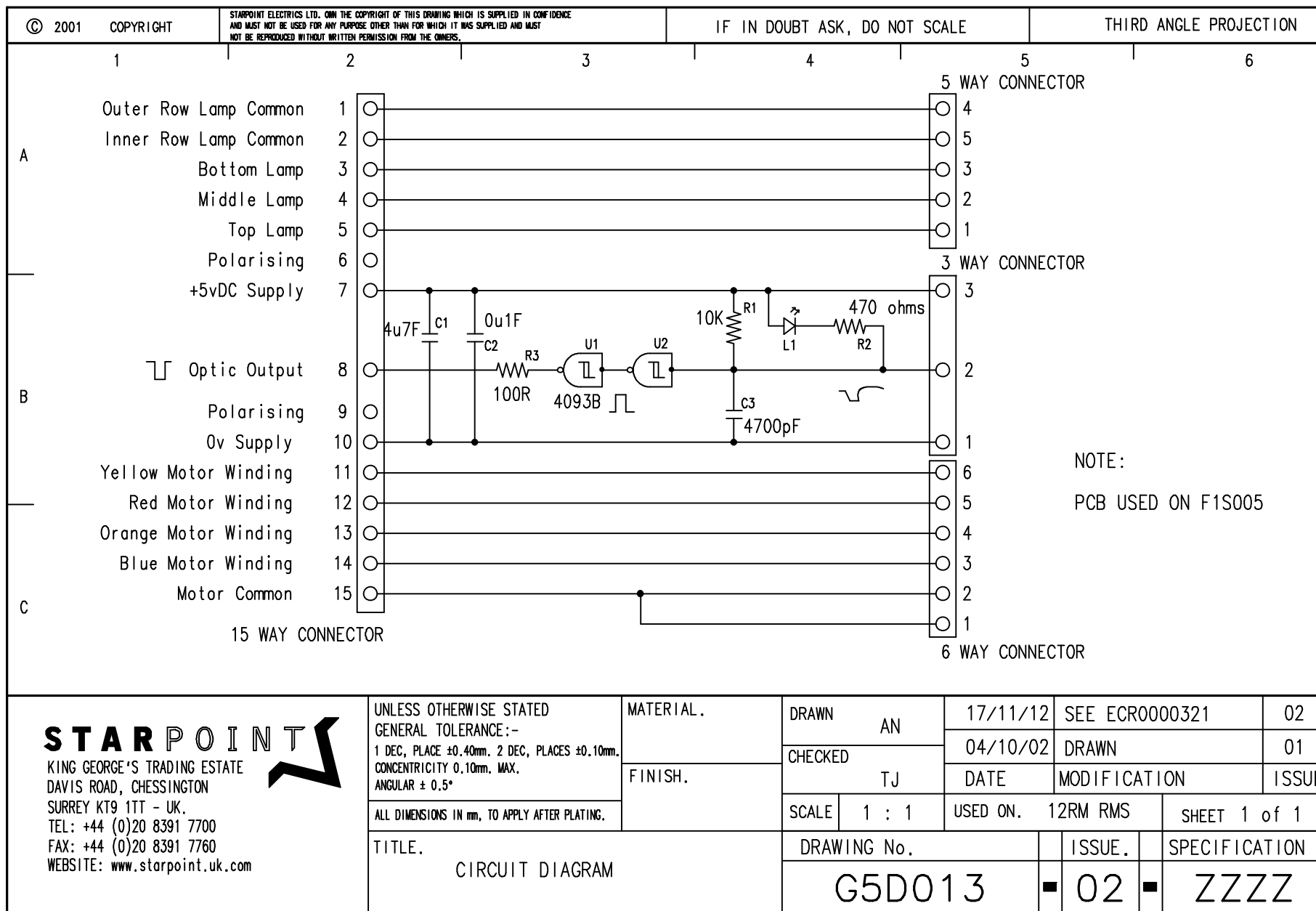
SYMBOL / MOTOR STEP POSITIONS

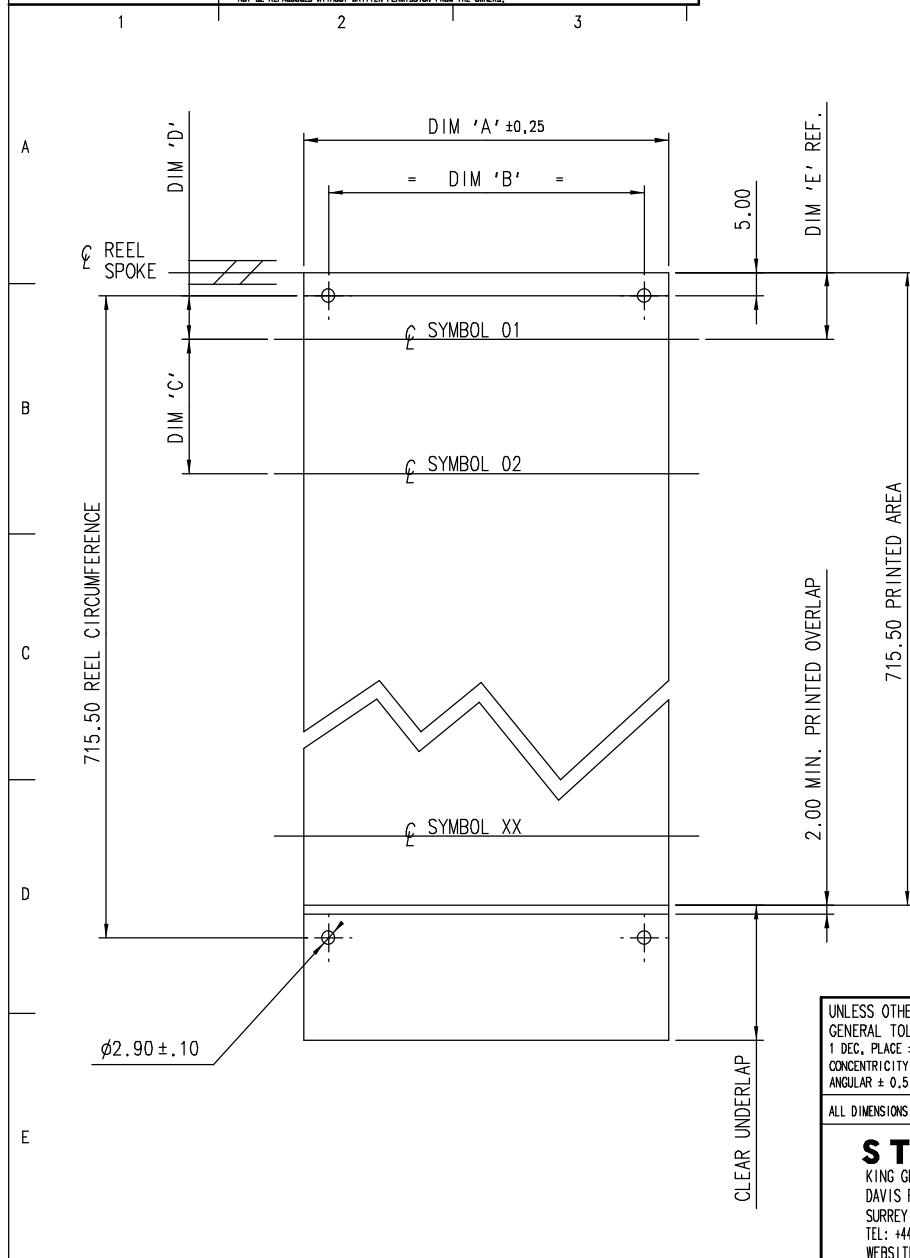
Symbol / Motor Step Positions from Reset Position							
Symbol	12	16	18	20	22	24	25
1	8	6	6	5	5	4	4
2	25	19	17	15	14	12	12
3	42	31	28	25	23	21	20
4	58	44	39	35	32	29	28
5	75	56	50	45	41	37	36
6	92	69	61	55	50	45	44
7	108	81	72	65	59	54	52
8	125	94	83	75	68	62	60
9	142	106	94	85	77	71	68
10	158	119	106	95	86	79	76
11	175	131	117	105	95	87	84
12	192	144	128	115	105	96	92
13		156	139	125	114	104	100
14		169	150	135	123	112	108
15		181	161	145	132	131	116
16		194	172	155	141	129	124
17			183	165	150	137	132
18			194	175	159	146	140
19				185	168	154	148
20				195	177	162	156
21					187	171	164
22					196	179	172
23						187	180
24						196	188
25							196

Appendix E









REEL	DIM 'A'	DIM 'B'
90.0	86.75	78.00
79.5	76.25	67.50
66.0	62.75	54.00
56.0	51.75	-

SYMBOLS	DIM 'C'	DIM 'D'	DIM 'E' REF.
25	28.62	9.31	14.31
24	29.81	9.91	14.91
22	32.52	11.26	16.26
20	35.78	12.89	17.89
16	44.72	17.36	22.36
12	59.63	24.81	29.81

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

MATERIAL.
0.25 THICK PVC
INC. INK

FINISH.

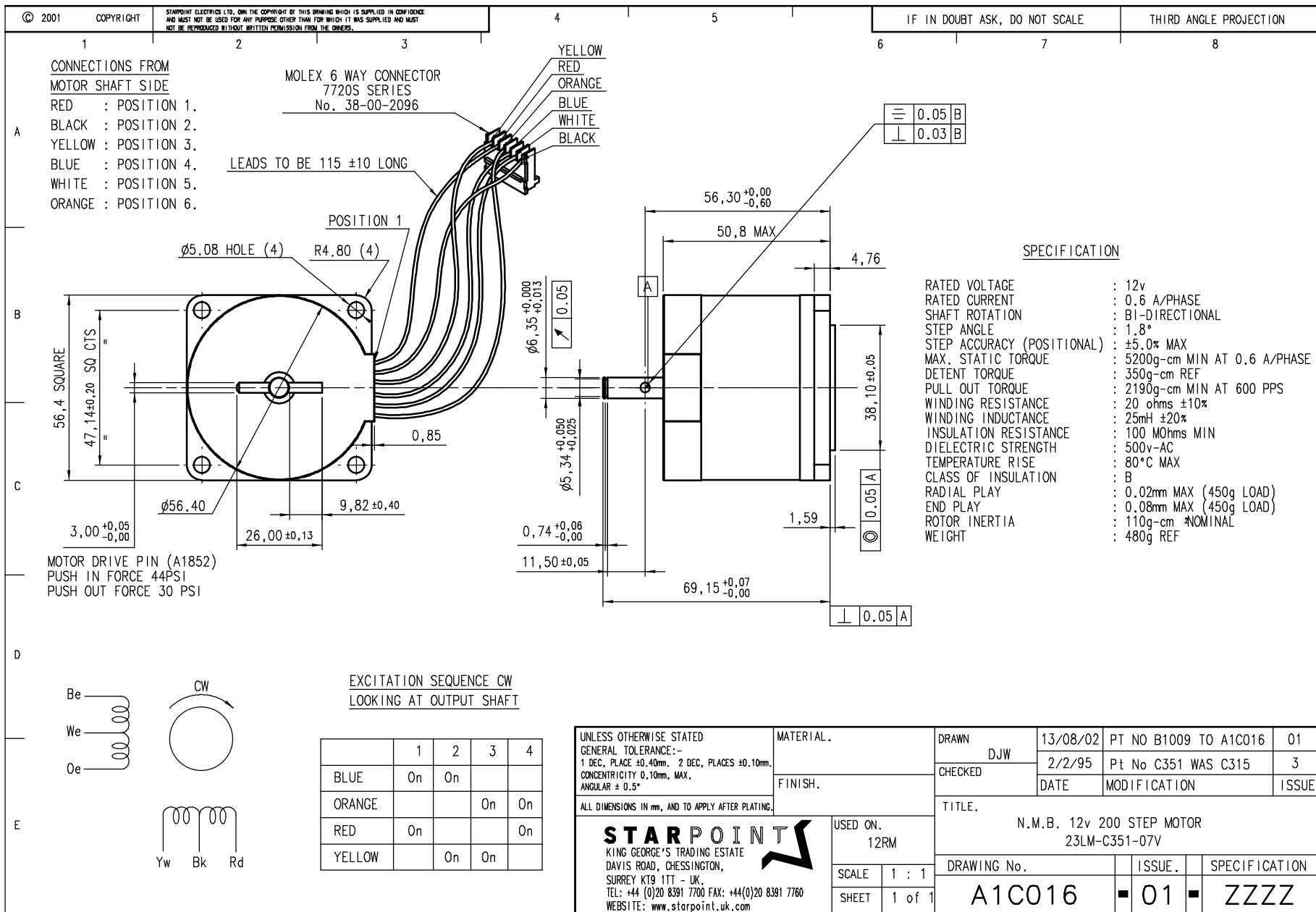
ALL DIMENSIONS IN mm, AND TO APPLY AFTER PLATING.

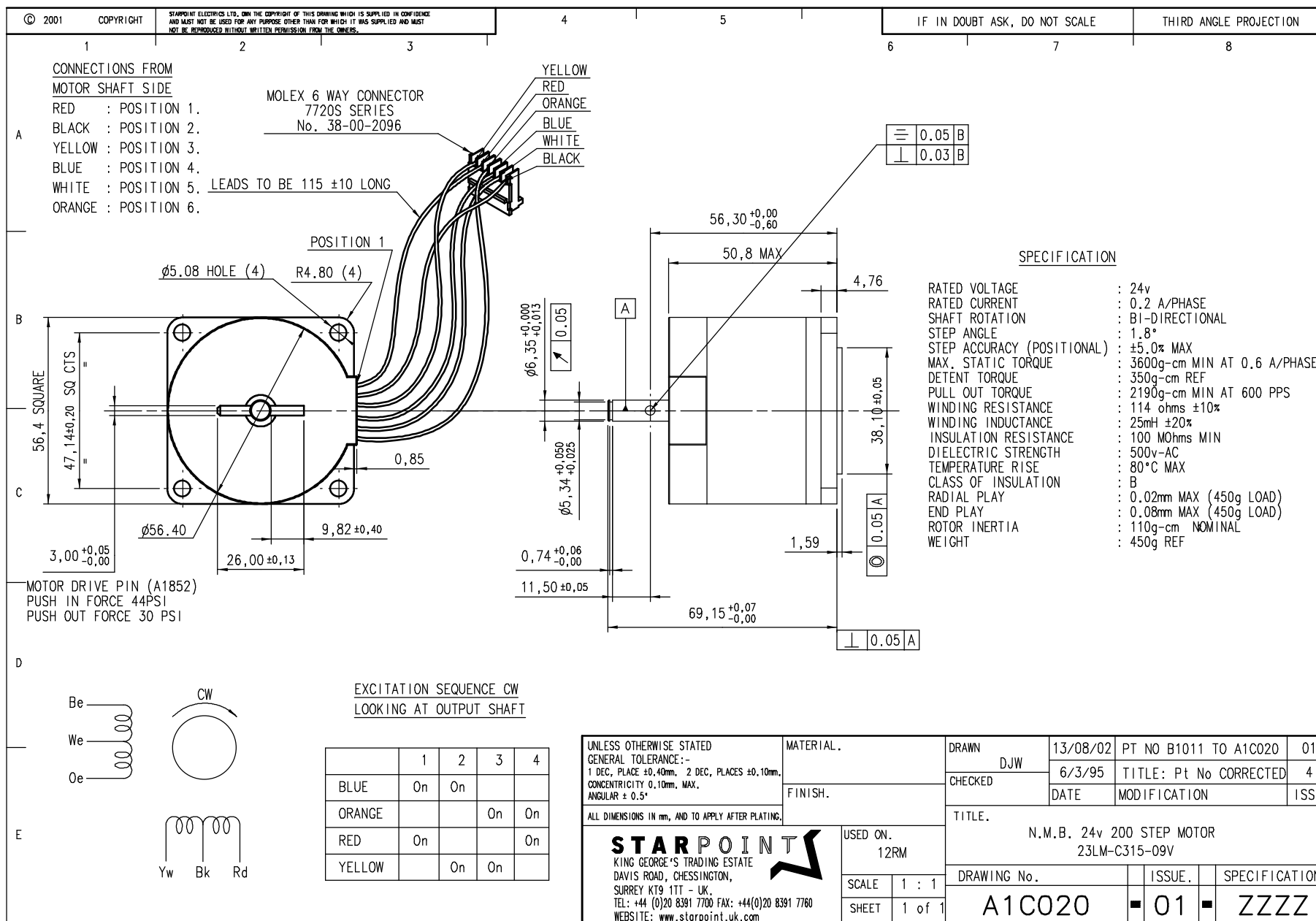
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USED ON.
12/17/20/21RM

SCALE
SHEET of

DRAWN	AN			
CHECKED	TJ	01/06/01	DRAWING RELEASED	01
		DATE	MODIFICATION	ISSUE
TITLE. REEL BAND DETAILS				
DRAWING No.		ISSUE.	SPECIFICATION	
G6D007		01	ZZZZ	





EXCITATION SEQUENCE CW
 LOOKING AT OUTPUT SHAFT

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

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

ALL DIMENSIONS IN mm. AND TO APPLY AFTER PLATING.

STARPOINT
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 WEBSITE: www.starpoint.uk.com

MATERIAL.

FINISH.

USED ON.
 12RM

SCALE 1 : 1

SHEET 1 of 1

DRAWN DJW

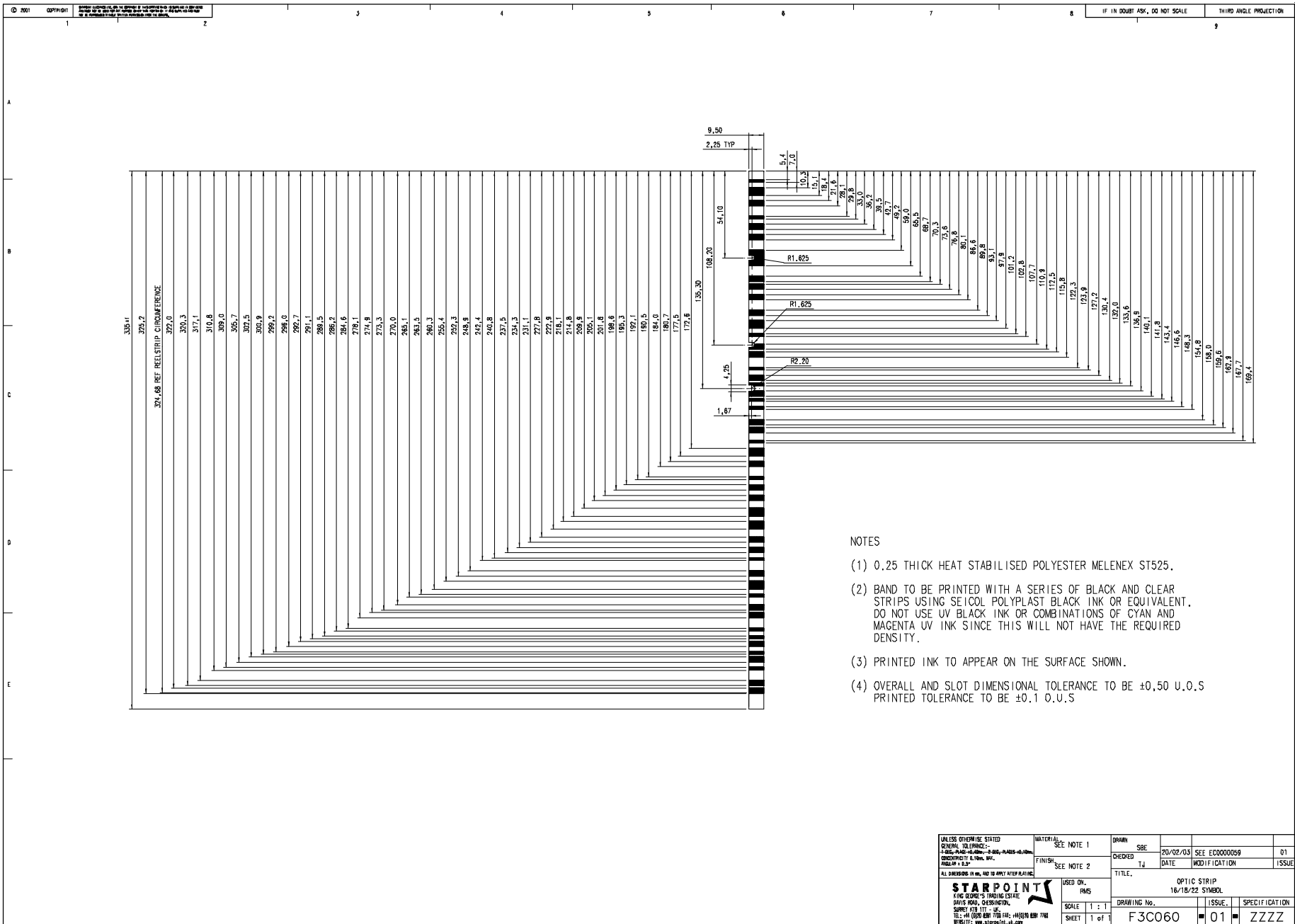
CHECKED

TITLE.
 N.M.B. 24v 200 STEP MOTOR
 23LM-C315-09V

DRAWING No. A1C020

ISSUE. 01

SPECIFICATION ZZZZ



UNLESS OTHERWISE STATED GENERAL TOLERANCES: FRACTIONS - HOLE - DRILLING - 3 SIG. FIGS. - 4 SIG. FIGS. DECIMALS - 3 SIG. FIGS. ANGLES - 3 SIG. FIGS. ALL DIMENSIONS IN IN., AND TO APPLY AFTER FINISHING	MATERIAL SEE NOTE 1	DRAWN SRE	20/02/03	SEE EC0000059	01
	FINISH SEE NOTE 2	CHECKED T.J.	DATE 20/02/03	MODIFICATION SEE EC0000059	ISSUE 01
TITLE OPTIC STRIP 16/18/22 SYMBOL					
USED ON PMS					
SCALE 1 : 1					
SHEET 1 of 1					
DRAWING No. F3C060					
ISSUE 01					
SPECIFICATION ZZZZ					

