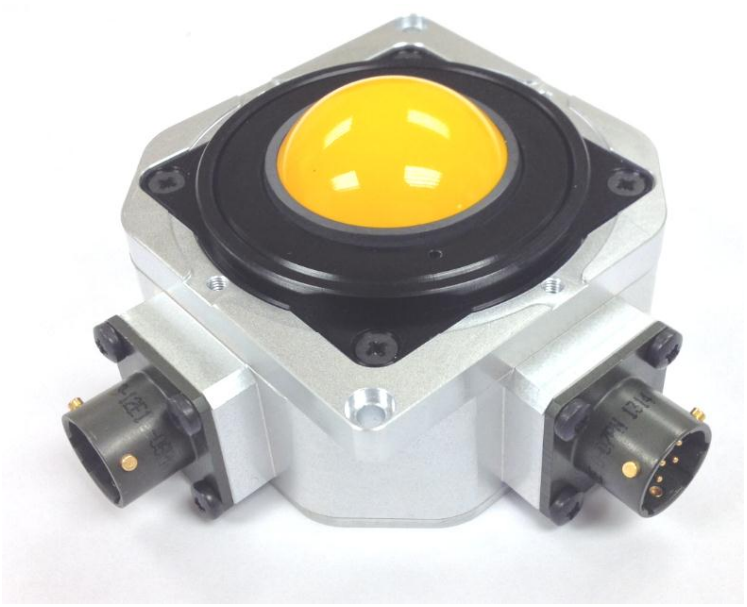
F38 Series – Rugged Mechanical Trackball, USB or PS/2 Output



1. DESCRIPTION

The F38 Series trackball is a high specification human interface device designed to operate in extremely demanding environments where reliability and robustness are essential.
The unique aluminium 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 also includes the Cursor Controls Ltd, 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 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 has been designed to be back of panel mounted as part of a rugged keyboard/console or alternatively can be supplied as part of a custom panel solution with integrated switches (please consult your local sales office for details on customised solutions).

2. FEATURES

- Electrical Output: USB or PS/2
- Smooth operation in rugged environments
- Excellent environmental protection
  - IP65 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;
  - Threaded removable ring/ball to allow for ease of servicing
  - 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 DS38058 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	~285 grams
3.1.2	Ball size	Ø38.1 mm (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	Main body material/finish	Aluminium/Surtec 650 finish
3.1.8	Top plate configuration	Option 1 = Black aluminium top plate - non-removable ball Option 2 = Black aluminium top plate, removable aluminium threaded ring Please see section 7 for ordering code
3.1.9	Ball sealing material	PTFE composite
3.1.10	Operating position	Horizontal to 60°
3.1.11	Tracking engine	Dual channel photo-interrupters
3.1.12	Mechanical lifetime	1 million ball revolutions
3.1.13	MTBF	50,000 hours

3.2 ELECTRICAL		
3.2.1	Protocol/output	USB or PS/2 (see section 7 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	Switch inputs	3 switches: Left, Middle, and Right (other options available)
3.2.8	Switch input connector	Amphenol 62GB-12E10-06PN or equivalent (6 way circular connector)
3.2.9	Mating switch input connector	Compatible 6 way socket e.g. Amphenol part 62GB-56T10-06 SN
3.2.10	PCB protection	Acrylic conformal coating

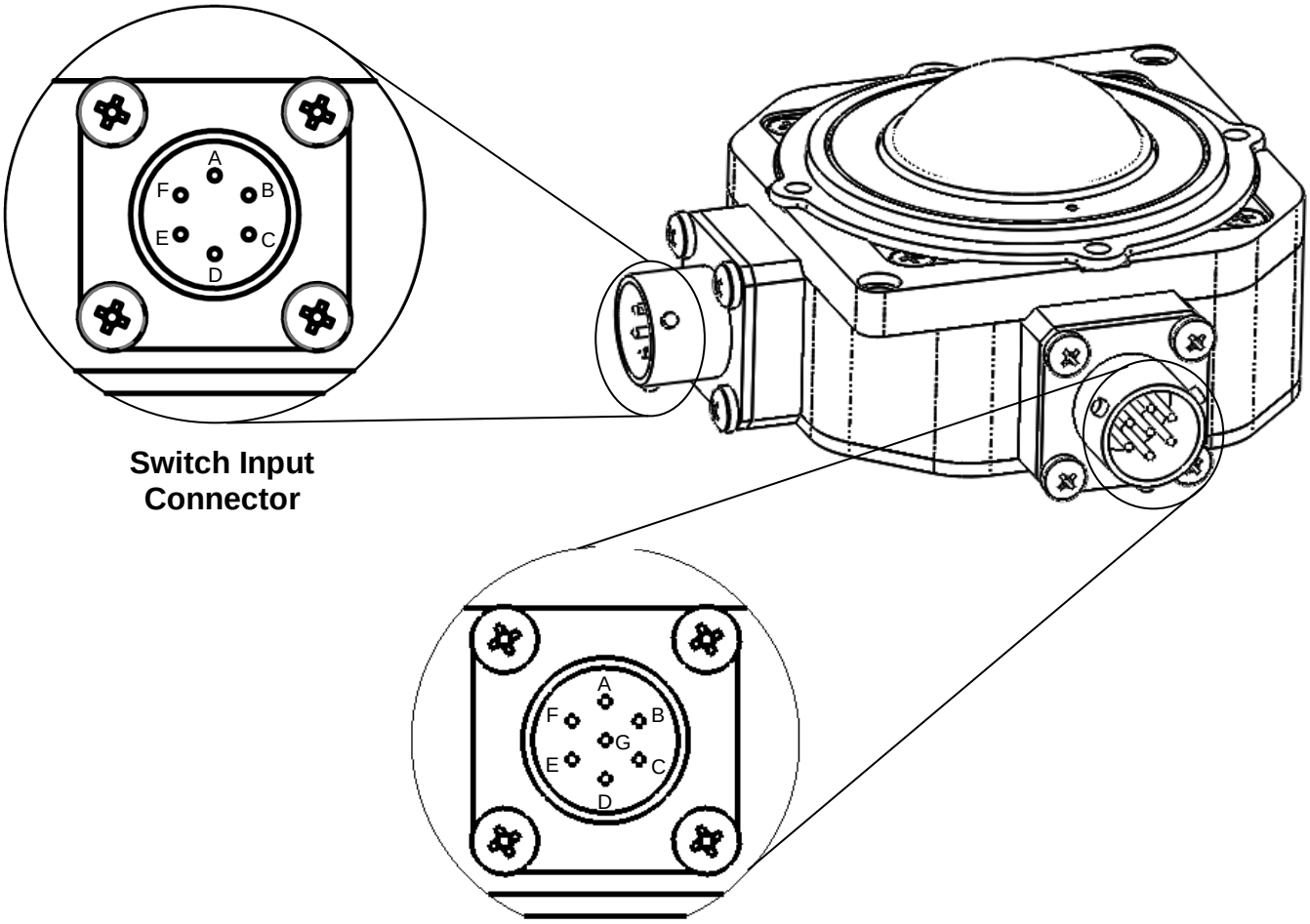
3.3 ENVIRONMENTAL		
3.3.1	Operating temperature	-45°C to +70°C (DO 160F CAT B2)
3.3.2	Storage temperature	-55°C to + 85°C (DO 160F CAT B2)
3.3.3	Low Pressure	25,000ft (37.6KPa) operating (DO 160F CAT B2)
3.3.4	Rapid Decompression	40000ft, 15secs, duration = 10mins (MIL-STD-810G Procedure III)
3.3.5	Power on temperature	-45°C (DO 160F CAT B2)
3.3.6	Temperature variation	5°C per min (DO 160F CAT B)
3.3.7	Humidity	95% @ 65°C, non-condensing (DO 160F CAT B SEVERE)
3.3.8	IP Rating	IP65 (IEC 60529)
3.3.9	Sand and dust	Sand and dust (MIL-STD-810G procedure I, II)
3.3.10	Salt Fog	Salt fog (MIL-STD-810G)
3.3.11	Vibration	7.7g, 20 to 2000Hz, 1 hour/axis. MIL-STD-810G Minimum integrity test
3.3.12	Shock (Functional)	40g, 15-23ms duration, 3 shocks in +/-directions (MIL-STD-810G)
3.3.13	Shock (Crash test)	75g, 8-13ms duration, 2 shocks in +/-directions (MIL-STD-810G)
3.3.14	Ball Impact	20 Joules
3.3.15	EMC	Designed to pass MIL-STD-461F

.

3.4 ELECTRICAL OUTPUT COMPATIBILITY
Windows 95
Windows 98
Windows 2000
Windows ME
Windows NT4
Windows XP
Windows Vista
Windows 7
Redhat Linux
Sun Sparc
Fully compliant with USB 2.0 (Low Speed) framework (chapter 9) and HID specifications

4. CONNECTION DETAILS

Connection is made to the F38 trackball by means of two circular connectors. 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's Part No: 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)

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.1 Output Connections

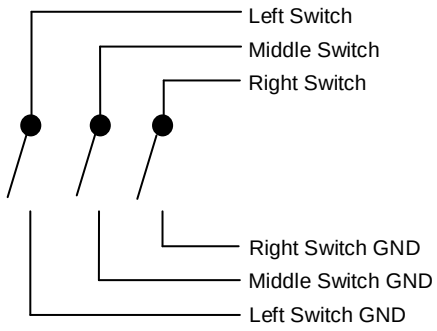
4.2 SWITCH INPUT CONNECTOR:

Description: 6-way circular connector with bayonet latching features
Manufacturer: Amphenol (or equivalent)
Manufacturer's Part No: 62GB-12E10-06PN (or equivalent)
Mating connector: Compatible 6 way socket e.g. 62GB-56T10-06SN or 62GB-16F10-06SN or equivalent (6 way circular socket)

PIN	FUNCTION
A	Left Switch
B	Left Switch GND
C	Middle Switch
D	Middle Switch GND
E	Right Switch
F	Right Switch GND
SHELL	EARTH

Table.2 Switch Connections

4.3 SWITCH SCHEMATIC



5. TRACKBALL CONFIGURATION

The F38 series trackball provides features that may be selected using the DIP switch located on the printed circuit board. Please note that the trackball base plate must be removed to access the DIP switch (please refer to application note AN0031 for details on how to remove the base plate).

5.1 DIP SWITCH FUNCTIONS

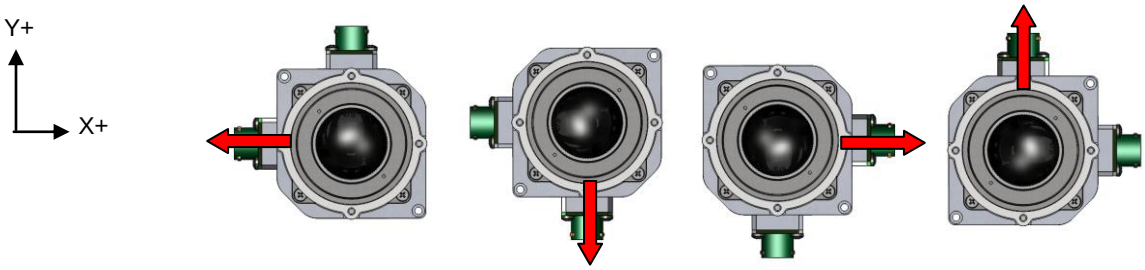
DIP SWITCH	FUNCTION	OFF	ON
1	Orientation 1 Setting	See Figure.1	See Figure.1
2	Orientation 2 Setting	See Figure.1	See Figure.1
3	Tracking Mode	Ballistic tracking	Linear tracking
4	Anti-vibration Technology	Enabled	Disabled

Table 3 – DIP Switch Functions

Factory default setting: All DIP switches OFF

5.2 ORIENTATION

The orientation function allows the user to mount the F38 series device in one of four positions (see figure. 1 below). The orientation of the device is determined by the direction in which the output connector is facing (when viewed from the top of Trackerball device). The direction of the connector is indicated by the arrow.
The Trackerball orientation can be selected to accommodate customer requirements for connector location and wiring.



Switch 1 (Orientation 1)	OFF	ON	OFF	ON
Switch 2 (Orientation 2)	OFF	OFF	ON	ON

Figure 1 – Mounting Orientations

5.3 TRACKING MODE

Ballistic Tracking

The ballistic tracking mode is an intuitive 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.

Linear Tracking

When the trackball is configured in linear tracking mode (DIP switch 3 ON) the data from the encoding system is transmitted to the host system with no manipulation or filtering within the trackball firmware. For example, if 3 counts of movement are generated by the encoding system, 3 counts of movement will be transmitted to the host system. In this mode one ball rotation will always generate 965 counts of movement, irrespective of the ball speed.

5.4 ANTI-VIBRATION TECHNOLOGY

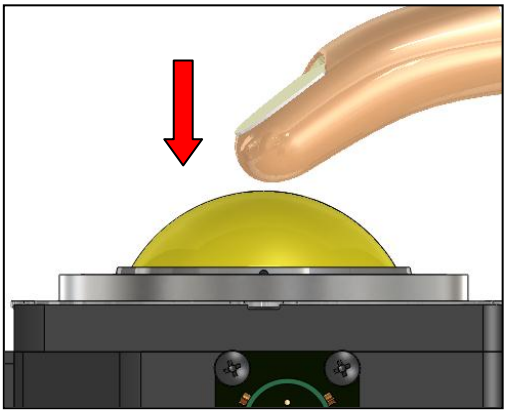
The F38 trackball incorporates the latest Cursor Controls Ltd patented anti-vibration technology. The anti-vibration technology ensures that only intended ball movements are transmitted to the host system (i.e. when the user's hand is in contact with the surface of the ball). This feature eliminates 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

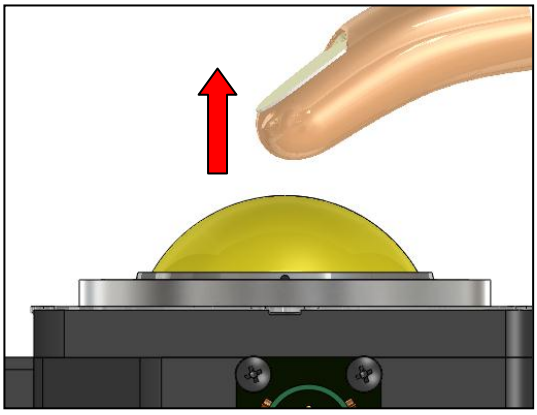
At the start of each power cycle the anti-vibration feature will default to an inactive state until it detects the very first contact made by a finger/hand. This initial inactive state allows the feature to calibrate to the operating environment and distinguish when hand contact is made. Please note 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 1mm 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



Ball motion will be transmitted when the finger is between 0 to 1mm away from the ball surface



Ball motion will be supressed when the finger is over 2mm away from the ball surface

5.5 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.

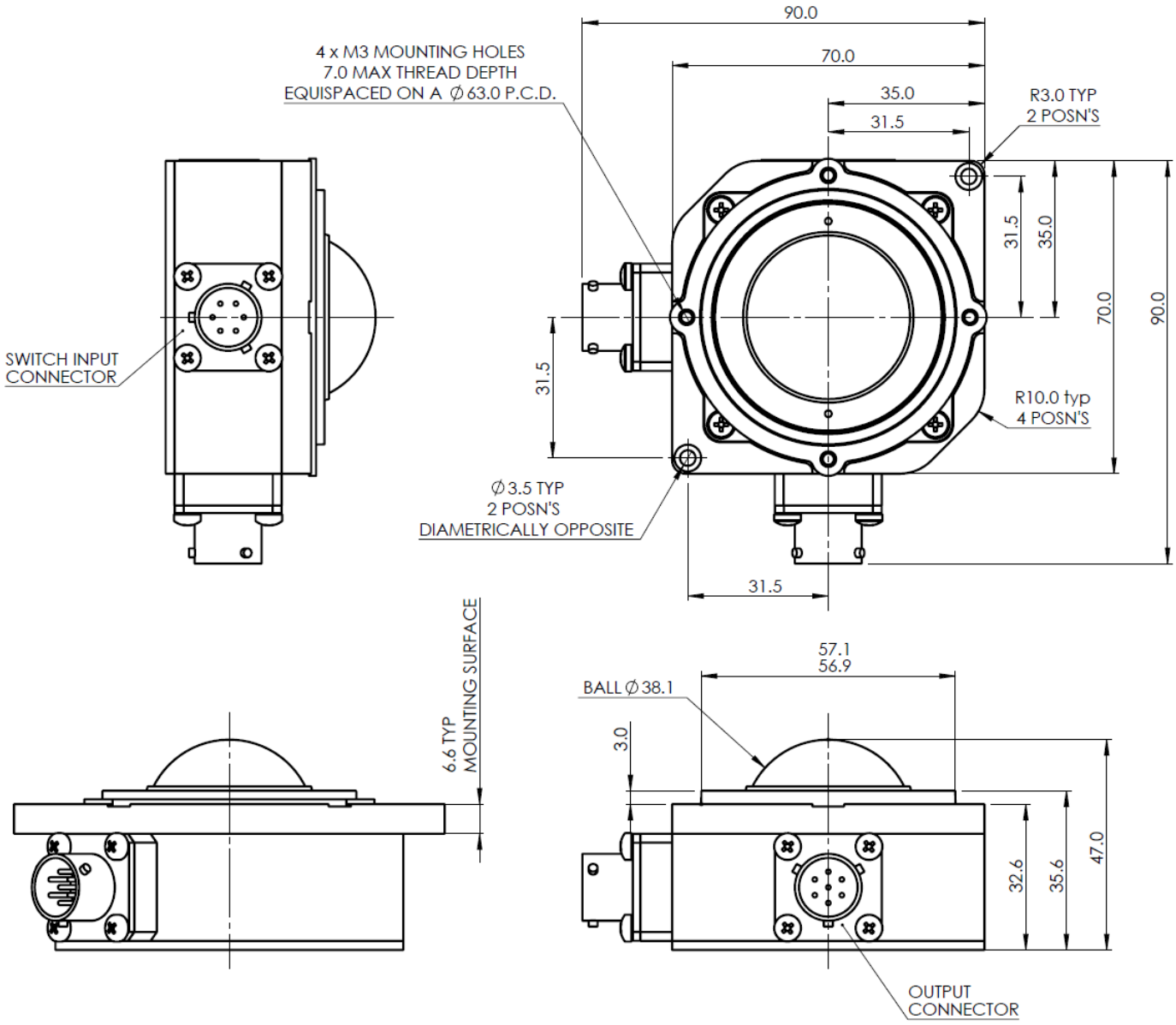
5.6 SUPPORT DOCUMENTS

The following documents provide supporting information for the F38 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
AN0031	Application note: Trackball Installation
AN0035	Application note: Servicing Guide
AN0037	Application note: Capacitive Anti-Vibration Guide
DS38058	Datasheet: Product Selector

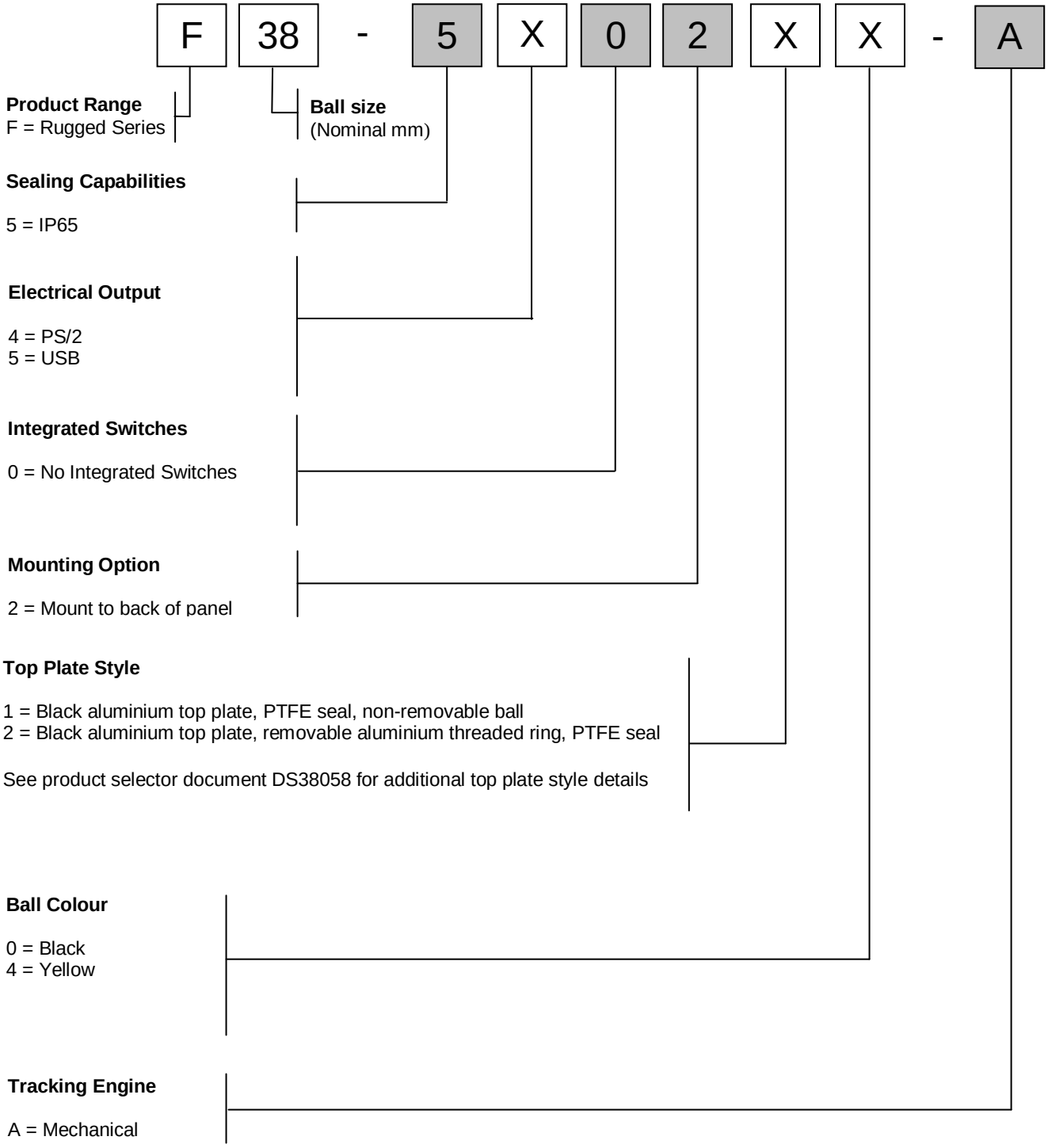
6. OUTLINE DRAWING



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. PRODUCT ORDERING CODE SYSTEM

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



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

7.1 ORDERING EXAMPLE

F38-550210-A: F38 Rugged Series, IP65, USB, no integrated switches, mount to back of panel, Black aluminium top plate, PTFE seal, non-removable ball, black ball

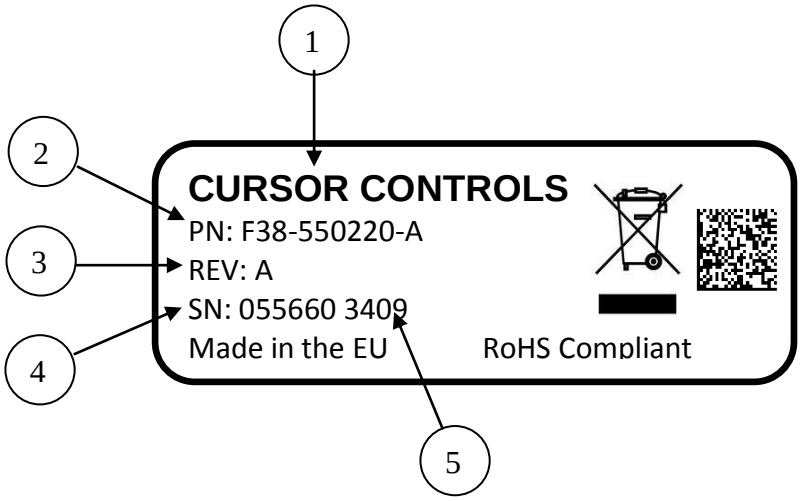
8. PACKAGING AND SHIPPING REQUIREMENTS

8.1 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 revision
4. Manufacturer's product serial number
5. Manufacturer's date code

Label Format



8.2 PACKAGING

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

- Cursor Controls part number
- Trackball revision
- Trackball quantity

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

9. DOCUMENT REVISION STATUS

Revision	Date	Author	Remarks
A	13/02/14	C.E.	Document release – NP812

Contact :
NSI bvba
Haakstraat 1A
B-3740 Bilzen
Belgium
Tel. +3289519000
info@nsi-be.com
www.nsi-be.com