

F38 Series – Rugged Trackball Module, USB or PS/2, 3 Switches



Figure 1: CCL F-Series Trackball module

1 DESCRIPTION

The F38 Series trackball module is a high specification human interface device designed to operate in extremely demanding environments where reliability and robustness are essential.

The module is supplied with three integrated switches which provide the conventional left, middle and right button functionality found in commercial trackballs/mice. Alternatively, the number and position of the switches can be selected as part of a custom solution.

The unique aluminum construction provides excellent impact strength, electrical shielding, and environmental protection, making the trackball an all-round robust solution for the most demanding of military, marine and aerospace applications.

High-grade stainless steel shafts and bearings ensure a solid and precise pointer control.

The trackball module also includes the patent protected anti-vibration technology which ensures that only intended ball movements are transmitted to the host system (i.e. when the user's hand is in contact with the surface of the ball). This feature eliminates any unwanted cursor motion resulting from ball movement caused by external shocks or vibrations.

The F38 Series trackball module can also be configured with various top plate styles providing options on ball tracking force and illumination for use in low light environments.

The trackball module has been designed to be front of panel mounted as part of a rugged keyboard/console.

2 FEATURES

- Electrical Output: USB or PS/2
- Three integrated switches providing left, middle and right button functionality
- Smooth operation in rugged environments
- Excellent environmental protection
 - IPX5 sealing rating
 - Sand and dust protection
 - High level of corrosion resistance
 - High impact strength
- Patented anti-vibration technology for use in environments where vibration/shock is commonplace
- Various top plate configurations are available;
 - Removable ring/ball to allow for ease of servicing, available in the following styles
 - Quick release bayonet locking ring
 - Threaded locking ring
 - Non removable ring/ball
- For use in military, marine, and aerospace keyboards and consoles
- Manufactured to ISO 9001 quality system
- Please see product selector document DS38057 for further configuration options including;
 - Additional top plate configurations
 - "HALO" LED illumination around the top ring/ball for use in low level light environments

3 SPECIFICATIONS

3.1 MECHANICAL		
3.1.1	Weight	825 grams (+/- 10%)
3.1.2	Ball size	Ø38.1mm (1.5")
3.1.3	Ball material	Epoxy resin
3.1.4	Ball tracking force	30-80 grams
3.1.5	Ball load	200N for 2 minutes
3.1.6	Resolvable ball speed	30 inches per second
3.1.7	Top plate material/finish	Brushed Aluminium/ Black anodised
3.1.8	EMC can material/finish	Aluminium/Surtec 650
3.1.9	Ball retention style/colour	Option 3 = Removable polycarbonate bayonet locking ring, black Option 4 = Removable polycarbonate threaded locking ring, black Option 5 = Non-removable polycarbonate ring, black Option 6 = Removable aluminium threaded locking ring, black Please see section 8 for ordering code
3.1.10	Ball sealing material	PTFE composite
3.1.11	Operating position	Horizontal to 60°
3.1.12	Tracking engine	Dual channel photo-interrupters
3.1.13	Switch actuation force	100 – 120 grams
3.1.14	Switch travel	3mm +/- 0.5mm
3.1.15	Switch lifetime	1,000,000 cycles
3.1.16	Mechanical lifetime	1 million ball revolutions
3.1.17	MTBF	Ground benign 25°C = 348,000 hours

3.2 ELECTRICAL		
3.2.1	Protocol/output	USB or PS/2 (see section 8 for ordering code)
3.2.2	Supply voltage	4.4 to 5.25V D.C.
3.2.3	Supply current	15mA typical, 20mA Maximum
3.2.4	Resolution	965 counts per ball revolution – linear tracking mode
3.2.5	Output connector	Amphenol 62GB-12E10-07PN or equivalent (7 way circular connector)
3.2.6	Mating output connector	Compatible 7 way socket e.g. Amphenol part 62GB-56T10-07 SN
3.2.7	Integrated switches	3 switches: Left, Middle, and Right (other options available)
3.2.8	PCB protection	Silicone conformal coating

3.3 ENVIRONMENTAL		
3.3.1	Operating LOW temperature	RTCA DO 160F, Section 4.5.2, 2 hours @ -45°C (Category B2)
3.3.2	Operating High temperature	RTCA DO 160F, Section 4.5.4, 2 hours @ +70°C (Category B2)
3.3.3	Ground Survival LOW temperature	RTCA DO 160F, Section 4.5.1, 3 hours @ -55°C (Category B2)
3.3.4	Ground Survival HIGH temperature	RTCA DO 160F, Section 4.5.3, 3 hours @ +85°C (Category B2)
3.3.5	Altitude	RTCA DO 160F, Section 4.6.1, 2 hours @ 25,000ft (37.6KPa) (Category B2)
3.3.6	Rapid Decompression	MIL-STD-810F, Method 500.4, Procedure III, 40000ft, 15secs, dwell = 10mins.
3.3.7	LOW temperature power on	RTCA DO 160F, Section 5, -45°C (Category B)
3.3.8	Temperature variation	RTCA DO 160F, Section 5, -45°C to +70°C @ 5°C/min, 2 cycles (Category B)
3.3.9	Humidity	RTCA DO 160F, Section 6, 95% @ 65°C, non-condensing (Category B - Severe)
3.3.10	Ingress Protection Rating	IPX5 (IEC 60529)
3.3.11	Dust	MIL-STD-810F, Method 510.4, Procedure I
3.3.12	Sand	MIL-STD-810F, Method 510.4, Procedure II
3.3.13	Salt Fog	MIL-STD-810F, Method 509.4
3.3.14	Vibration (Minimum Integrity Test)	MIL-STD-810G, Method 514.5, Procedure I, Category 24, All 3 axis, duration = 1 hour per axis, 7.7g RMS, 20 to 2000Hz
3.3.15	Functional Shock	MIL-STD-810G, Method 516.5, Procedure I, 40g, 15-23ms duration, 3 shocks in +/-directions, operating,
3.3.16	Crash Hazard	MIL-STD-810G, Method 516.5, Procedure V, 75g, 15-23ms duration, 2 shocks in +/-directions ,

3.4 ELECTROMAGNETIC COMPATIBILITY		
3.4.1	EMC	MIL-STD-461E tests as detailed: CE101, 30Hz to 10kHz, Navy and Army Aircraft (fig CE101-4) CE102, 100kHz to 10MHz (fig CE102-1) RE101, 30Hz to 100kHz, Navy applications (fig RE101-2) RE102, 10kHz to 18GHz, Helicopter applications (fig RE102-3) RS101, 30Hz to 100kHz, Navy application (fig RS101-1) RS103, 2MHz to 18GHz, 60V/m CS101, 30Hz to 150kHz (fig CS101-1) CS114, 10kHz to 200MHz, Curve 5 CS115, All applications (fig CS115-1) CS116, 10kHz to 100MHz, Air force Applications - I _{max} = 5amps (fig CS116-2)
3.4.2	ESD	EN 61000-4-2 Level 4 (8kV contact , 15kV air)
3.4.3	EFT	EN 61000-4-4 Level 4 (4kV)

3.5 OPERATING SYSTEM COMPATIBILITY		
3.5.1	USB	Windows, Linux, Mac OS, and Android Fully compliant with USB 2.0 framework (chapter 9) & HID specifications
	PS/2	Windows, Linux

4 CONNECTION DETAILS

Connection is made to the F38 trackball by means of a single circular connector. Tables 1 and 2 highlight the connection details.

4.1 Output Connector

Description	7-way circular connector with bayonet latching features
Manufacturer	Amphenol (or equivalent)
Manufacturer Part Number:	62GB-12E10-07PN (or equivalent)
Mating Connector:	Compatible 7 way socket e.g. 62GB-56T10-07SN, 62GB-16F10-07SN or equivalent (7 way circular socket)

Table 1: Output Connector Details

PIN	USB OUTPUT	PS/2 OUTPUT
A	D-	PS/2 Data
B	D+	PS/2 Clock
C	-	-
D	-	-
E	-	-
F	GND (0V)	GND (0V)
G	5V D.C	5V D.C.
SHELL	EARTH	EARTH

Table 2: Output Connector Pinout

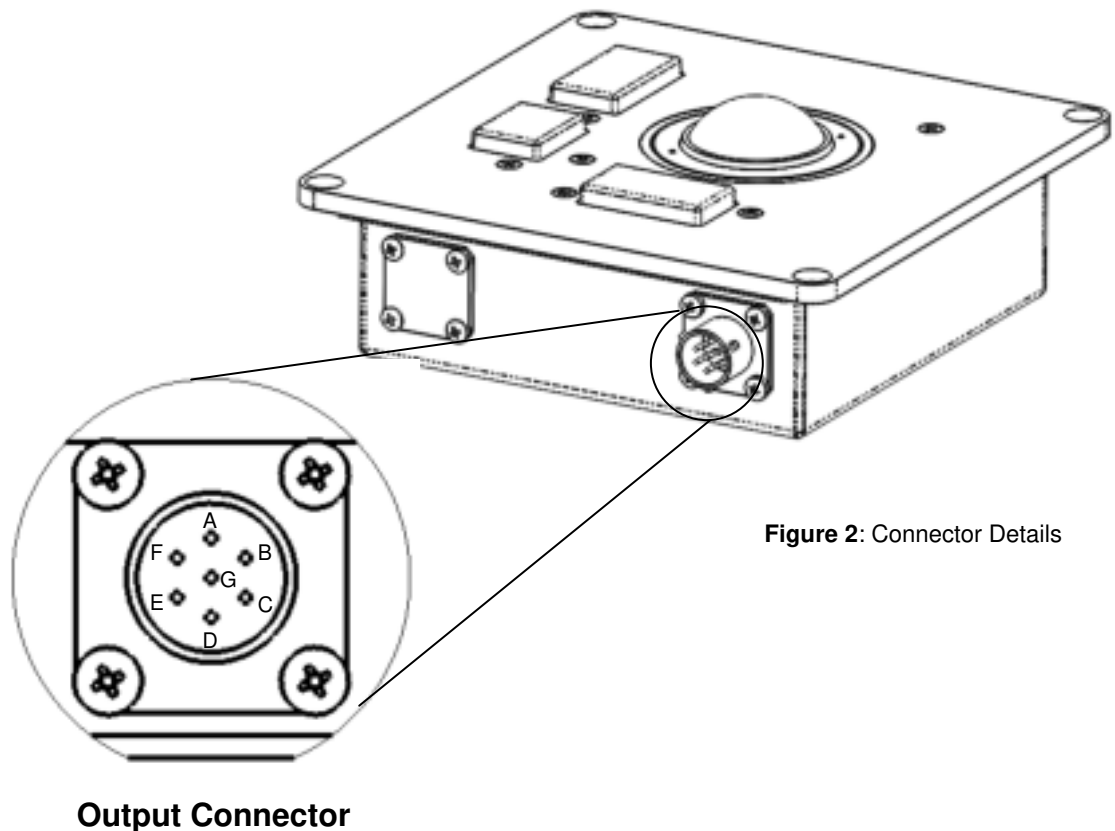


Figure 2: Connector Details

5 TRACKBALL CONFIGURATION

5.1 Switch Arrangement

Figure 3 below highlights the switch arrangement for the F38 trackball module.

Left Switch: The functionality corresponds to the left button on a standard mouse.

Middle Switch: The functionality corresponds to the middle button on a standard mouse.

Right Switch: The functionality corresponds to the right button on a standard mouse.

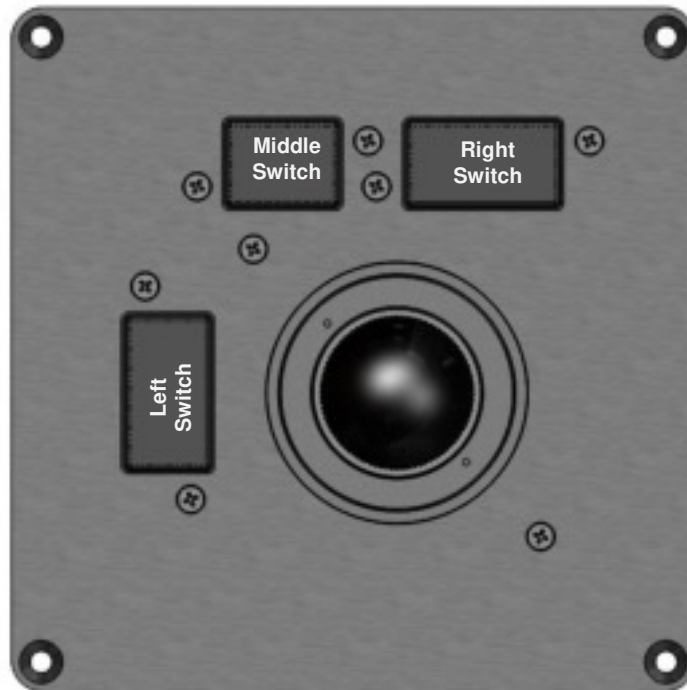


Figure 3: Switch Arrangement

5.2 Orientation

The F38 trackball module is configured to operate with the connector orientated on the left hand side (when viewed from the top of the module). Please note that alternative orientations are available upon request. Please contact your local sales office for more information.

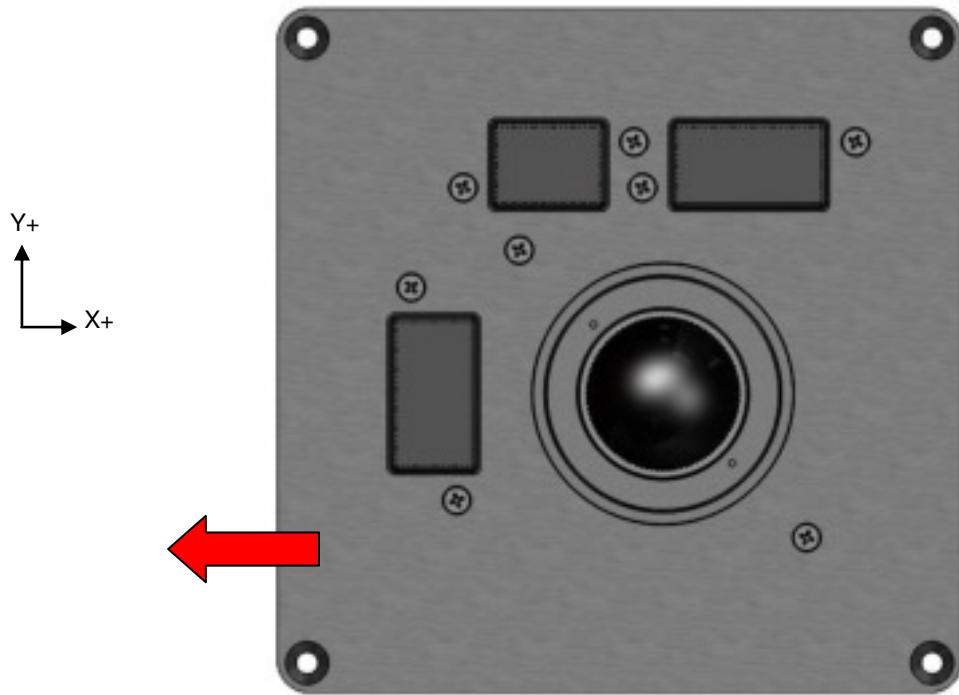


Figure 4: Mounting Orientation

5.3 Tracking Mode

Ballistic Tracking Feature

The F38 trackball module utilizes an intuitive ballistic tracking algorithm that provides increased cursor resolution with fast ball movements whilst retaining the native resolution (965 counts per revolution) at slow tracking speeds. This feature enables more efficient tracking on systems with large screens or monitors and at the same time ensures tracking accuracy is maintained at slow speeds. The algorithm applies a gain which is directly related to the velocity of the ball and results in larger displacements of the cursor at faster ball speeds.

5.4 Anti-Vibration Technology

The F38 Series trackball incorporates the latest patented anti-vibration technology. The anti-vibration technology ensures that only intended ball movements are transmitted to the host system (i.e. when the user's hand is in contact with the surface of the ball). This feature eliminates any unwanted cursor motion resulting from ball movement caused by external shocks or vibrations. For additional information regarding this technology please refer to application note AN0037.

5.4.1 Anti-Vibration Initialisation

At the start of each power cycle the anti-vibration feature will default to an inactive state until it detects the very first contact made by a finger/hand. This initial inactive state allows the feature to calibrate to the operating environment and distinguish when hand contact is made. Please note that prior to this initial finger/hand detection it is possible that any shock/vibration may cause unintended cursor movement on screen.

The anti-vibration feature has been designed to recognise a touch at a height of approximately 1 mm from the ball surface to ensure that the ball can still be operated with a gloved hand (e.g. NBC and military flight gloves).

5.4.2 Activation Levels

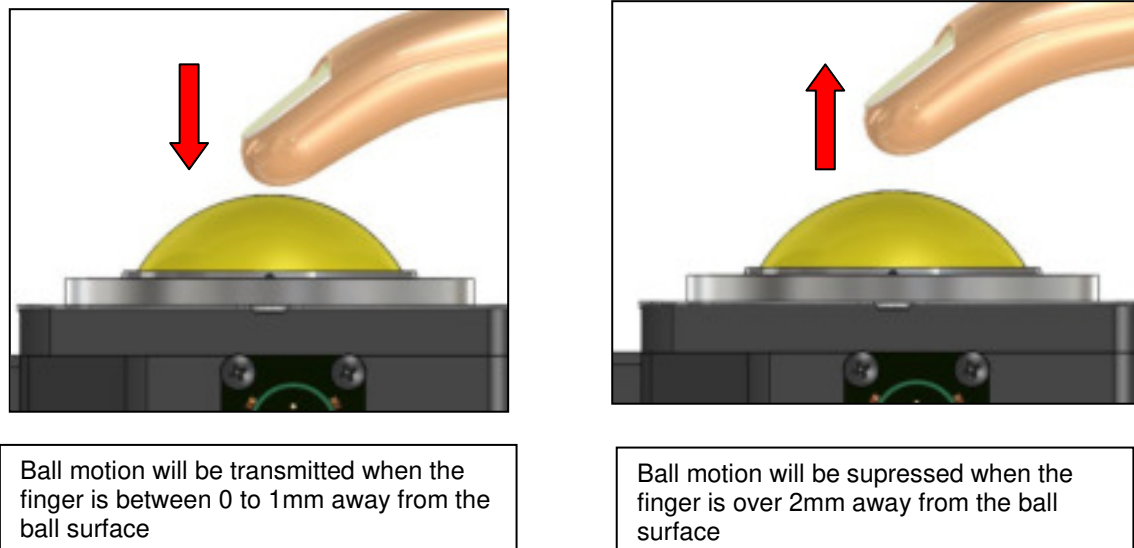
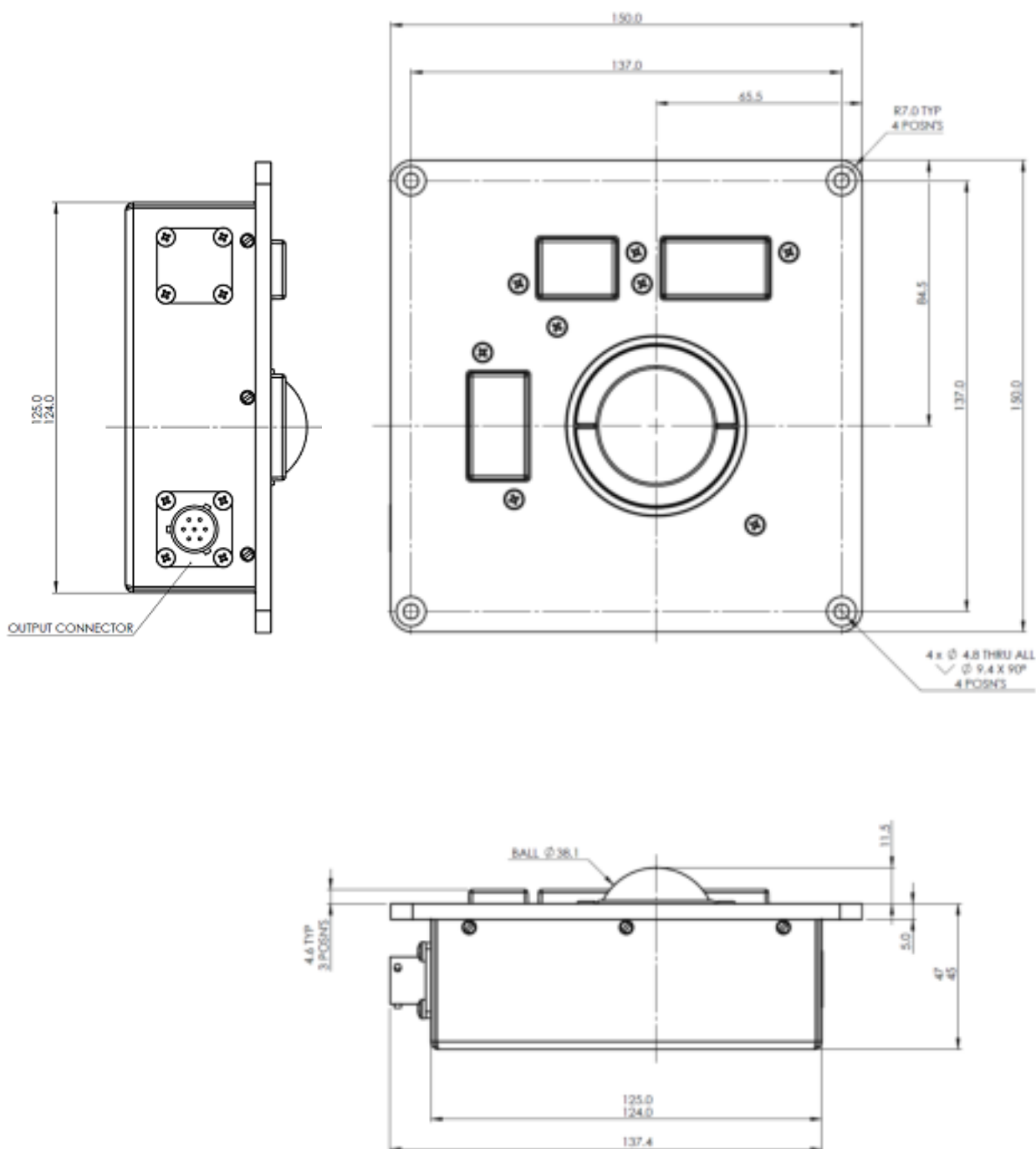


Figure 5: Anti-vibration Operation

6 OUTLINE DRAWING



Dimensional drawing specifies factory default orientation.

All dimensions are in mm unless otherwise stated.

Tolerances +/- 0.2mm unless otherwise stated

Please note that an IGES model is available on request. Please contact your local sales office for more information.

7 RECOMMENDED PANEL CUT-OUT

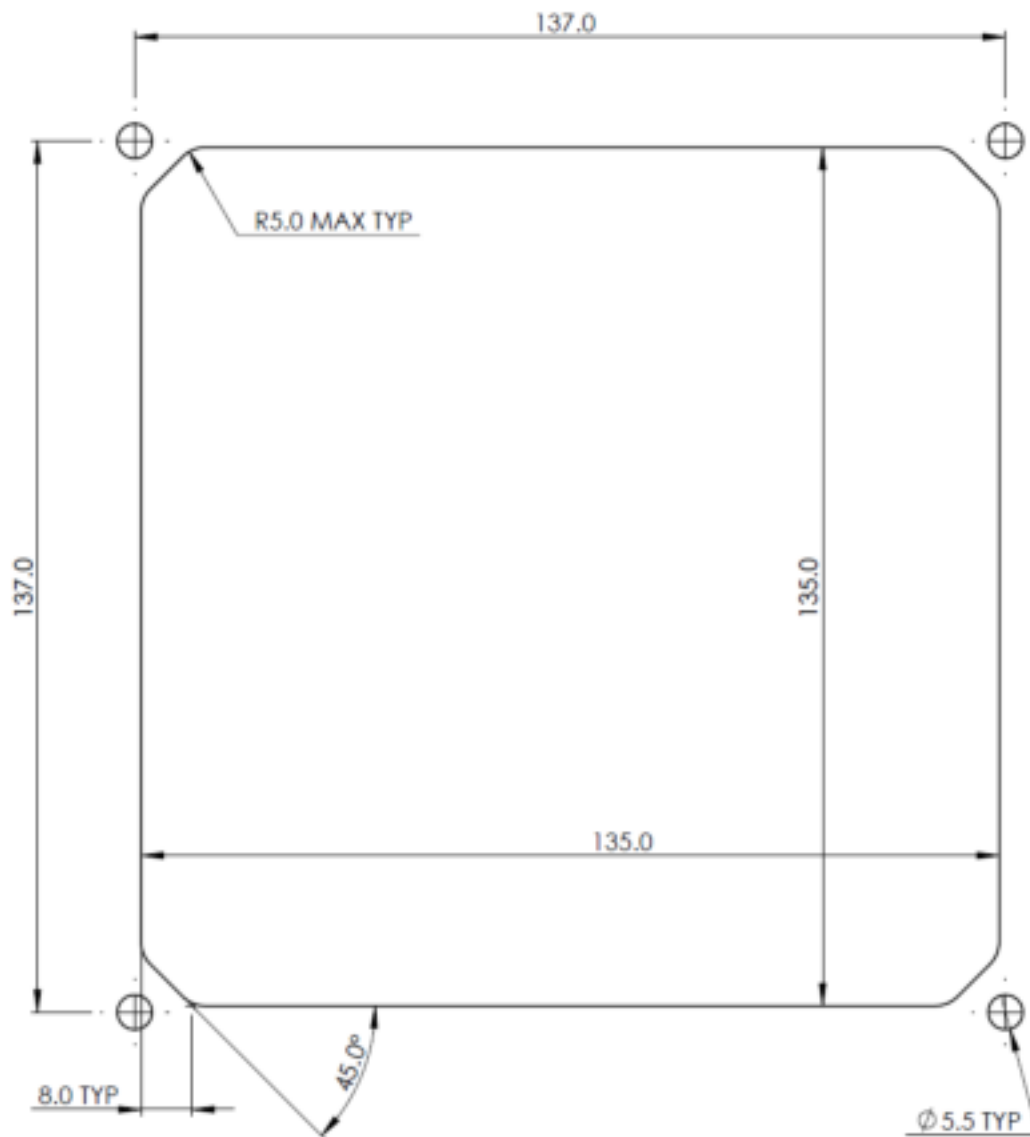


Figure 6: Recommended Panel Cut-out

8 PRODUCT ORDERING CODE SYSTEM

Please construct your standard product ordering code by selecting the numbers and letters to suit your specification:

F	38	-	5	X	3	1	X	X	-	A
Product Range F = Rugged Series	Ball size (Nominal mm)									
Sealing Capabilities 5 = IPX5										
Electrical Output 4 = PS/2 5 = USB										
Integrated Switches 3 = Three Integrated Switches										
Mounting Option 1 = Mount to front of panel										
Ball Retention Style Option 3 = Removable polycarbonate bayonet locking ring, black Option 4 = Removable polycarbonate threaded locking ring, black Option 5 = Non-removable polycarbonate ring, black Option 6 = Removable aluminium threaded locking ring, black See product selector document DS38057 for additional top plate style details										
Ball Colour 0 = Black 4 = Yellow										
Tracking Engine A = Mechanical										

For further options on ball colours and top plate styles please contact your local sales representative

8.1 Ordering Example

F38-553130-A: F38 Rugged Series, IPX5, USB, 3 integrated switches, mount to front of panel, removable polycarbonate bayonet locking ring, and black ball.

9 MANUFACTURE

9.1 Environmental Impact Requirements

The device shall not contain any toxic materials other than those necessary for soldering purposes.

9.2 ESD Protection

All CCL products shall be manufactured in an ESD safe environment. ESD precautions shall be observed through the production and packing process.

9.3 Workmanship

The trackball device has been designed and produced in accordance with IPC-A-610, Class 2. All Printed Circuit Boards and all soldering are conformal coated to IPC standards.

10 PACKAGING AND SHIPPING REQUIREMENTS

10.1 Trackball Identification

The Trackball shall be supplied with a label detailing the following information:

1. Name of manufacturer
2. Manufacturer's product part number
3. Manufacturer's product serial number
4. Manufacturer's date code

Label Format

Label Size: 9.7 x 25.4mm

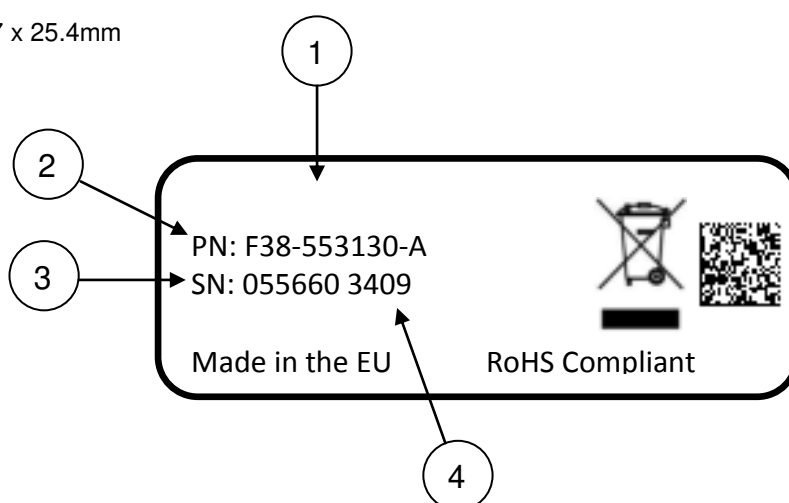


Figure 7: Serial Label Details

The label shall be covered by a clear, protective over-laminate measuring 50mm x 20 mm and this shall overlap the label on all sides.

10.2 ESD Labelling

The trackball module and its packaging shall be clearly labelled stating that the product must be handled in an ESD safe manner. ESD warning labels shall comply with MIL-STD-129



Figure 8: ESD Label Details

10.3 Label Placement

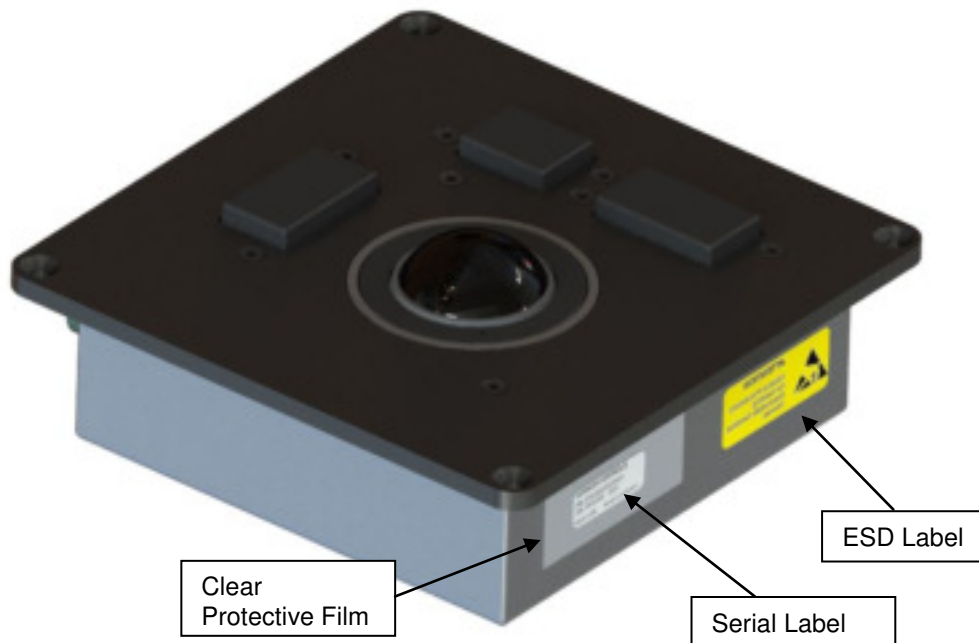


Figure 9: Label Placement

10.4 Packaging

Each box, in which the trackballs are packaged, shall be marked with:

- Part number
- Trackball quantity

Each trackball shall be packed in an ESD-protected package.

11 SUPPORT DOCUMENTS

The following documents provide support information for the F38 Series trackball and are available upon request from your local sales office.

NOTE: PLEASE READ THE SUPPORT DOCUMENTS CAREFULLY BEFORE INSTALLING THE TRACKBALL.

DOCUMENT NUMBER	DESCRIPTION
AN0035	Application note: Servicing Guide
AN0036	Application note: Trackball Installation
AN0037	Application note: Capacitive Anti-Vibration Guide
DS38057	Datasheet: Product Selector

Table 3: Support Documents

12 DOCUMENT REVISION STATUS

ISSUE	DATE	AUTHOR	REMARKS
A	13/02/14	C.E.	Document release – NP839
B	08/04/14	C.E.	ECN1506
C	21/06/17	C.E.	ECN1788

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