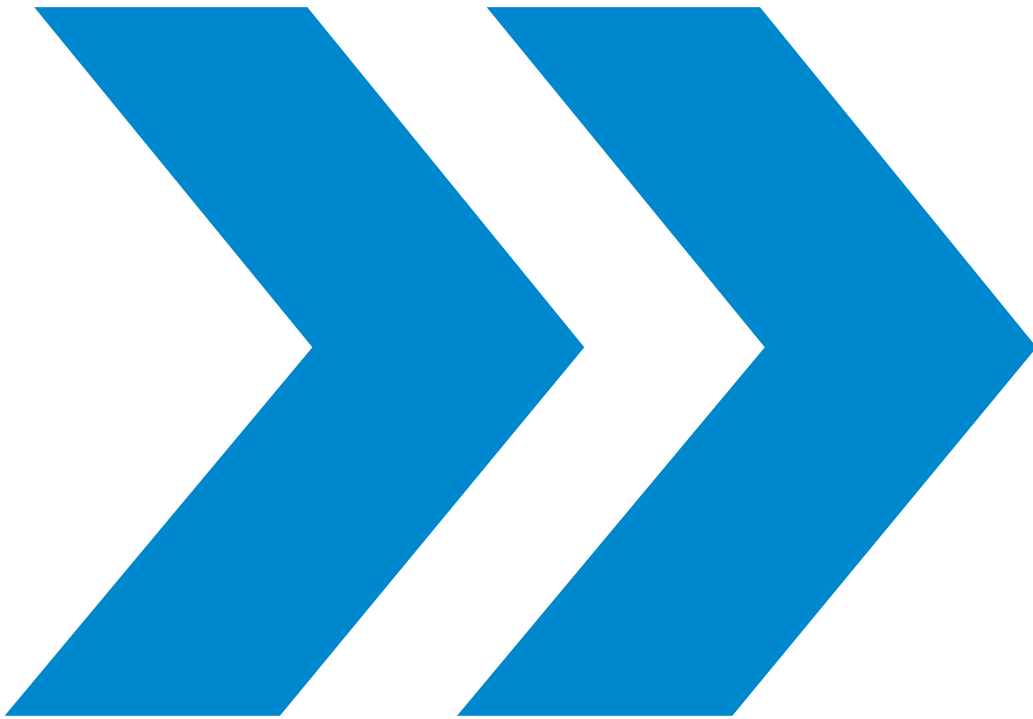




TX5021 RMXM Telltale  
RockMonitor XM



**TROLEXX | NOME**

# User Manual



# TX5021 Telltale

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## 1. General Description

The Trolex RockMonitor XM is a mechanical extensometer designed to monitor the condition of roof-bolted underground roadway or cut-through strata. It offers a fully mechanical solution for measuring displacement of tunnel strata, allowing geotechnical engineers and mine operators to periodically monitor and assess critical information regarding the safety and effectiveness of roadway support structures.

Mechanical extensometers (hereafter referred to as telltales) give local visual indication of displacement measurement to provide information regarding strata condition. Spring anchors are used to locate a set of wires at different heights inside a borehole. The wires are connected to the visual indicator measurement mechanism. Any dilation or bed separation of the strata will appear to pull the indicators along their axis showing how much each anchor has moved (relative to roadway roof).

Telltales can be installed at varying intervals in the sides as well as the roof of a tunnel and are designed for ease of installation, measurement accuracy and mechanical re-set as required (up to 150mm of measurement displacement without re-set).



RockMonitor XM Telltale

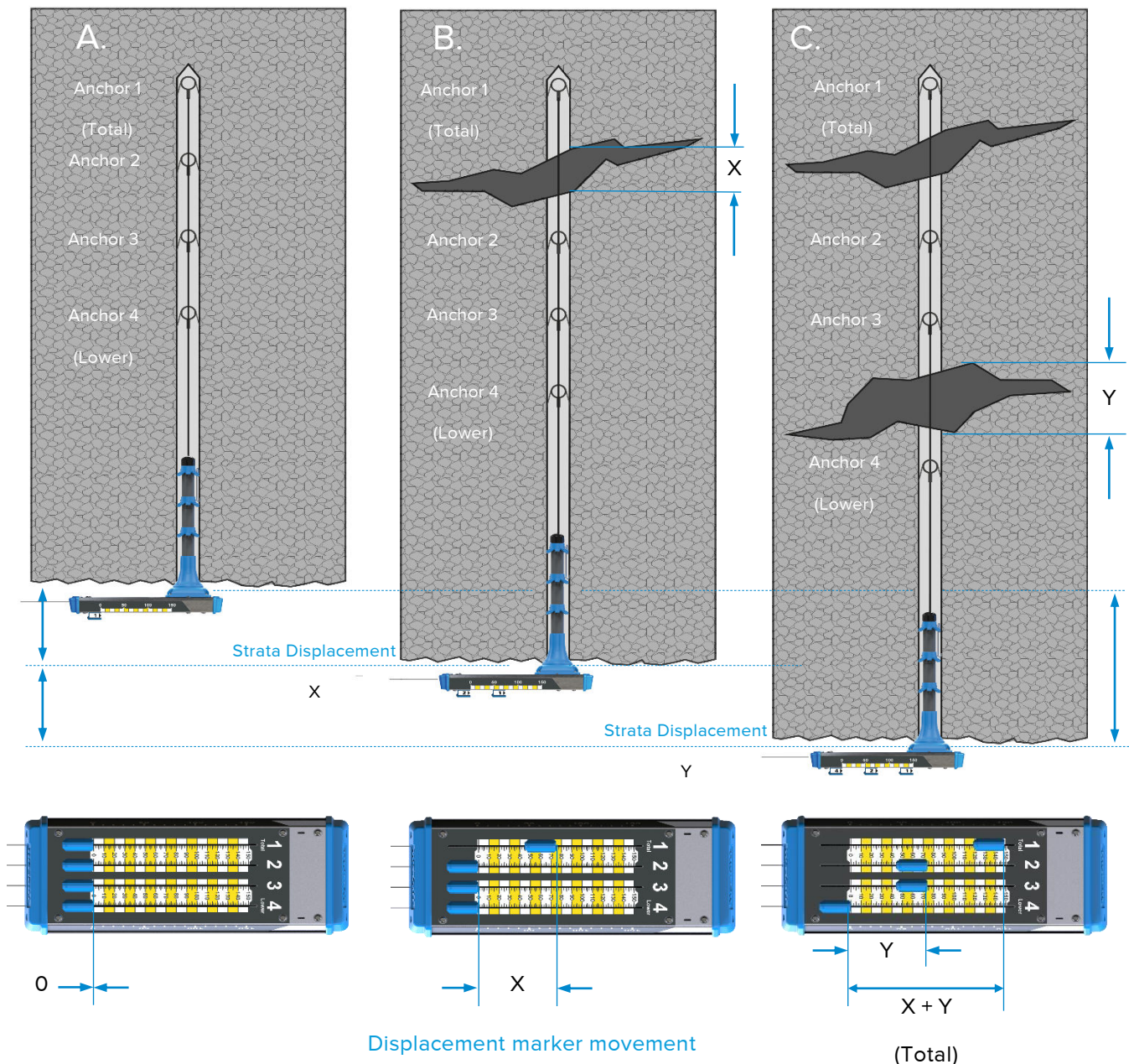
## 1.1 Main features

- Continuous monitoring of strata displacement
- Strata displacement measurement up to 150mm (without reset)
- Resettable height measurement for movement in excess of 150mm
- Two or four monitoring points (anchor heights) between 0.6m and 16m
- Highly visible display of displacement measurement on-device
- Simple and robust installation methodology

## 1.2 Theory of operation

The RockMonitor XM Telltales can be configured with either two or four measurement heights. Anchor wires are inserted into a borehole drilled either in the roof or sidewall of a roadway and secured into position using spring anchors connected to the ends of the wires. The tube section of the telltale is then inserted into the borehole with securing features automatically gripping the sides of the borehole and keeping the telltale in position in the tunnel roof or side wall. Any displacement of the strata occurring within the height of the anchors will cause the body of the RockMonitor XM Telltale to move relative to the anchor. The anchor wires connect the anchor points to mechanical measurement units housed within the body of the telltale. Movements are then shown visually on-device and can be recorded at determined manual reading intervals.

The use of multiple anchor points allows more detailed insight into where the strata displacement is occurring. A typical installation would use a minimum of two anchors, placing one above the bolted height and one within the bolted height. This can provide valuable insight into the effectiveness of the chosen support strategy. The four-anchor version provides even more data with which to optimise bolting strategies or support strata investigations.



## Displacement measurement

Installation position. No strata movement indicated – all displacement markers read 0mm on the measurement scale.

Displacement occurs between anchor 1 and 2 as shown by 'X'. Anchor 1 displacement marker moves to indicate the amount of displacement.

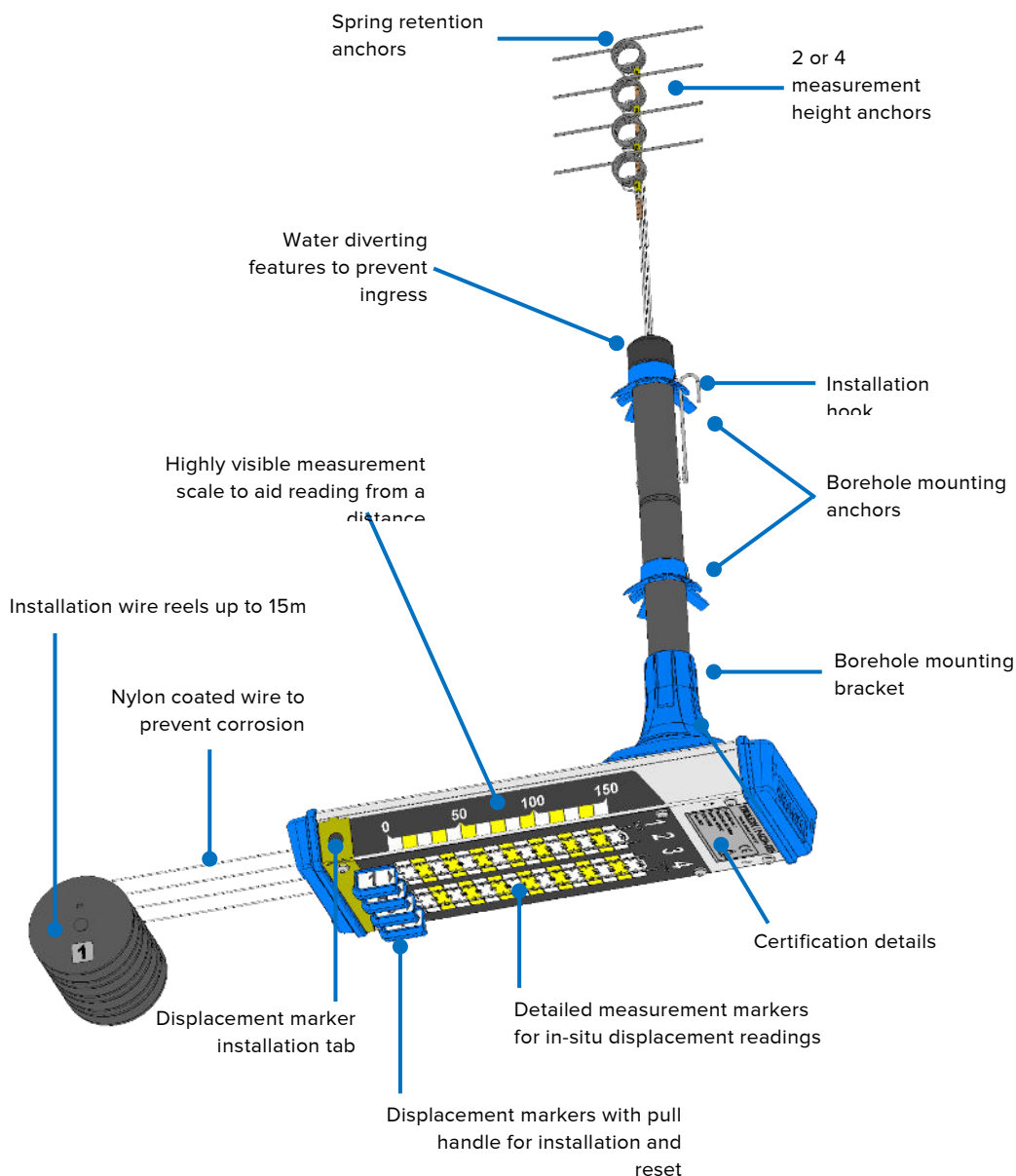
Second displacement occurs between anchors 3 and 4 as shown by 'Y'. Anchor 2 and 3 displacement markers move to represent displacement figure 'Y', whilst anchor 1 displacement marker moves to represent a total distance of 'X + Y'.

### 1.3 RockMonitor XM Telltale – TX5021

The mechanical measurement system is housed within a robust stainless-steel enclosure that remains visible after installation in the tunnel roof. Anchor springs fix the anchor wires into the borehole at the required measurement depths (within or above the bolted height) whilst the vertical tube is secured into the borehole by the three borehole grippers. This allows the stainless-steel body of the device to maintain a low profile to the roof or side wall.

As displacement occurs, the anchor wires pull a mechanical assembly through the instrument body to measure strata displacement. The anchor wires are secured to the measurement mechanism using clamping devices with a spring providing tension on the wires to ensure accurate measurement. Measurement indicators give easily visible local information regarding displacement of each individual anchor.

The figure below shows an individual telltale with four anchors (note that the full lengths of the anchor wires are not shown).



## 2. Certification and Approvals

### 2.1 Mechanical non-electrical equipment

The RockMonitor XM Mechanical Telltale is a mechanical, non-electrical equipment that is operated and installed under human power only. The instrument has no potential ignition hazards which are not solely due to the materials of construction. The RockMonitor XM Mechanical Telltale is therefore outside the scope of the ATEX Directive and does not require IECEx certification for use in Hazardous Locations.

To minimise the risk of electrostatic discharge which may occur as a function of the use of the equipment, please follow the guidance provided in IEC TS 60079-32-1 and any additional local regulations.

Additional information for the risk assessment associated with the materials of construction:

1. Materials used in the construction of the Telltale (internal and external) do not contain, by mass:
  - more than 15% in total of aluminium, magnesium, titanium and zirconium, and
  - more than 6 % in total of magnesium, titanium and zirconium
2. Exposed external parts of the Telltale are not painted or coated with preparations containing, in metallic form: aluminium, magnesium, titanium or zirconium.
3. The projected surface area of any external non-metallic part of the enclosure is less than 10 000 mm<sup>2</sup>.



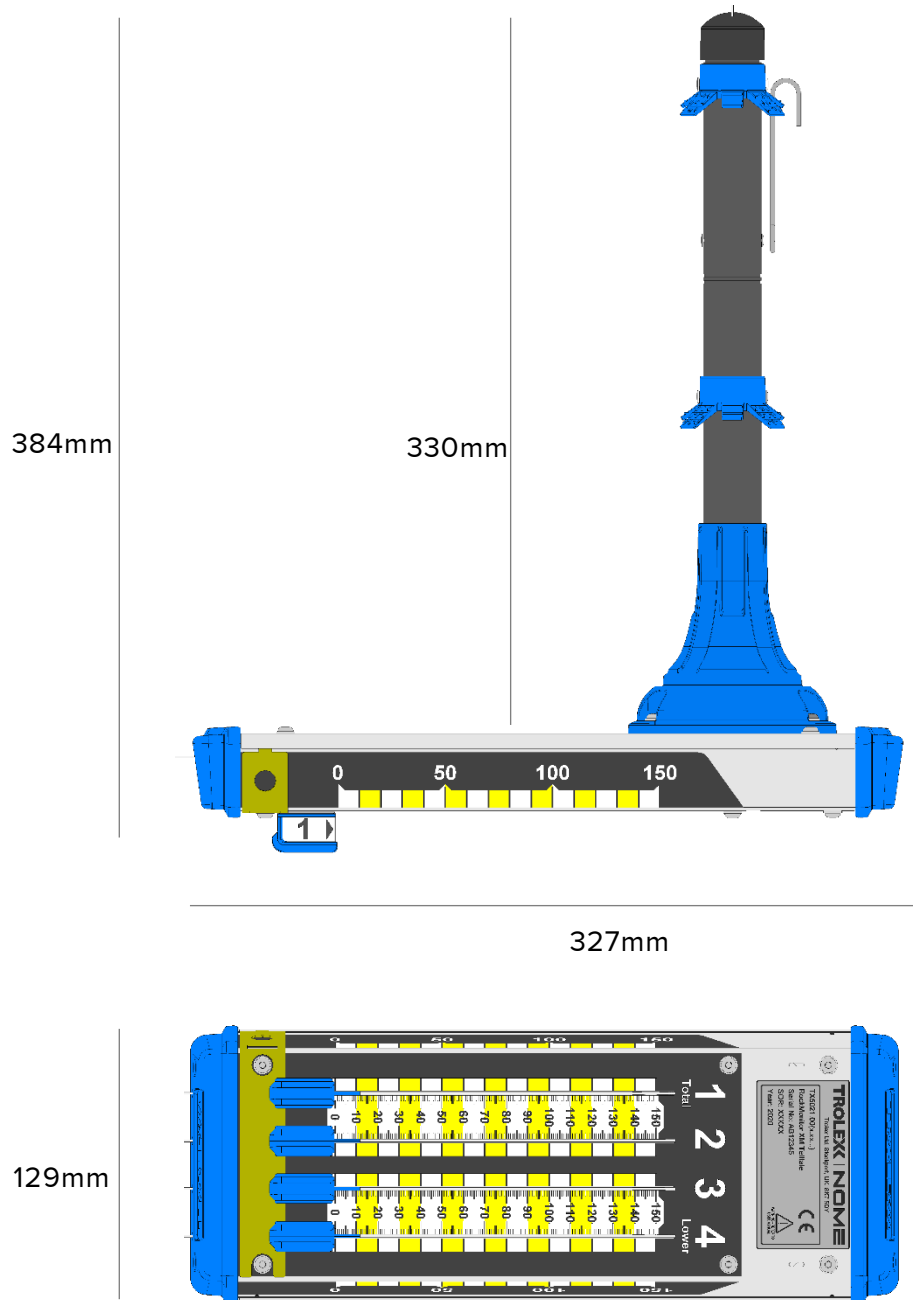
## 3. Technical Information

### 3.1 Product Specifications

#### TX5021 RockMonitor XM Telltale

Ambient temperature:	0 °C to +50 °C
Storage temperature:	-20 °C to +50 °C
Humidity:	10 to 98%
Protection classification:	Dust and waterproof to IP54
Housing materials:	SS316, PC/ABS
Net weight:	2.1kg
Measurement points:	2 or 4
Borehole diameter:	35 to 45 mm
Measurement range:	0 to 150 mm (without reset)
Accuracy:	<1.0mm
Repeatability:	<0.1mm

3.2 Product Dimensions



## 4. Hardware Installation

The installation of the product must only be carried out by competent personnel. Each installation needs to be considered with reference to the local safety regulations and authorities. Refer to the following standards for additional guidance:

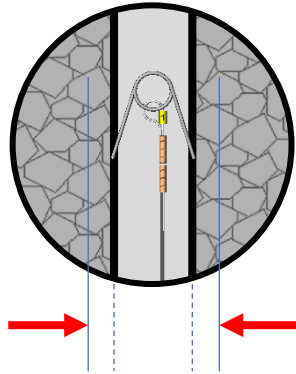
- IEC/EN 60079-14
- IEC/EN 60079-25

Refer to the Certification Section of this User Manual and to the relevant certificates for any installation parameters and special conditions of safe use.

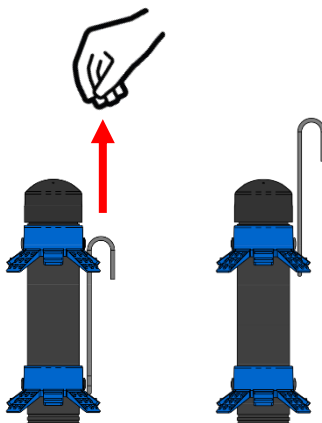
### 4.1 Telltale Installation

To install a RockMonitor XR Telltale into a tunnel roof or sidewall, follow the procedure below:

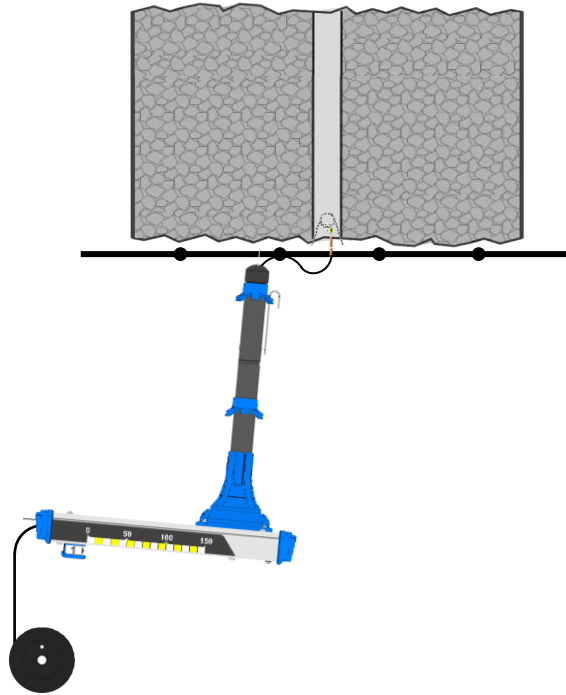
1. Drill a 35mm-45mm borehole to the height required for the topmost anchor.



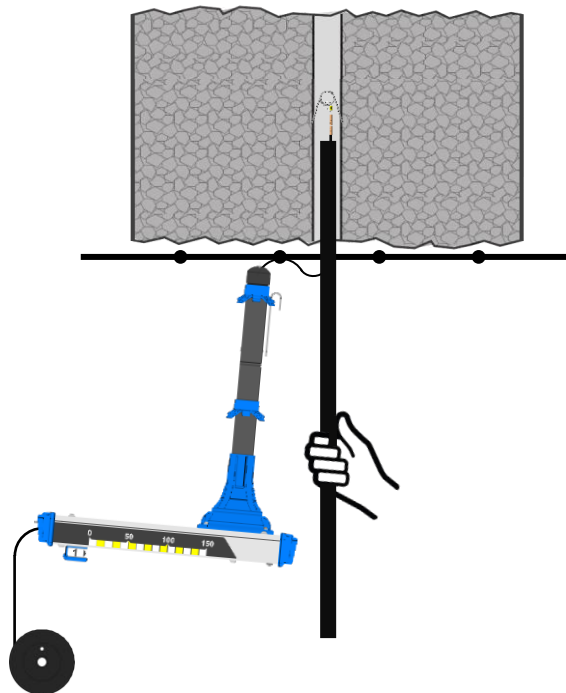
2. Cut a hole in the roof mesh large enough to ensure there is no interference to the telltale body once installed.
3. Using the integrated installation hook located in the top anchor, hang the device off the roof mesh as close to the bore hole opening as possible. Ensure the yellow installation hold-off tab is left in place.



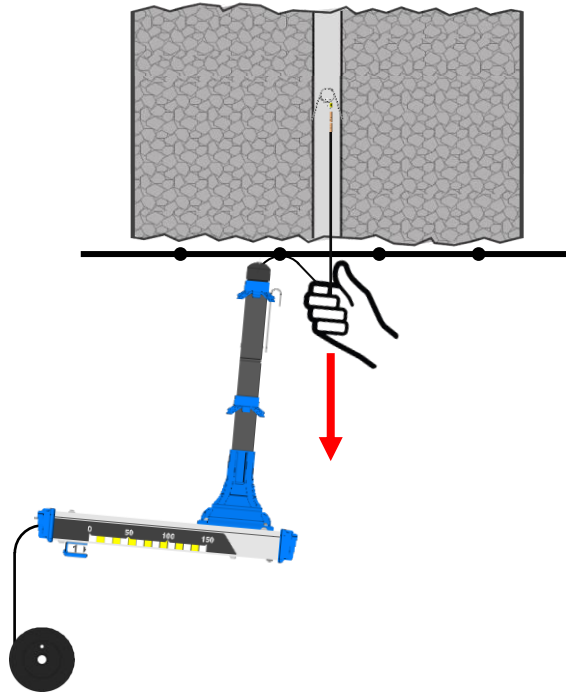
4. Remove the wire reel for anchor 1 and allow to unspool.



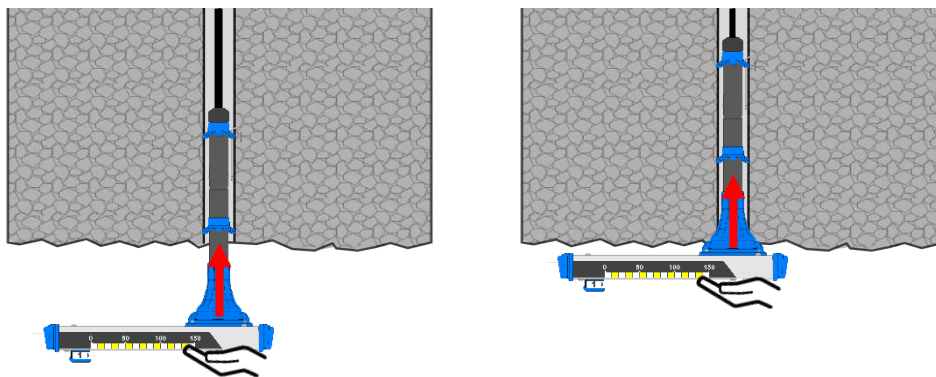
5. Using an installation rod push anchor 1 up the borehole to the required height. Repeat these steps for anchors 2, 3 and 4.



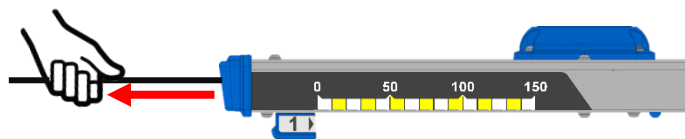
- Pull down on each wire placed into the bore hole to ensure the spring anchors find a lie within the hole.



- Unhook the device from the mesh and push the device as far as it will go into the borehole taking care to push from the center of the device body.

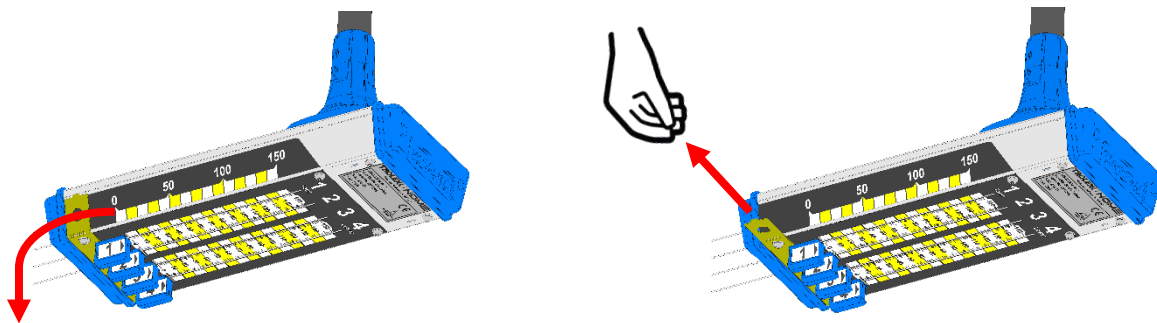


- Pull the slack cable through the device from the back end as you do this.

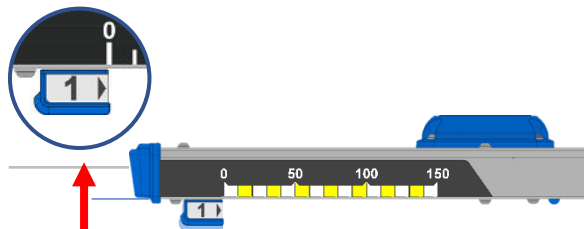


- Device orientation will be dependent on local strata conditions and should be determined on a case by case basis. However, use of the side scale for viewing at distance requires the telltale to be mounted perpendicular to the direction of travel.

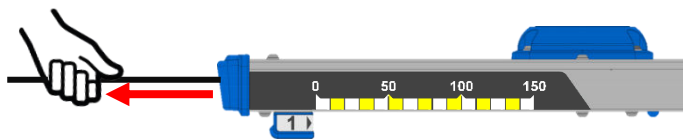
10. Remove the handle installation hold-off tab (the yellow plastic strip).



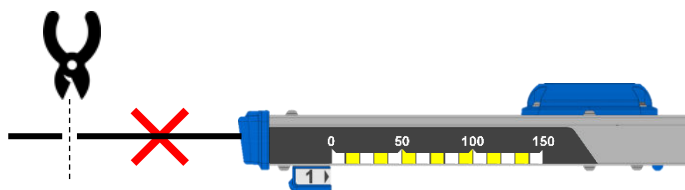
11. Ensure all marker handles sit flush against the device and are not stuck in the down position.



12. Pull on each cable coming out of the device to remove slack in the line.



13. Excess cable can be removed with wire cutters. However, care must be taken to ensure there is enough cable to allow for potential resetting of anchors.



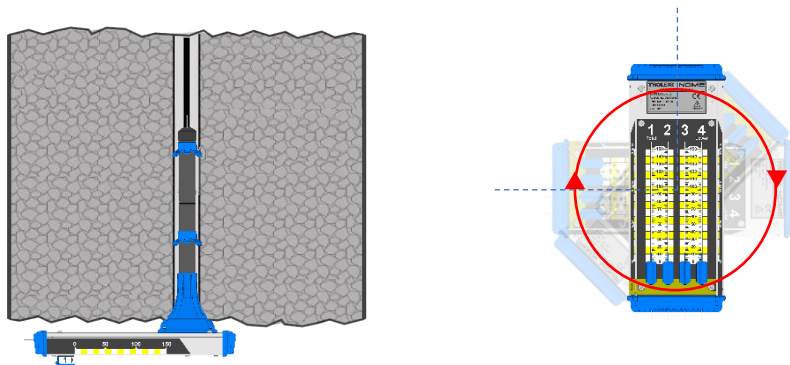
14. It is recommended that a suitable amount of cable remains after cutting to allow for any number of anchor height resets. Each reset requires 150mm of cable, plus 100m of remaining cable to allow for tensioning and to prevent the end of the cable being lost inside the device. Please calculate the cable trim length based on your system requirements.

## 4.2 Telltale Orientation

It is important to consider the appropriate installation orientation of individual Telltales when fitting or expanding a RockMonitor XM system. Telltale devices have been designed to allow for various installation options when mounting into a mine roof or sidewall whilst offering the maximum protection from unnecessary ingress. Please follow the orientation installation guide below.

### Roof Mounting

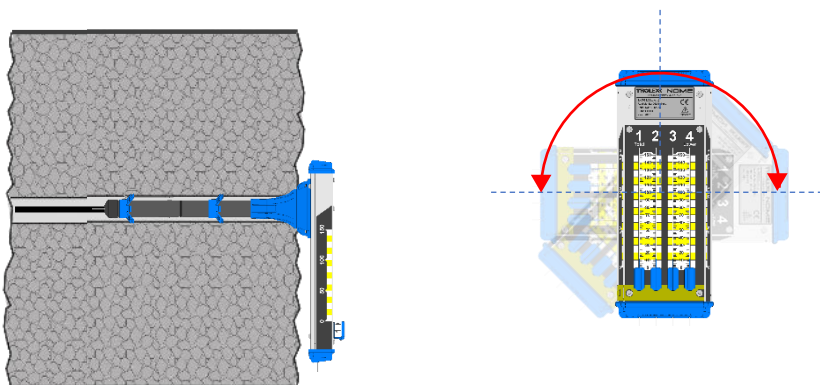
A device can be mounted directly into the mine roof with the Telltale body being positioned in any degree of angle about the bore hole centre. It is recommended to orientate the device so that it is perpendicular with the walls of the roadway. This will allow for the side scales on the device and the anchor indicators to be viewable down the roadway from both sides.



Roof Mounting Orientation

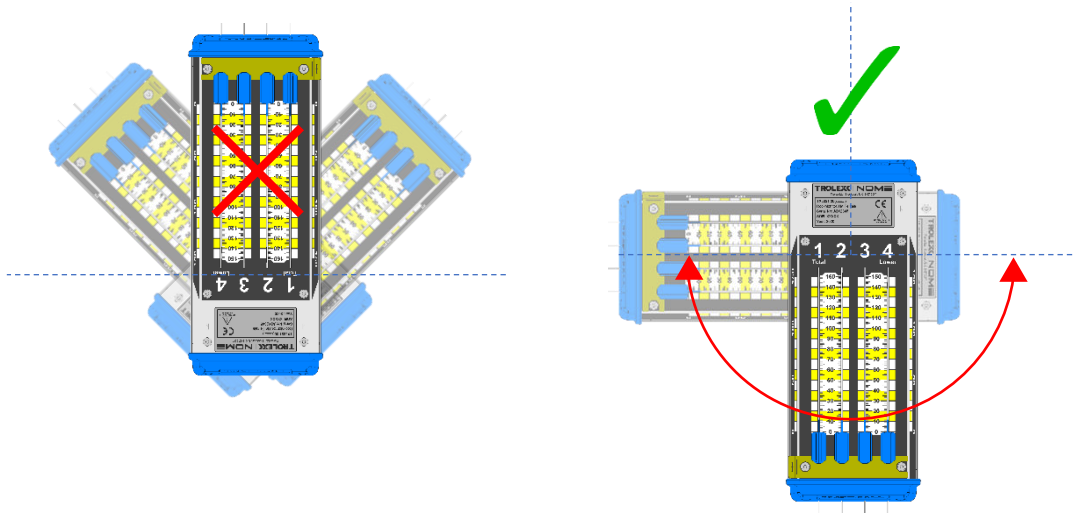
### Sidewall Mounting

A device can be mounted directly into a mine sidewall with the Telltale body being positioned in a fixed orientation about a 180-degree angle around the bore hole centre. It is recommended to orientate the device so that the scale label is on or below a horizontal installation position to ensure suitable in-situ ingress draining takes place.



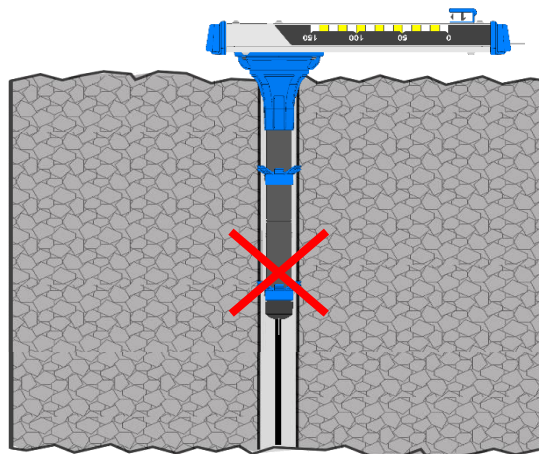
Sidewall Mounting Orientation

During sidewall mounting, the device should never be installed with the scale label positioned above the horizontal installation level.



Incorrect sidewall Telltale mounting

Telltales must never be installed with the bore tube pointing down.



Inverted device mounting

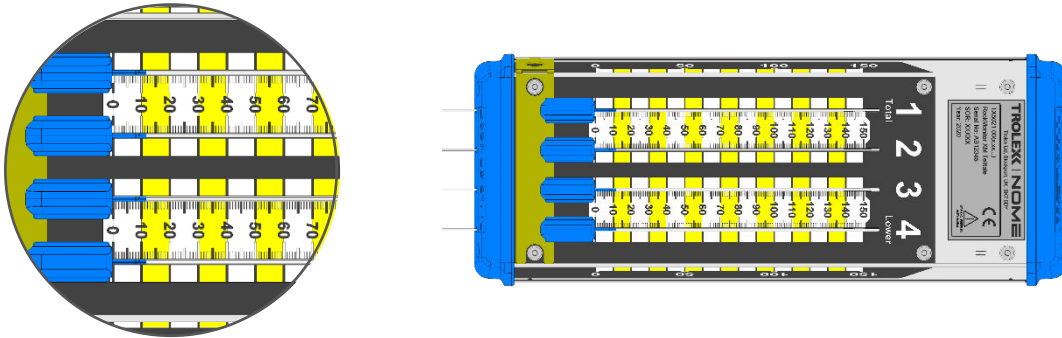


## 5. General Operation

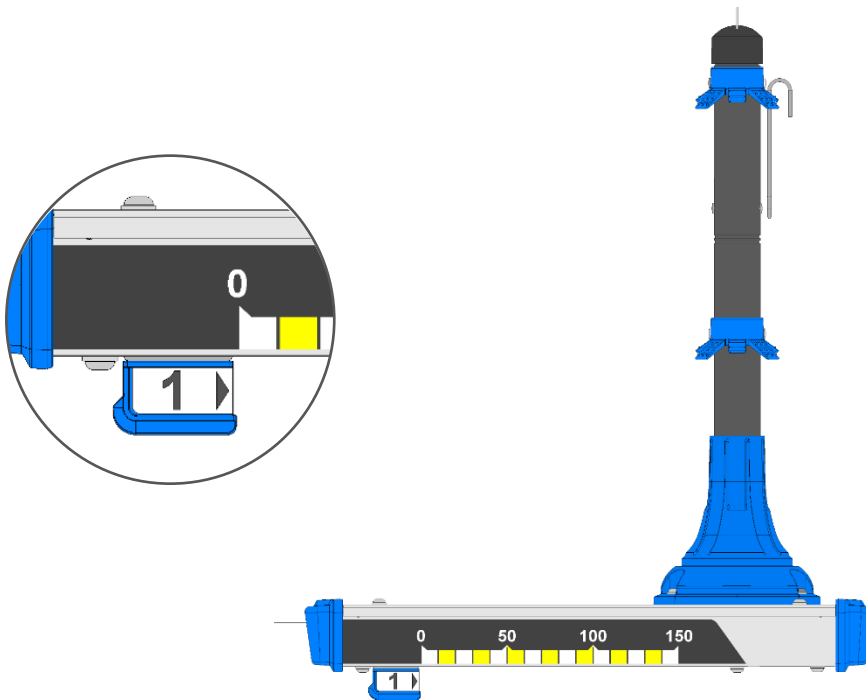
### 5.1 Measuring Displacement

The Telltale provides local indication of displacement by way of linear scales on the device. These are provided as a high visual indication and there are two types of visual scale on the device:

1. A fine scale on the underside of the device which provides measurement of displacement to the millimetre. The scale should be read from the leading (front) face of the anchor indicators.



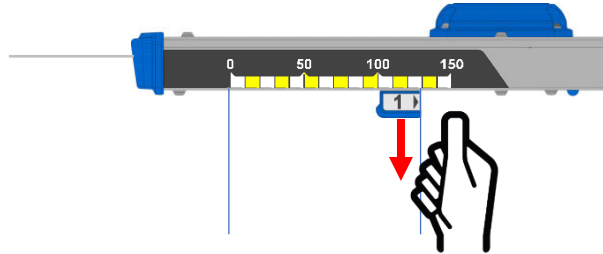
2. A course scale on the sides of the device. These are intended to provide general indication of displacement from a distance in increments of 10mm. Viewing of the side scale from any angle other than perpendicular will result in an inability to judge displacement with any accuracy.



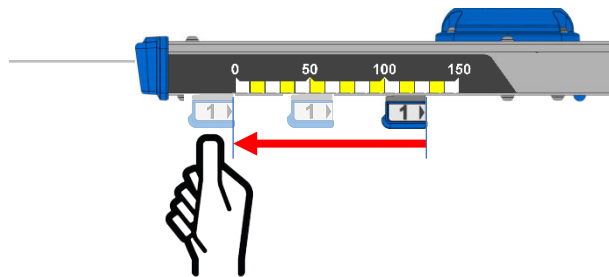
## 5.2 Extending the Measurement Range

The Telltale has a measurement range of 0 to 150mm, however this range can be extended if required. There is facility to manually reset the anchor indicators back to 0 to allow for further travel whilst maintaining the current readings. To reset the telltale, follow the procedure below:

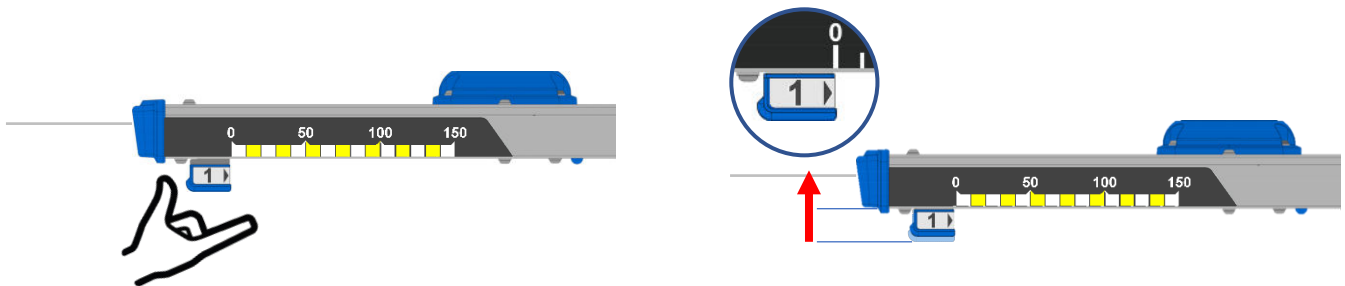
1. On the telltale itself, pull the reset handle down



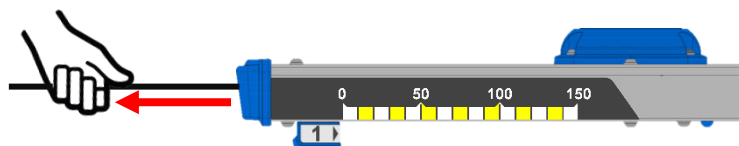
2. Whilst holding the handle down, slide the handle back to the zero position on the scale.



3. Release the handle. Ensure the handle snaps upwards against the device and is not stuck in the down position.



4. Pull on each cable coming out of the device to remove slack in the line.



## 6. Maintenance

The maintenance of the product must only be carried out by competent personnel. Maintenance shall be considered with reference to the local safety regulations and authorities. Refer to the following standards for additional guidance:

- IEC/EN 60079-17

The product shall only be serviced and repaired by Trolex Ltd., or a local Trolex service agent approved by Trolex Ltd. in order to maintain the certification of the product.

### 6.1 Visual Checks

Periodical visual checks should be carried out to assess if there are any issues arising with the Telltales. Check for:

1. Labels on the device are still in place and are not peeling or discolouring. Ensure all labels are clean by following 8.2 below.
2. Check for any damage to the device. Plastic parts should not be cracked or broken which could affect IP rating of the device. The metal housing should not be dented or bent which could cause issues with the mechanical mechanism.
3. Check that the device is still fitted tight against the roof and has not slipped down in the bore hole.

### 6.2 Cleaning Labels

It is recommended to clean the device periodically to ensure linear scales and indicators are clean and readable. The product should only be cleaned with a damp cloth.

### 6.3 Check Mechanism for Seizure or Jamming

Periodically check that the spring mechanisms on the displacement indicators are able to move freely. This can be done by pushing each indicator forward a little and releasing. The indicator should slide back freely to its original position and not stick in place.

### 6.4 Replacing Telltales

The telltale is designed to be a one-time fit into the bore hole, due to the retention required to hold the device in place. If a faulty instrument does need to be removed from a bore hole, then this is possible, but it would require a high degree of force to extract. Take any relevant precautions when doing this to minimise the risk of injury.

## 7. System Troubleshooting and Diagnosis

### 7.1 Reset Handle

The reset handle is part of a spring-loaded mechanism designed for releasing the handle from the anchor wire to allow it to be moved back to zero.

- If the reset handle is difficult to pull down it is not recommended to apply too much force to pull it. Use one hand to brace against the metal body of the device and another to pull the handle down.

If the handle does not snap back into the up position it could also be due to dust ingress. Do not leave the handles stuck in the down position as this means the anchor wire may not be clamped and displacement may not be measured. The handles can be pushed up manually if required, once they are against the body of the device the anchor wire will be clamped.

## 8. Technical Support

Our technical services team are available to provide expert ongoing technical assistance and technical support packages tailored to your specific requirements.

Please contact our technical services team:

Troxex

Tel: +44 (0) 161 483 1435

Email: [service@trolex.com](mailto:service@trolex.com)

Nome Services

Tel: +61 (0) 437 754 904

Email: [service@nomeservices.com.au](mailto:service@nomeservices.com.au)

## 9. Disclaimers

The information provided in this document contains general descriptions and technical characteristics of the performance of the product. It is not intended as a substitute for and is not to be used for determining suitability or reliability of this product for specific user applications. It is the duty of any user or installer to perform the appropriate and complete risk assessment, evaluation and testing of the products with respect to the specific application or use. Trolex | Nome shall not be responsible or liable for misuse of the information contained herein. When instruments are used for applications with technical safety requirements, the relevant instructions must be followed.

All pertinent state, regional, and local safety regulations must be observed when installing and using this instrument. For reasons of safety and to help ensure compliance with documented system data, only Trolex | Nome or its affiliates should perform repairs to components.

Trolex | Nome Ltd. reserves the right to revise and update this documentation from time to time without obligation to provide notification of such revision or change. Revised documentation may be obtainable from Trolex | Nome.

Trolex | Nome Ltd. reserves the right, without notice, to make changes in equipment design or performance as progress in engineering, manufacturing or technology may warrant.

## 10. Revisions

Description	ECR	Date	Initials
Initial Release DRAFT	-	02/06/2020	KH
Document Release	-	08/06/2020	KH

## 11. Feedback

If you have any suggestions for improvements or amendments, or find errors in this publication, please notify us at [marketing@trolex.com](mailto:marketing@trolex.com).

## 12. Trademarks

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