



RST INSTRUMENTS LTD.

Tunnel Convergence Meter Instruction Manual

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RST Instruments Ltd.
11545 Kingston St.,
Maple Ridge, B.C. Canada V2X 0Z5
Tel: (604) 540-1100
Fax: (604) 540-1005
Email: info@rstinstruments.com
Website: www.rstinstruments.com

Tunnel Convergence Meter Instruction Manual

Although all efforts have been made to ensure the accuracy and completeness of the information contained in this document, RST Instruments Inc. reserves the right to change the information at any time and assumes no liability for its accuracy.

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1 GENERAL DESCRIPTION

RST Instruments Tunnel Convergence Meter is used to measure differential angles in the X directions. The Tunnel Convergence Meter System consists of a Tunnel Convergence Meter and a Mounting Bracket so that the system can be installed onto concrete wall in a tunnel. The main application is to measure convergence of a ring of precast concrete segments installed as lining by Tunnel Boring Machine (T.B.M.).

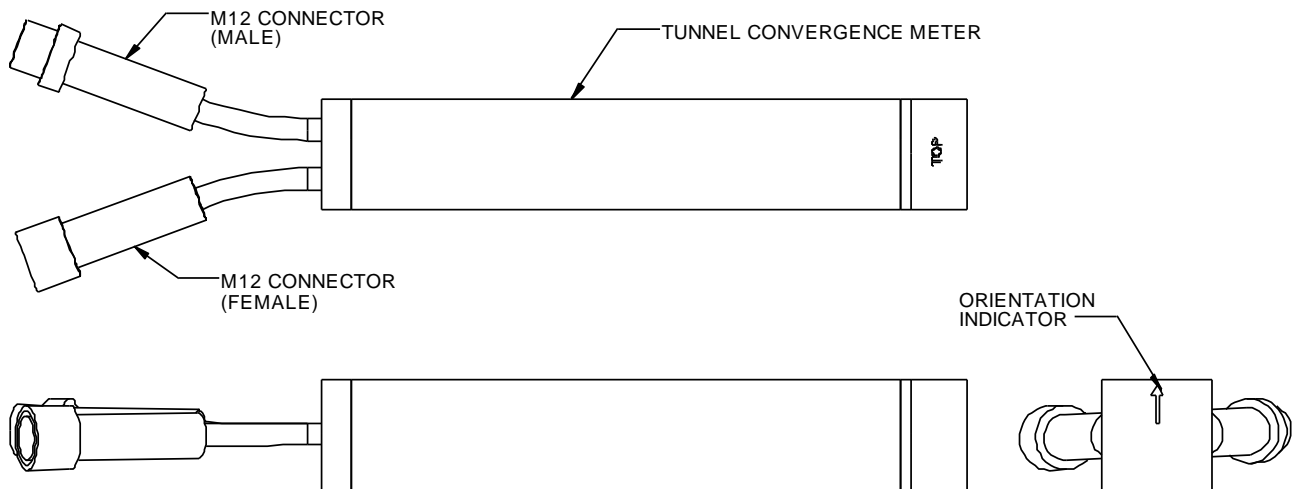


Figure 1: Tunnel Convergence Meter

2 Required Tools/Components

Before beginning the installation of the Tunnel Convergence Meter, ensure that all of the components and tools required for installation are present. See the list below for tools and equipment required for a typical installation:

- Tunnel Convergence Meter
- ¼" -20 UNC Concrete Anchors
- Tunnel Convergence Meter Mounting Bracket
- Medium Size Slotted Screw Driven (for open up Mounting Bracket)
- (4) SS washers, (4) ¼" -20 UNC SS nuts
- Wrench
- Level

3 INSTALLATION

Determine the Tunnel Convergence Meter installation orientation. In general, one Tunnel Convergence Meter is installed on each of the concrete segments of a ring, including the key segment. The Tunnel Convergence Meter can be installed in the middle of the segment or away from middle if it is interfered with other object or any component of the T.B.M.

1. Drill 2 holes for ¼"-20 concrete anchors. Distance between 2 anchors should be 2.75" (69.9mm)
2. Install anchors and allow them to set
3. Use a Slotted Screw Driver to open up the opening on the Mounting Bracket a little bit bigger so that the Tunnel Convergence Meter can slide into it to approximately mid-length

Note: Try to Slide the Tunnel Convergence Meter and open up the slot on the Mounting Bracket at the same time. Do not tighten the fastener on the Mounting Bracket yet.

4. Thread a hex nut onto each anchor until they reach the desired position
5. Place a washer over each anchor
6. Slide the Tunnel Convergence Meter Mounting Bracket onto the anchors
7. Place a washer over each anchor
8. Thread a hex nut onto each anchor and tighten it
9. Orientate the Tunnel Convergence Meter so that the 'Arrow' is always pointed up (see figure 2)
10. Put a level on the Tunnel Convergence Meter to ensure it is horizontally mounted with the arrow pointing upward and The 'Top' is located above
11. Tighten the fastener on the Mounting Bracket

12. Repeat steps 1-11 until all Tunnel Convergence Meters are installed (see figure 3).

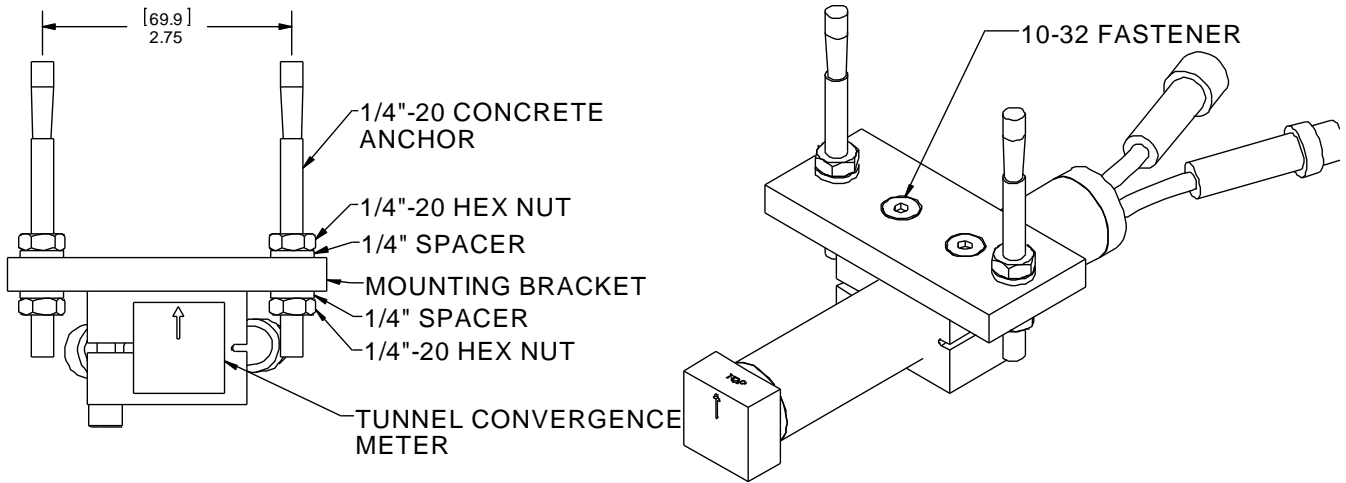


Figure 2: Tunnel Convergence Meter installation detail

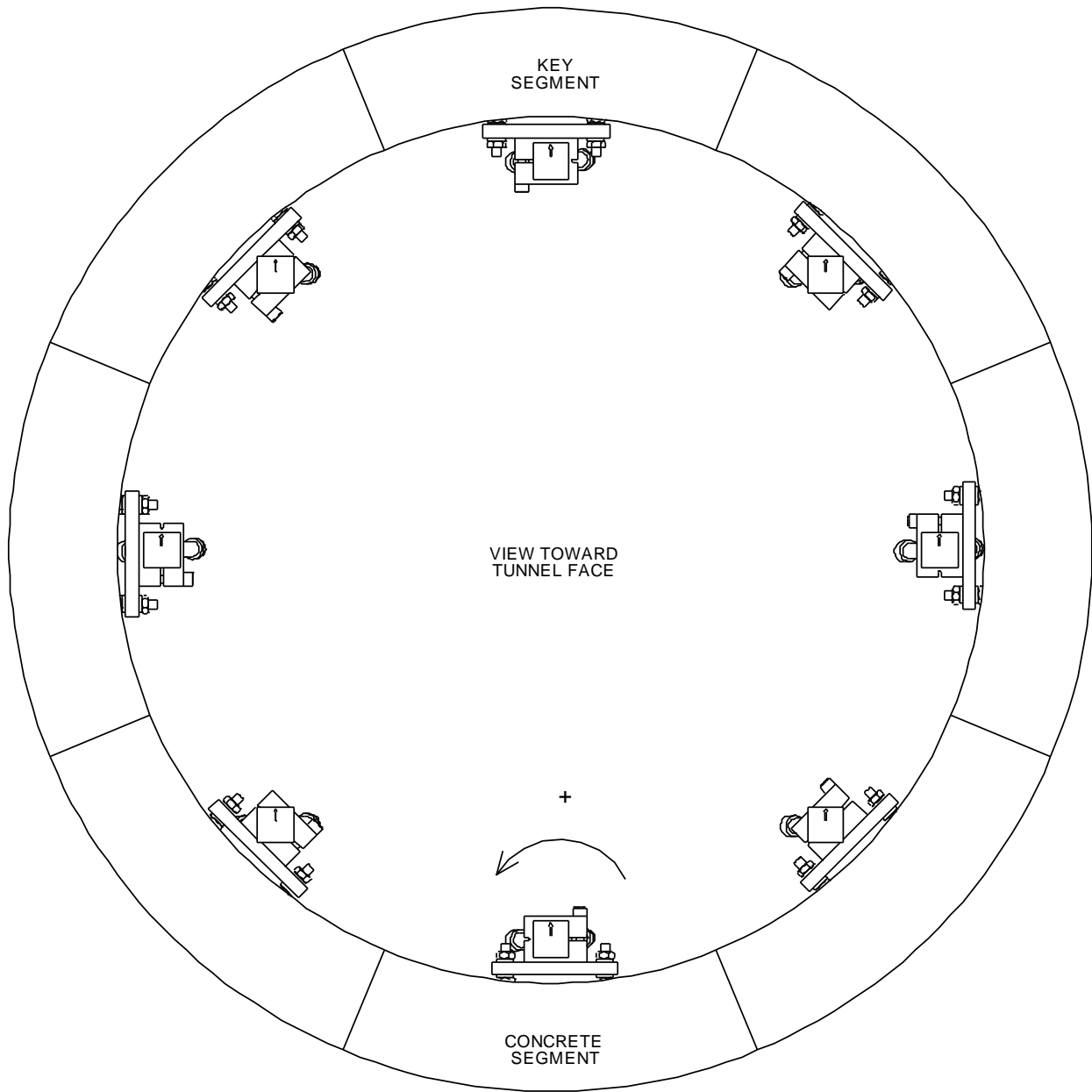


Figure 3: Tunnel Convergence Meter installed on concrete segments in tunnel

4 ELECTRICAL CONNECTIONS

Information regarding your sensor configuration and cable type is listed below and on your Calibration Certificate.

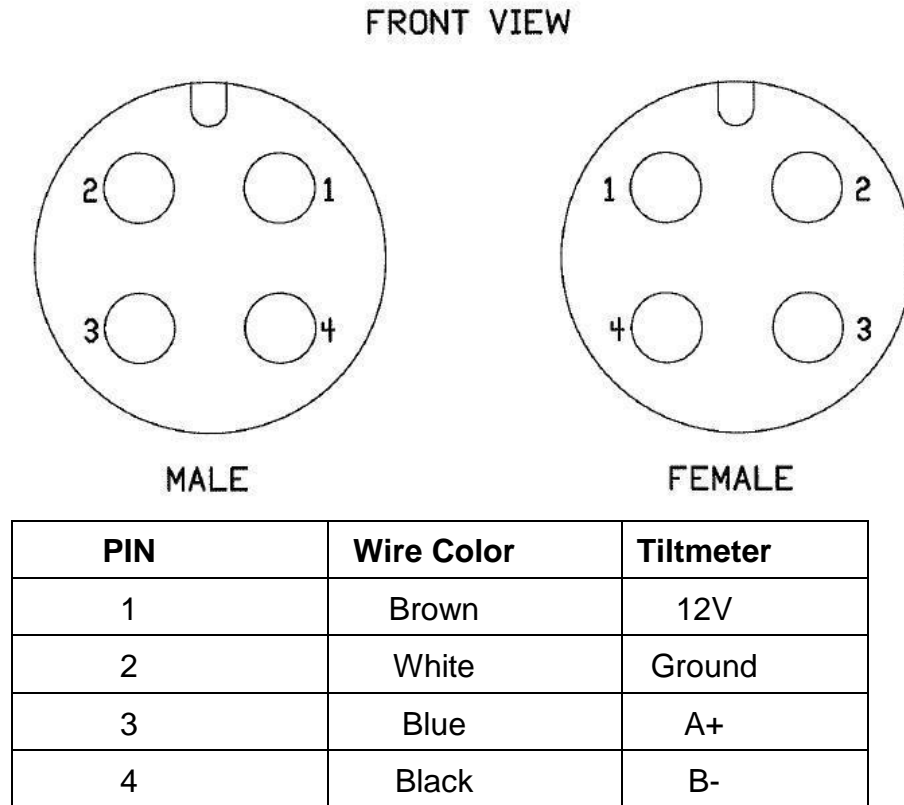


Figure 4: Pins configuration for M12 micro-change connector

5 Specifications

5.1 ENVIRONMENTAL	
Operating temperature	-40°C to +80°C
5.2 ELECTRICAL	
Sensor	One MEMS Tilt Sensor(s)
Range	± 15 Degree Standard
Resolution	0.0013 Degree
Null Repeatability	<0.004 Degree
Signal Cable	22 Gauge Shielded Twisted
Datalogger Readout	FlexDaq 1000/800 Field PC

Appendix A: Sample Calibration Certificate (Digital Output)



Calibration Record

200 - 2050 Hartley Ave., Coquitlam, British Columbia, Canada V3K 6W5
 Tel: 604.540.1100 • Fax: 604.540.1005 • Toll Free: 1.800.665.5599 (North America only)
 e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

MEMS Tunnel Concrete Segment Tiltmeter - Bussed

Customer: RST-06
 Work Order Number: Q0000000
 Model: ICTCSCMS
 Serial Number: ET0735
 Date: 17-Feb-10
 References: RST-06
 Referenced to National Standards Annually

A-Axis

Face Frame Angle Degrees	A+/-	Sin \ominus	Swing Right Sin \ominus	Swing Left Sin \ominus	Mean Sin \ominus	Error Sin \ominus
5	L	0.08716	0.08718	0.08721	0.08719	-0.00004
4	L	0.06976	0.06975	0.06976	0.06976	0.00000
3	L	0.05234	0.05239	0.05239	0.05239	-0.00005
2	L	0.03490	0.03496	0.03495	0.03495	-0.00005
1	L	0.01745	0.01751	0.01748	0.01749	-0.00004
0		0.00000	0.00000	0.00003	0.00001	-0.00001
1	R	-0.01745	-0.01748	-0.01747	-0.01747	0.00002
2	R	-0.03490	-0.03485	-0.03481	-0.03483	-0.00007
3	R	-0.05234	-0.05231	-0.05227	-0.05229	-0.00004
4	R	-0.06976	-0.06979	-0.06979	-0.06979	0.00003
5	R	-0.08716	-0.08711	-0.08711	-0.08711	-0.00005

Calibrated By: J. Chu

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