

TAPESWITCH
Solo Sensing Edges
TECHNICAL MANUAL 343192-01
English

WARNING

Tapeswitch pressure sensitive sensing edge systems are intended to protect operators working at or near dangerous machinery. They can only perform this function if they are correctly fitted to a suitable machine. It is essential that the full contents of this manual and all the authoritative documents referred to herein are fully understood before any attempt at installation is made. If in doubt contact Tapeswitch or your Tapeswitch distributor.

IMPORTANT

This manual must accompany the product throughout its working life. Those persons responsible for the use of the product must ensure that all persons involved in the installation, commissioning, operation, maintenance and servicing of the product have access to all the information supplied by the manufacturers of the machine and its safety system.

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1. GENERAL

Tapeswitch *Solo* sensing edges are pressure sensitive devices designed to protect personnel and equipment in both industrial and commercial environments.

They are available in a range of different profiles and pressure sensitivities to suit various applications.

The *Solo* sensing edge is designed to meet the requirements of BS EN 1760-1:1998 and contains an integral fail-safe function which monitors the switching elements to Category 3 of EN954-1 providing dual channel outputs.

Tapeswitch *Solo* sensing edges are obstruction sensing devices. The sensing edge is usually mounted on the leading edge of a power driven object, for example a door, such that the sensor is actuated when it meets an obstruction. The obstruction may take the form of a person, any part of a person or any solid object, so the sensing edges can be used to protect equipment as well as personnel.

The *Solo* sensing edges are ideal for use with safety bus systems. The sensing edges can connect directly to the same kind of standard safety bus I/O connection modules that are used to connect E-Stop switches over the safety bus. This is much more convenient than the alternative of having an additional control unit close to the sensing edge so that it can provide the volt-free, normally closed connections to the safety bus I/O module.

WARNING

The information contained in this manual relates to the use of a *Solo* sensing edge, to provide a basic safety switching device.

In some applications the *Solo* sensing edge may be used together with other equipment to provide additional functions and features i.e. for use with safety bus systems. Any other documentation supplied must be used in conjunction with this manual.

2. TECHNICAL DESCRIPTION

2.1 SYSTEM OVERVIEW

When the *Solo* sensing edge is actuated, by pressure on its surface, it issues a stop signal to the equipment control system by switching off its output switching devices, causing dangerous motion to cease or be prevented.

IMPORTANT

From the above it can be seen that the safe use of the *Solo* sensing edges relies not only on the safety integrity of the sensing edge itself but also on its mechanical and electrical interfacing to the machine.

The safety integrity of the *Solo* sensing edge itself is the responsibility of Tapeswitch.

Proper mechanical and electrical interfacing is the responsibility of the user. Comprehensive information for this purpose is provided in section 4 of this manual.

2.2 SENSORS

2.2.1 GENERAL

The construction of a Tapeswitch *Solo* sensing edge is shown in Figure 1. The sensor consists of a Tapeswitch ribbon switch fitted inside an extruded durable polymer housing. The ribbon switch is sealed at each end and is connected to the in-line fail-safe monitor. The housing is fitted into a choice of extruded mounting channel. The construction of the Tapeswitch switching elements is shown in Figure 2.

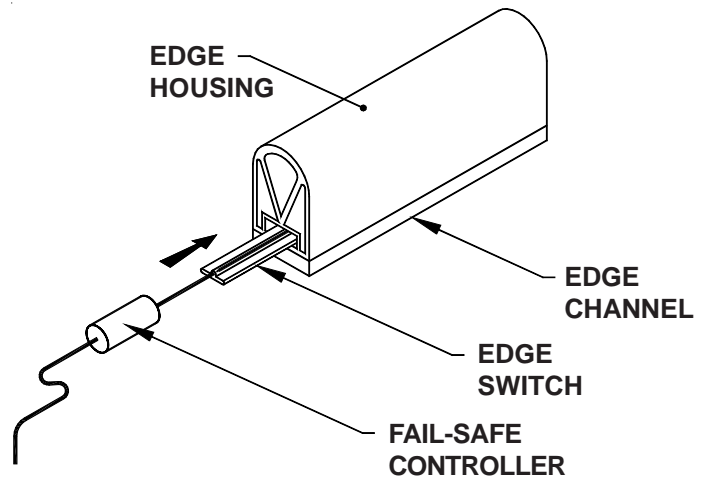


Figure 1 - Typical construction of a *Solo* Sensing Edge

Each switching element is a long normally open switch. The switch consists of two copper plated steel conductors held apart at the sides by an insulator. When pressure is applied to the bead, the two conductors are forced together in the centre, closing the switch. Heavy gauge tin plated copper wire is used for all internal wiring and all connections to the switching elements are direct solder joints. The switches are self-bottoming and as a result they can withstand very high loads and repeated operation. Several million operations is typical.

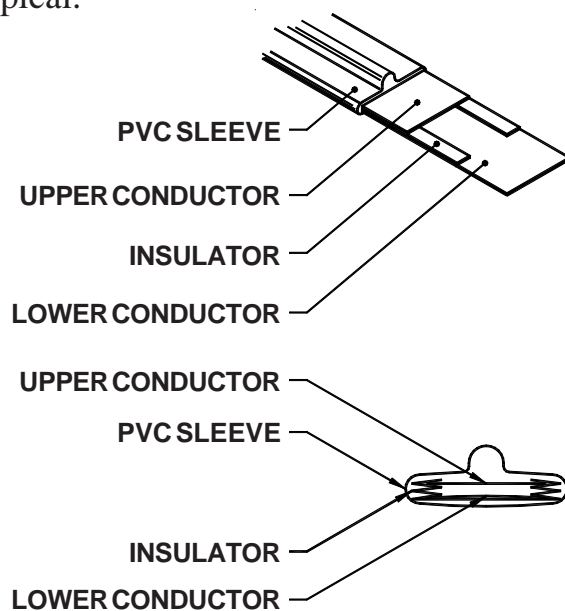
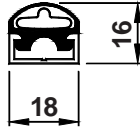


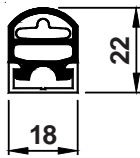
Figure 2 - Construction of Tapeswitch Switch Elements

2.2.2 Solo SENSING EDGES

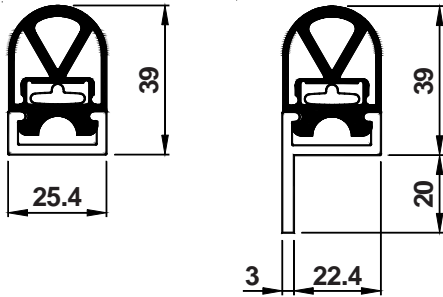
Tapeswitch *Solo* sensing edges are available in a wide range of different profiles and pressure sensitivities to suit various applications:



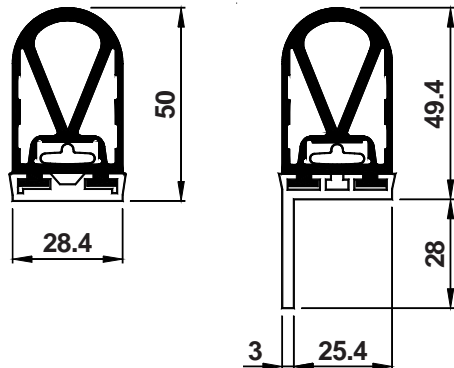
TS6 - Very small edge with minimum compression before activation.



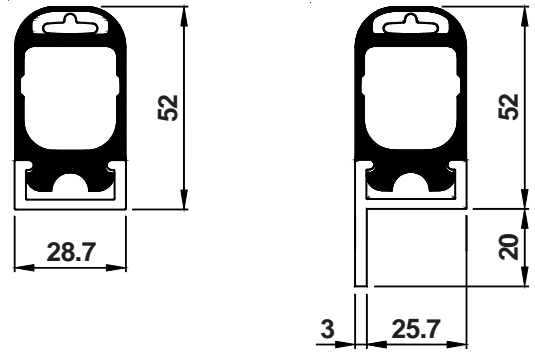
TS16S - Small edge with minimum compression before activation.



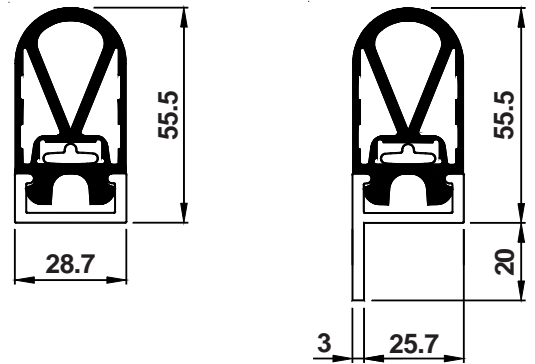
TS26C - Medium edge with immediate activation and cushioned overtravel.



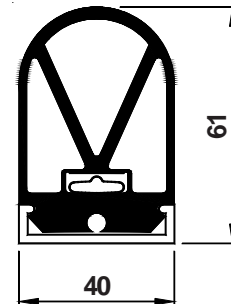
TS46D - Medium/large edge with cushioned overtravel.



TS47 - Medium/large edge with immediate activation and high cushioned overtravel.



TS48 - Medium/large edge with cushioned overtravel.



KS1001 - Large edge with cushioned overtravel after compression.

3. SUITABILITY FACTORS

3.1 GENERAL

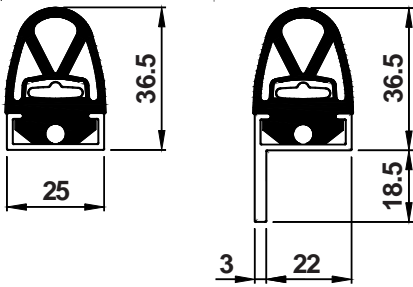
The equipment control system must satisfy the following requirements:

- (a) The dangerous motion of the equipment must be electrically controllable.
- (b) The equipment stopping performance must be adequate and consistent.
- (c) It must be possible to stop the dangerous motion at any point.
- (d) The control system as a whole must be constructed to provide the level of safety integrity determined by a risk assessment.

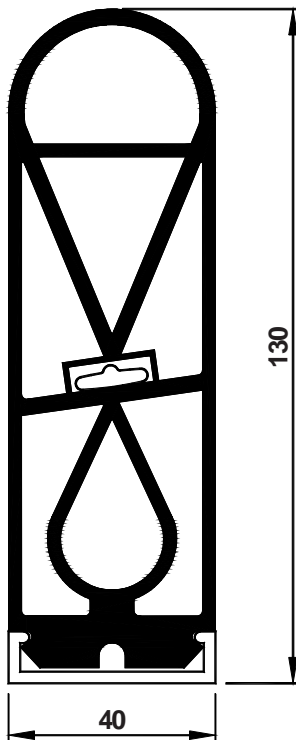
3.2 OVERTRAVEL

Part of the flexibility of the sensor provides a cushioning effect to protect the person or object from being subjected to large forces which may cause injury. Obviously the physical characteristics of a sensor limit the cushioning capability and therefore, it is very important to ensure that the moving parts are brought to rest or reversed before the safe flexible movement of the sensor is exhausted.

The cushioning capability of an edge is expressed as its overtravel. The overtravel of an edge is not a constant. It can be defined as the distance through which the sensor will further deform, after the point at which a stop signal is generated, until the point at which the compressed sensor exerts a specified maximum force on a specified object which was originally moving at a specified speed. A user must ensure that the dangerous parts come to rest within the overtravel of the sensor.



KS3003 - A medium edge with immediate activation and cushioned overtravel.



KS4401 - An extra large edge with immediate activation and considerable cushioned overtravel.

For details on the options available for each type of *Solo* sensing edge see section 7.2.

3.3 RISK FACTORS

Every application presents its own hazards. In order to determine the level of risk in a particular application a risk assessment must be performed. In many countries methods have been developed and published, usually by the organisations responsible for industrial safety, to enable a systematic risk assessment to be carried out. The guidance available in a particular country may take the form of national, European or international standards. Persons responsible for selecting safety devices should be familiar with the guidance available in their country before specifying particular safety devices.

In most current guidance the main factors considered in risk assessment are:

- (a) the severity of possible injury.
- (b) the frequency of exposure to the hazard.
- (c) the possibility of avoiding the hazard.

Solo sensing edge sensors are suitable for use in low to medium risk applications where the following conditions apply:

EITHER

- the severity of possible injury is slight.

OR

- the severity of possible injury could be serious AND
- the frequency of exposure to the hazard is low AND
- the possibility of avoiding the hazard is high.

4. INSTALLATION

WARNING

TAPESWITCH SENSING EDGE SYSTEMS ARE DESIGNED TO PROTECT OPERATORS WORKING AT OR NEAR DANGEROUS EQUIPMENT. THEY CAN ONLY PERFORM THAT FUNCTION IF THEY ARE CORRECTLY FITTED AND INTERFACED TO SUITABLE EQUIPMENT. EVERY EFFORT HAS BEEN MADE IN THE PRODUCTION OF THIS MANUAL TO PROVIDE COMPREHENSIVE AND ACCURATE INFORMATION. IT IS THE RESPONSIBILITY OF THE USER TO ENSURE THAT ALL PERSONS INVOLVED IN THE INSTALLATION OF THE PRODUCT HAVE THE KNOWLEDGE, TRAINING AND EXPERIENCE NECESSARY AND THAT THEY ARE FULLY CONVERSANT WITH ALL LAWS, RULES, REGULATIONS AND CODES OF PRACTICE PERTAINING TO THEIR TASK.

4.1 GENERAL

The attention of the installer is drawn to following general requirements for the installation of a Tapeswitch sensing edge system:

(a) The machine must be electrically controllable.

(b) It must be possible to stop the dangerous motion of the equipment at any point in its operation, in any operating mode.

(c) The control system as a whole must be designed to provide the required level of safety integrity determined by a risk assessment.

(d) Under no circumstances should a sensor be cut or drilled. It is not possible for the user to modify the size or shape of a sensor.

(e) Great care should be taken when handling sensors. Never pick the sensor up or drag it around using the cables.

(g) After installation the equipment/edge system must be commissioned in accordance with section 5 of this manual.

(h) Any covers removed during installation must be replaced as soon as possible.

4.2 SENSOR INSTALLATION

4.2.1 GENERAL REQUIREMENTS

The dimensions of each *Solo* sensing edge sensor are shown in Section 2.

The surface on which the sensor is mounted must be sound and reasonably flat. The sensor can tolerate minor irregularities but large projections may impair performance and/or cause premature degradation. The sensor cannot be fitted to a curved surface. The sensor should be fixed permanently in position. In this sense permanently means that it should not be possible to move or remove the sensor without the use of tools.

4.2.2 ELECTRICAL INSTALLATION

The *Solo* sensing edges are fitted with either a single 6-core cable or 2 x 4 core cables 0.5m long, fitted with an M12 plug.

The connections to the sensing edge sensor are shown in Figure 3 & Figure 4.

NOTE: In order to achieve EN954-1 Category 3 safety integrity, the outputs must be wired as two separate channels to a suitable control capable of monitoring them for equivalence.

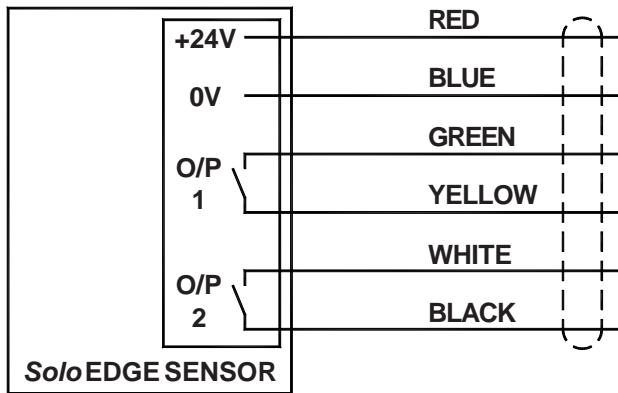


Figure 3 - Connection Details for *Solo* Sensing Edge with 6 Core Cable

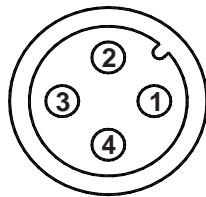
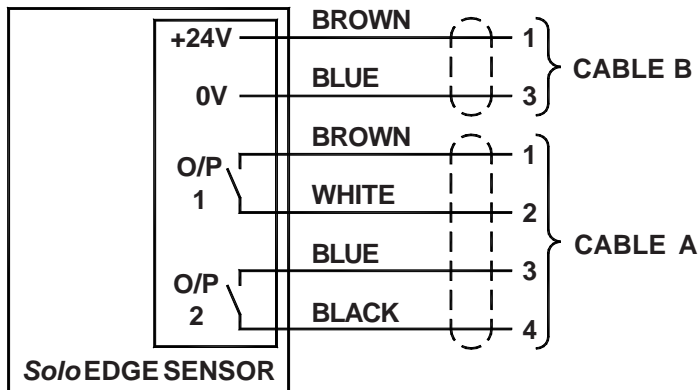


Figure 4 - Connection Details for *Solo* Sensing Edge with 2 x 4 Core Cable Assemblies

5. PERIODIC CHECKING

5.1 GENERAL

The following sections describe the periodic checks to be performed on equipment fitted with a Tapeswitch *Solo* sensing edge system. If the equipment is fitted with additional safety devices the periodic checks prescribed by the manufacturer of these devices should be incorporated into the periodic checking regime described below.

If the equipment/safety device fails any of the prescribed checks the equipment must be isolated and must not be used until the fault has been identified and rectified.

5.2 COMMISSIONING CHECKS

The commissioning checks should be carried out by persons who are competent and who have access to all the information supplied with the equipment and its safety devices. The results of the examination should be recorded and copies of this record should be kept by the user and the employer of the person performing the examination.

The person carrying out the examination should, as a minimum, perform the following checks:

(a) Check that the *Solo* sensing edge is suitable for use in the application:

(i) Check that the level of safety integrity provided by the *Solo sensing edge* is suitable for the level of risk presented by the equipment.

(iii) Check that the environment is suitable for the use of the *Solo* sensing edge.

(b) Examine the equipment controls and connections to the *Solo* sensing edge to ensure that the requirements described in this manual and in the equipment manual have been met.

(c) Check that the *Solo* sensing edge is fixed in position.

(d) Check that there are no hazards remaining which are not protected by the *Solo* sensing edge or by another safety device.

(e) Check that it is not possible for the dangerous parts of the equipment to be set in motion while the *Solo* sensing edge is actuated.

(f) Check that actuation of the *Solo* sensing edge during a dangerous phase of operation of the equipment results in the dangerous parts being arrested within the overtravel of the sensor.

(g) Check that, after the equipment has been stopped by the actuation of the *Solo* sensing edge, it is not possible for the dangerous parts to be set in motion until the sensor has been cleared, the reset button has been operated and released, and the equipment start control has been re-operated.

(h) Check that the removal of power from the *Solo* sensing edge prevents further operation of the equipment. It should not be possible for the dangerous parts of the equipment to set in motion until power has been restored, the reset button has been actuated and released, and the equipment start control has been actuated.

5.3 SIX MONTHLY CHECKS

(i) Check that the *Solo* sensing edge operates over the whole active area by pressing at regular intervals.

(j) Examine the stopping performance monitor (if fitted) to ensure that it is fitted and functioning correctly. Ensure that the means by which the stopping performance can be assessed by the operator is indicating correctly.

(k) Test the muting arrangements (if fitted). Ensure that the muting is only possible during non-dangerous operation and ensure that the safety level of the muting device is at or above that of the *Solo* sensing edge but never below.

(l) Examine brakes and clutches (if fitted) as recommended.

NOTE: No stopping performance monitor or muting facilities are provided with the Tapeswitch *solo* sensing edge system and there is no means provided for the connection of such devices to the system. These devices may however have been provided elsewhere in the equipment control system.

These examinations should be carried out by competent persons. The results should be recorded and a copy kept by the user.

The person should perform all the checks detailed in section 5.2. In addition the person should:

(a) Examine and test the machine primary control element(s) to ensure that they are functioning correctly and are not in need of maintenance or replacement.

(b) Inspect the equipment to ensure that there are no mechanical or structural aspects which could prevent the equipment from stopping or assuming an otherwise safe condition when called upon to do so.

(c) Check that no modifications have been made to the equipment control system, the *Solo* sensing edge or the interface between them, which could adversely affect the system and that any suitable modifications have been correctly performed and suitably recorded.

5.4 DAILY/SETTING CHECKS

The following tests should be carried out daily and after setting by a designated person appointed by the equipment user. The results should be recorded and a copy should be kept on or near the equipment. Specific statutory requirements may apply to certain types of equipment.

The designated person should:

(a) Inspect the outer surface of the *Solo* sensing edge for mechanical damage to ensure that it has not been penetrated or chemically damaged.

(b) Check the operation of the *Solo* sensing edge in several locations by operating the sensor with a thumb. Check at different locations each day such that the entire active area of the sensor is periodically checked.

(c) Check that all electrical enclosures are closed and locked and that any keys have been removed for retention by a designated person.

(d) Check that the stopping performance monitor (if fitted) is in use and is set up and functioning correctly.

(e) Check that all electrical enclosures are closed and locked and that any keys have been removed for retention by a designated person.

(f) Check for signs of damage to cables and connections

6. OPERATION, MAINTENANCE AND SERVICING

6.1 OPERATION

Operation of the system is straightforward. Once installed and interfaced to the equipment the *Solo* sensing edge will be an active safety sensor. The sensor will actuate each time pressure is applied to the active surface.

6.2 MAINTENANCE

The Solo sensing edges themselves do not require any maintenance but regular cleaning of any surfaces which come into contact with the sensor will prolong its working life.

6.3 SERVICING

WARNING

SERVICING OF SAFETY EQUIPMENT SHOULD ONLY BE CARRIED OUT BY QUALIFIED PERSONNEL. SERVICING INVOLVES THE EXPOSURE OF TERMINALS AND DEVICES CARRYING POTENTIALLY LETHAL VOLTAGES. ONLY THOSE PERSONS WITH THE APPROPRIATE TRAINING AND EXPERIENCE SHOULD UNDERTAKE THIS WORK. IF IN ANY DOUBT CALL TAPESWITCH OR YOUR TAPESWITCH DISTRIBUTOR.

IMPORTANT

AFTER ANY PART OF THE SYSTEM HAS BEEN REPLACED THE INSTALLATION SHOULD BE CONSIDERED AS NEW AND AS SUCH SHOULD BE COMMISSIONED IN ACCORDANCE WITH THIS MANUAL.

6.3.1 SENSOR REPAIR AND REPLACEMENT

It is not possible for the user to repair malfunctioning or damaged sensors. It is sometimes possible for repairs to be made by Tapeswitch or your Tapeswitch distributor. Consult your Tapeswitch distributor in the first instance for an assessment of the feasibility of a repair and the procedure for return of the defective sensor.

7. TECHNICAL SPECIFICATION

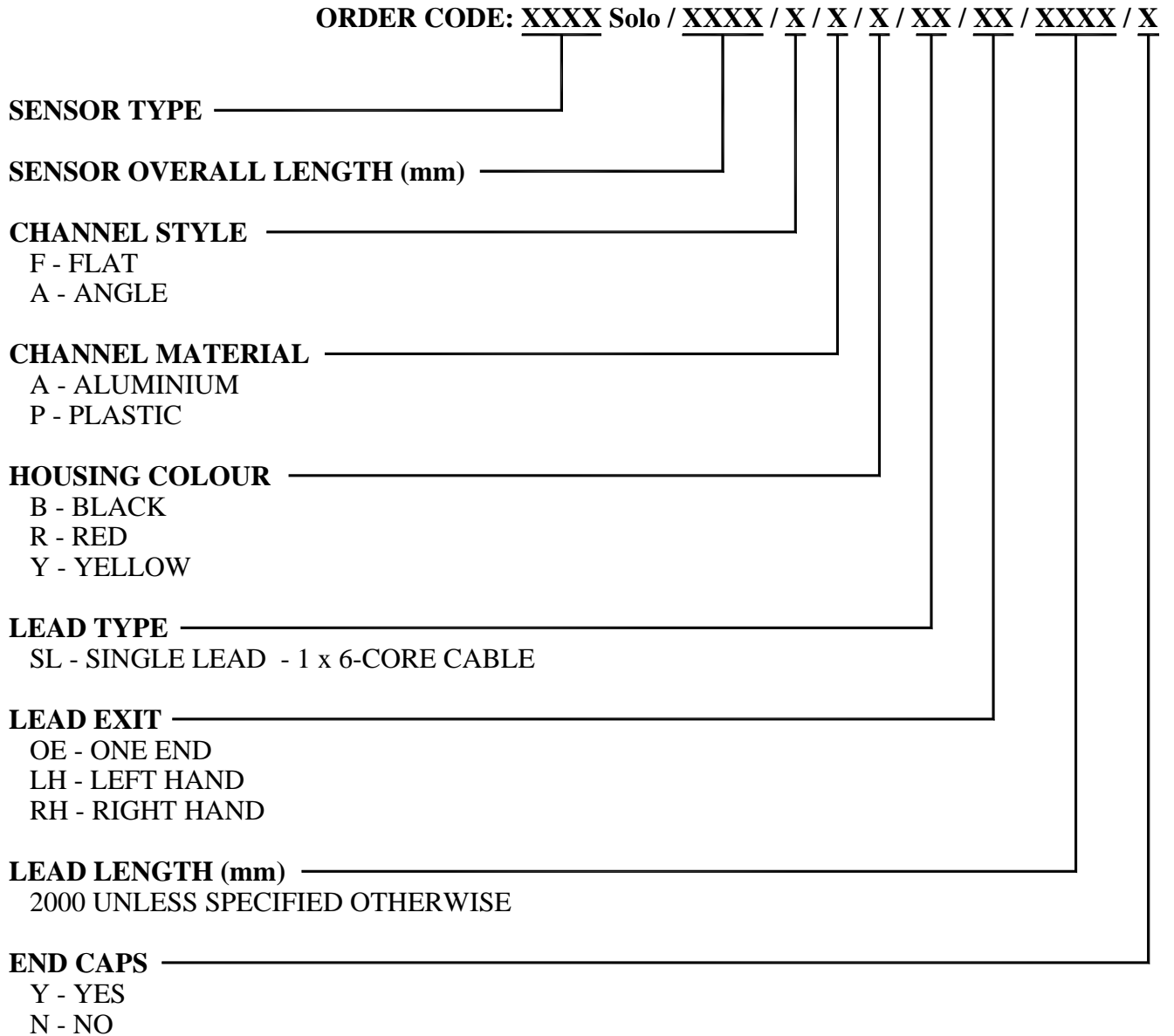
7.1 Solo SENSING EDGES

Technical Specification	TS6	TS16S	TS26C	TS46D	TS47	TS48	KS1001	KS3003	KS4401
Actuating Force (80mm Ø test piece)	<55N (5.5Kg)	<55N (5.5Kg)	<30N (3.0Kg)	<60N (6.0Kg)	<18N (1.8Kg)	<66N (6.6Kg)	<72N (7.2Kg)	<66N (6.6Kg)	<105N (10.5Kg)
Overtravel movement to 250N	2mm	2mm	8mm	21mm	24mm	21mm	20mm	15mm	50mm
Actuating Distance - Approx (80mm Ø test piece)	3.5mm	3.5mm	2mm	7mm	2mm	7mm	12mm	4.5mm	10mm
Housing Material	PVC		SANTOPRENE / PVC				EPDM		
Typical Weight	300g/m	350g/m	700g/m	1100g/m	1100g/m	1100g/m	1250g/m	450g/m	2150g/m
Ingress Protection	IP65								
Operating Temperature	0°C...+50°C								
Recommended Max. Voltage	30Vd.c.								
Switching Current @ 24Vd.c.	100mA max.								
Output Configuration	2 x N/C volt-free								
Number of Operations	> 3 million typical								

7.2 ORDERING INFORMATION

7.2.1 Solo SENSING EDGES

When ordering *Solo* sensing edge the following order code should be used. See Figure 4 for cable position details.



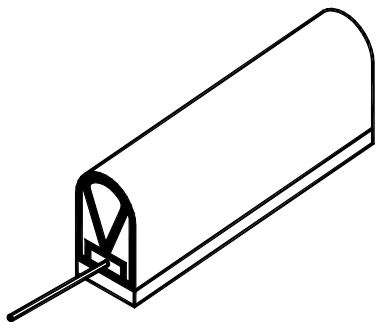
Example: TS16S *Solo* / 1000 / F / A / R / SL / OE / 2000 / Y

7.2.2 OPTION CHART

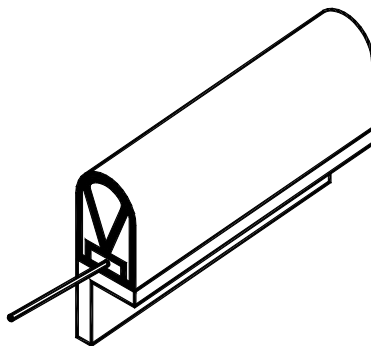
Sensing Edge	TS6	TS16S	TS26C	TS46D	TS47	TS48	KS1001	KS4401	KS3003
Maximum Length	4m	4m	4m	4m	4m	4m	5m	5m	5m
Channel type									
Flat aluminium	Y	Y	Y	Y	Y	Y	Y	Y	Y
Angle aluminium	N	N	Y	Y	Y	Y	N	N	Y
Flat plastic	Y	Y	Y	N	Y	Y	N	N	N
Housing colour									
Black	Y	Y	Y	Y	Y	Y	Y	Y	Y
Yellow	N	N	Y	Y	N	Y	N	N	N
Red	Y	Y	Y	Y	N	Y	N	N	N
Lead Type									
Single 6 Core cable	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lead Exit									
One End	Y	Y	Y	Y	Y	Y	Y	Y	Y
Left Hand	N	N	Y	Y	Y	Y	N	N	Y
Right Hand	N	N	Y	Y	Y	Y	N	N	Y
Lead length	up to 30m								

7.2.3 LEAD EXIT CONFIGURATIONS

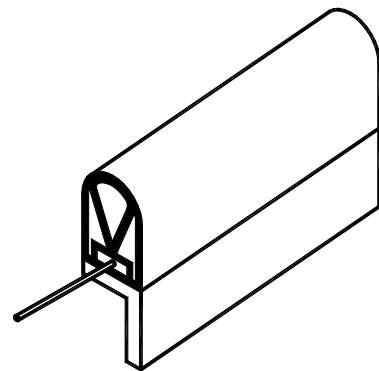
Tapeswitch *Solo* sensing edges are supplied with a single 6-core cable, with the *Solo* module located in-line. The lead exit configurations are shown below.



OE - Lead exits from One End



LH - Lead exits from Left Hand side



RH - Lead exits from Right Hand side

Figure 5 - Lead Exit Configuration

8. CONTACTS

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