



# INSTRUCTION MANUAL

## FISSUROMETER

### Model RTF

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This product should be installed and operated only by qualified personnel. Its misuse is potentially dangerous. The Company makes no warranty as to the information furnished in this manual and assumes no liability for damages resulting from the installation or use of this product. The information herein is subject to change without notification.

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E1071A-020320

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# 1 RTF 1D UNIAXIAL FISSUROMETER

## 1.1 DESCRIPTION

The RTF Surface Fissurometer is designed to monitor relative movements of adjacent surfaces across cracks in rock or in construction joints. Typical applications include:

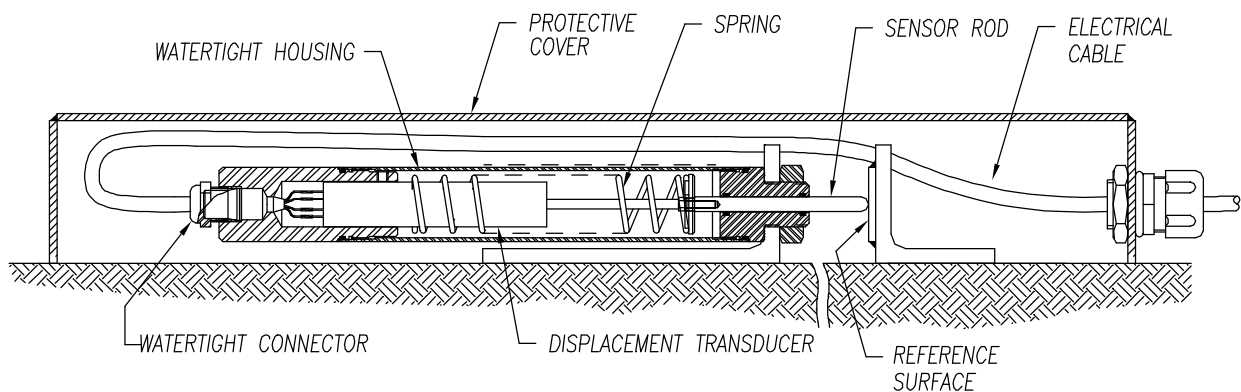
- Measuring movements at construction joints on concrete
- Monitoring deformation cracks on brick, masonry, concrete structures or rock

The RTF comprises two main components: the measuring module and the installation brackets. The measuring module consists of a displacement transducer housed in a rugged cylindrical enclosure which is end-fitted with a spring-loaded sliding rod. The displacement transducer is an LVDT, a linear potentiometer or a vibrating wire transducer depending on customer's wishes. The installation brackets are anchored across a crack or a joint. One bracket supports the measuring module whereas the other is fitted with the reference surface.

Movement between the two anchors is sensed by the transducer thanks to its sliding rod always in contact with the reference surface.

A steel protective cover is available to ensure a better protection for the fissurometer.

The RTF is delivered with a Calibration Data Sheet.



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FIGURE 1: RTF 1D with potentiometer

## 1.2 INSTALLATION

The RTF 1D fissurometer is installed astride the joint or crack to be monitored with anchor bolts. A steel positioning template fitted with six holes permit to locate holes emplacements for the mounting of the brackets and protective cover on the surface being monitored.

Once the six holes are drilled, fasten the two fissurometer's steel brackets. Screw the sensor to its bracket and lock it with the hexagonal nut according to the expected movement of the joint (opening or closing).

The sensor can be provided with a short length of electrical cable requiring a splice in the field or a sufficient length of cable to reach the reading panel. In cases where the electrical cable length is sufficient, the cable must be threaded through the BX connector on one end of the protective cover before fastening the cover.

In cases where the sensor is provided with a short length of electrical cable, the connection with the extension cable should be done using a Scotchcast #82A-7 splicing kit at a distance allowing the splice to be located under the protective cover.

***NOTE: Make sure to proceed to wiring in respect with wiring code provided with the Calibration Data Sheet. Never invert the supply wires.***

After complete installation of the fissurometer, take an initial reading.

## 1.3 READINGS AND INTERPRETATION

An RTF equipped with an LVDT can be read with an ACCULOG-X readout. An RTF equipped with a potentiometer can be read with a REP-1 readout. For information about these readout units, please refer to separate instruction manuals.

In order to read a RTF equipped with a vibrating wire transducer, proceed as follow: when using a MB-6T, put the position GAGE selector to **position 2(JM)** and the THERMISTOR selector (if applicable) to position:

<u>Thermistor type</u>	<u>Position</u>
2KΩ	A
3KΩ (standard)	B
10KΩ	C

An increase in the readings according to the initial reading taken after installation indicates an opening of the joint over which the fissurometer is installed. The opposite means, consequently, a closing of the joint.

For the measurement of the displacement, the following equation applies using Linear Units displayed by the MB-6T:

Where:	<b>D</b>	=	$(L_1 - L_0) \times C.F.$
	D	=	The displacement in mm
	$L_0$	=	Initial reading with MB-6T
	$L_1$	=	Current reading with MB-6T
	C.F.	=	Calibration factor in mm/Linear Units

Example

	$L_0$	=	2500
	$L_1$	=	6000
	C.F.	=	0.001651 mm./Linear Units
	D	=	$(6000 - 2500) \times 0.001651$ 5.779mm

Note that increasing numbers indicate increasing displacement.

The measured displacement divided by the gage length can be said to represent the change in strain in concrete or rock.

## 1.4 ENVIRONMENTAL FACTORS

Since the purpose of the jointmeter installation is to monitor site conditions, factors which may affect these conditions should always be observed and recorded. Seemingly minor effects may have a real influence on the behavior of the structure being monitored and may give an early indication of potential problems. Some of these factors include, but are not limited to: blasting, rainfall, tidal levels, excavation and fill levels and sequences, traffic, temperature and barometric changes, changes in personnel, nearby construction activities, seasonal changes, etc.

The RTF can also be read with a data acquisition system.

## 2 RTF 3D TRIAXIAL FISSUROMETER

### 2.1 DESCRIPTION

The RTF 3D allows simultaneous measurements in three orthogonal directions. It comprises the following parts:

- Up to 3 measuring modules
- A reference stainless-steel cubic prism
- Two brackets, one supporting the measuring modules, and one the cubic prism
- One or two spacing plates

- Three PVC positioning blocks and/or one positioning template consisting of a steel plate fitted with holes

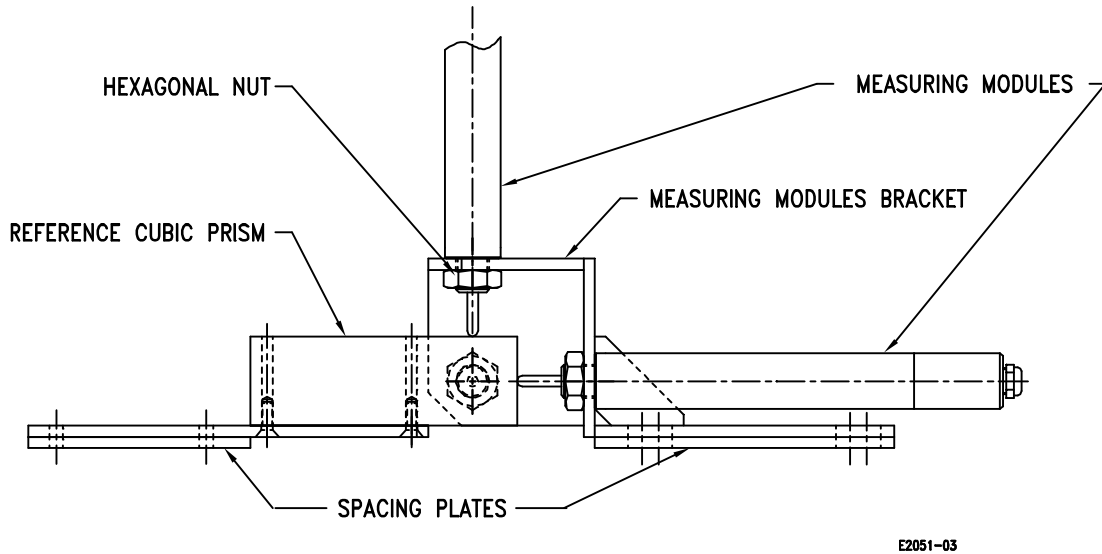


Figure 2: RTF 3D

## 2.2 INSTALLATION

The RTF 3D must be installed on a plane surface astride the crack or joint. It can be anchored to the surface using either bolts or groutable lengths of Rebars.

Prior to installation, make sure that both surfaces on each side of the crack/joint are at the same level. If not, compensate using grout.

Two methods can be used to locate holes emplacement: using the positioning steel template (refer to Section 1.2), or using the PVC positioning blocks shown below.



FIGURE 3: PVC Positioning Block

In that second case, proceed as follows:

1. Mount the bracket with the cubic prism at the proper location
2. Thread the PVC positioning blocks into the other bracket
3. Install that bracket such a way that the PVC positioning blocks sit on the cubic prism
4. Locate the holes emplacements, then bore
5. Install the spacing plate(s)
6. Install the two brackets, making sure that all the screws are well tightened
7. Remove the PVC positioning blocks and install the measuring modules

### **2.3 READINGS AND INTERPRETATION**

Refer to Section 1.3

### 3 SPECIFICATIONS

MODEL:	RTF-05	RTF-25		RTF-40	RTF-50
RANGE* in mm:	±2.5	±12.5		±19	±25
TYPE OF TRANSDUCER**:	LVDT	VW	LP	LVDT	LP
ACCURACY:	1%, 0.5% or 0.25% of FS according to the model	0.1% OF F.S.	1%, 0.25% or 0.1% of FS according to the model	1%, 0.5% or 0.25% of FS according to the model	1%, 0.25% or 0.1% of FS according to the model
SUPPLY VOLTAGE:	6.5 V DC	---	6.5 VDC	6.5 V DC	6.5 V DC
OPERATING TEMPERATURE:	-55°C to +60°C	-27°C TO +65°C	-55°C TO +125°C	-55°C to +125°C	-55°C to +125°C
ELECTRICAL CABLE:	BCP-250: Shielded 4 conductor cable with PVC jacket, 22 AWG, 6.35 mm OD.	IRC-41A(P): 2 twisted pairs 22 AWG, sheilded, φ ext. 6.2mm	BCP-250: Shielded 4 conductor cable with PVC jacket, 22 AWG, 6.35 mm OD.	BCP-250: Shielded 4 conductor cable with PVC jacket, 22 AWG, 6.35 mm OD.	BCP-250: Shielded 4 conductor cable with PVC jacket, 22 AWG, 6.35 mm OD.
<b>DIMENSIONS in mm</b>					
MEASURING MODULE	OD: LENGTH:	32 350 (For a potentiometer-equipped RTF-50. Length may change with other models)			
BRACKETS	RTF 1D: RTF 3D:	127 x 76 x 51 high and 51 x 76 x 51 high 230 x 76 x 57 high (Including reference cube) and 260 x 85 x 95 high			
PROTECTIVE COVER	RTF 1D: RTF 3D:	457 x 185 x 64 high 660 x 470 x 420 high			
WEIGHT in kg (approx.)	RTF 1D: RTF 3D:	1.3 9			

\*Other ranges available upon request

\*\*Fiber-optic transducers are available on request

LP: Linear Potentiometer

VW: Vibrating wire

## 4 MISCELLANEOUS

### CONVERSION FACTORS

	To Convert From	To	Multiply By
LENGTH	Microns	Inches	3.94E-05
	Millimeters	Inches	0.0394
	Meters	Feet	3.2808
AREA	Square millimeters	Square inches	0.0016
	Square meters	Square feet	10.7643
VOLUME	Cubic centimeters	Cubic inches	0.06101
	Cubic meters	Cubic feet	35.3357
	Liters	U.S. gallon	0.26420
	Liters	Can-Br gallon	0.21997
MASS	Kilograms	Pounds	2.20459
	Kilograms	Short tons	0.00110
	Kilograms	Long tons	0.00098
FORCE	Newtons	Pounds-force	0.22482
	Newtons	Kilograms-force	0.10197
	Newtons	Kips	0.00023
PRESSURE AND STRESS	Kilopascals	Psi	0.14503
	Bars	Psi	14.4928
	Inches head of water*	Psi	0.03606
	Inches head of Hg	Psi	0.49116
	Pascal	Newton / square meter	1
	Kilopascals	Atmospheres	0.00987
	Kilopascals	Bars	0.01
	Kilopascals	Meters head of water*	0.10199
TEMPERATURE	Temp. in °F = (1.8 x Temp. in °C) + 32		
	Temp. in °C = (Temp. in °F - 32) / 1.8		

\* At 4 °C

E6TabConv-990505

Temp. °C	Reading in Ohms			Temp. °C	Reading in Ohms		
	With a 2K Thermistor	With a 3K Thermistor	With a 10K Thermistor		With a 2K Thermistor	With a 3K Thermistor	With a 10K Thermistor
-50		201100	670500	1	6208	9310	31030
-49		187300	670500	2	5900	8851	29500
-48		174500	624300	3	5612	8417	28060
-47		162700	581700	4	5336	8006	26690
-46		151700	542200	5	5080	7618	25400
-45		141600	440800	6	4836	7252	24170
-44		132200	472000	7	4604	6905	23020
-43		123500	411700	8	4384	6576	21920
-42		115400	384800	9	4176	6265	20880
-41		107900	359800	10	3980	5971	19900
-40	67320	101000	336500	11	3794	5692	18970
-39	63000	94480	315000	12	3618	5427	18090
-38	59000	88460	294900	13	3452	5177	17260
-37	55280	82870	276200	14	3292	4939	16470
-36	51800	77660	258900	15	3142	4714	15710
-35	48560	72810	242700	16	3000	4500	15000
-34	45560	68300	227700	17	2864	4297	14330
-33	42760	64090	213600	18	2736	4105	13680
-32	40120	60170	200600	19	2614	3922	13070
-31	37680	56510	188400	20	2498	3748	12500
-30	35400	53100	177000	21	2388	3583	11940
-29	33280	49910	166400	22	2284	3426	11420
-28	31300	46940	156500	23	2184	3277	10920
-27	29440	44160	147200	24	2090	3135	10450
-26	27700	41560	138500	25	2000	3000	10000
-25	26080	39130	130500	26	1915	2872	9574
-24	24580	36860	122900	27	1833	2750	9165
-23	23160	34730	115800	28	1756	2633	8779
-22	21820	32740	109100	29	1682	2523	8410
-21	20580	30870	102900	30	1612	2417	8060
-20	19424	29130	97110	31	1544	2317	7722
-19	18332	27490	91650	32	1481	2221	7402
-18	17308	25950	86500	33	1420	2130	7100
-17	16344	24510	81710	34	1362	2042	6807
-16	15444	23160	77220	35	1306	1959	6532
-15	14596	21890	72960	36	1254	1880	6270
-14	13800	20700	69010	37	1203	1805	6017
-13	13052	19580	65280	38	1155	1733	5777
-12	12352	18520	61770	39	1109	1664	5546
-11	11692	17530	58440	40	1065	1598	5329
-10	11068	16600	55330	41	1024	1535	5116
-9	10484	15720	52440	42	984	1475	4916
-8	9932	14900	49690	43	945	1418	4725
-7	9416	14120	47070	44	909	1363	4543
-6	8928	13390	44630	45	874	1310	4369
-5	8468	12700	42340	46	840	1260	4202
-4	8032	12050	40170	47	808	1212	4042
-3	7624	11440	38130	48	778	1167	3889
-2	7240	10860	36190	49	748	1123	3743
-1	6876	10310	34370	50	720	1081	3603
0	6532	9796	32660	51	694	1040	3469

TABLE 1: Thermistor: temperature reading (Continued)

Temp. °C	Reading in Ohms			Temp. °C	Reading in Ohms		
	With a 2K Thermistor	With a 3K Thermistor	With a 10K Thermistor		With a 2K Thermistor	With a 3K Thermistor	With a 10K Thermistor
52	668	1002	3340	102	128	192.2	640.3
53	643	965.0	3217	103	125	186.8	622.1
54	620	929.6	3099	104	121	181.5	604.4
55	597	895.8	2986	105	118	176.4	587.5
56	576	863.3	2878	106	114	171.4	571.0
57	555	832.2	2774	107	111	166.7	555.1
58	535	802.3	2675	108	108	162.0	540.0
59	516	773.7	2580	109	105	157.6	524.9
60	498	746.3	2488	110	102	153.2	510.7
61	480	719.9	2400	111	99	149.0	496.4
62	463	694.7	2316	112	97	145.0	483.1
63	447	670.4	2235	113	94	141.1	469.8
64	432	647.1	2157	114	91	137.2	457.4
65	416	624.7	2083	115	89	133.6	444.9
66	402	603.3	2011	116	87	130.0	433.4
67	388	582.6	1942	117	84	126.5	421.8
68	375	562.8	1876	118	82	123.2	410.7
69	363	543.7	1813	119	80	119.9	399.6
70	350	525.4	1752	120	78	116.8	389.4
71	339	507.8	1693	121	76	113.8	379.2
72	327	490.9	1636	122	74	110.8	369.4
73	316	474.7	1582	123	72	107.9	360.1
74	306	459.0	1530	124	70	105.2	350.8
75	296	444.0	1479	125	68	102.5	341.9
76	286	429.5	1431	126	67	99.9	333.0
77	277	415.6	1385	127	65	97.3	324.6
78	268	402.2	1340	128	63	94.9	316.6
79	260	389.3	1297	129	62	92.5	308.6
80	251	376.9	1255	130	60	90.2	301.1
81	243	364.9	1215	131	59	87.9	293.5
82	236	353.4	1177	132	57	85.7	286.0
83	228	342.2	1140	133	56	83.6	279.3
84	221	331.5	1104	134	54	81.6	272.2
85	214	321.2	1070	135	53	79.6	265.5
86	208	311.3	1036	136	52	77.6	259.3
87	201	301.7	1004	137	51	75.8	253.1
88	195	292.4	973.8	138	49	73.9	246.9
89	189	283.5	944.1	139	48	72.2	241.1
90	183	274.9	915.2	140	47	70.4	235.3
91	178	266.6	887.7	141	46	68.8	229.6
92	172	258.6	861.0	142	45	67.1	224.2
93	167	250.9	835.3	143	44	65.5	218.9
94	162	243.4	810.4	144	43	64.0	214.0
95	157	236.2	786.4	145	42	62.5	208.7
96	153	229.3	763.3	146	41	61.1	203.8
97	148	222.6	741.1	147	40	59.6	199.4
98	144	216.1	719.4	148	39	58.3	194.5
99	140	209.8	698.5	149	38	56.8	190.1
100	136	203.8	678.5	150	37	55.6	185.9
101	132	197.9	659.0				

TABLE 3: Thermistor: temperature reading