


APPROVAL REPORT

82TC AND 84TC ADVANTAGE SERIES TRANSMITTERS FOR USE IN HAZARDOUS LOCATIONS

Prepared For:

ABB INSTRUMENTATION DIVISION
2175 LOCKHEED WAY
CARSON CITY, NV 89706

J.I. 3008810
(3610, 3611)
December 1, 2000

FACTORY MUTUAL | 

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82TC AND 84TC ADVANTAGE SERIES TRANSMITTERS
 FOR USE IN
 HAZARDOUS LOCATIONS

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 2175 LOCKHEED WAY
 CARSON CITY, NV 89706

I INTRODUCTION

1.1 ABB requested Approval of the apparatus listed in Section 1.2 to be in compliance with the applicable requirements of the following standards:

<u>Title</u>	<u>No.</u>	<u>Issue Date</u>
Electrical Equipment for Use in Hazardous (Classified) Locations General Requirements	3600	November 1998
Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II and III, Division 1, Hazardous (Classified) Locations	3610	October 1988
Electrical Equipment for use in Class I, Division 2 Class II, Division 2 and Class III, Division 1 and 2	3611	April 1986
Electrical and Electronic Test, Measuring, and Process Control Equipment	3810 (Including Supplement 1)	March 1989 (July 1, 1995)
Enclosures for Electrical Equipment	ANSI/NEMA250	1991

FACTORY MUTUAL RESEARCH
Job Identification: J.I. 3008810

1.2 This report supplements Approval Reports J.I. 3008122, 3004044, and 3000671. This report covers the addition of the Toroidal Conductivity (TC) input board and sensor.

1.3 The apparatus was examined as follows:

1.3.1 The following was evaluated as intrinsically safe, with entity parameters, for use in Class I, II and III, Division 1, Group A, B, C, D, E, F and G in accordance with manufacturing's Control Drawing No. PO807, Rev. E; Non Incendive for use in Class I, Division 2, Groups A, B, C and D; and suitable for use in Class II, III, Division 2, Groups F and G indoor/outdoor (Type 4X) hazardous (classified) locations and will appear in the Approval Guide as follows:

aa82bb cdefghijk, pH and Conductivity Transmitters.

IS / I,II,III / 1 / ABCDEFG / TC3 Ta = 60°C — PO807 / E – Entity; Type 4X

NI / I / 2 / ABCD / T5 Ta = 60°C; Type 4X

S/II/2/FG/ T5 Ta = 60°C; Type 4X

Entity Parameters:

VMax = 42 V dc, IMax = 200 mA, Ci = 0µF, Li = 0.2 mH, Pi = 1.2 W.

aa = TB, ML.

bb = Input: PH, EC, TE, or TC

c = Programming Option: 1,2.

d = Digital Communications Option: 0,1.

e = Lightning Suppressor: 0,1.

f = Housing Type: 0.

g = Mounting Hardware: 0,1,2,3,4.

h = Agency Approval: 1.

i = Identification Tag: 0, 1, 2.

j = Language: 1, 2.

k = Keypad (ML Version Only): 1,2.

1.3.2 The following was evaluated as Non Incendive for use in Class I, Division 2, Groups A, B, C and D; and suitable for use in Class II, III, Division 2, Groups F and G indoor/outdoor (Type 4X) hazardous (classified) locations and will appear in the Approval Guide as follows:

aa84bb cdefghijk, pH and Conductivity Transmitters.

NI / I / 2 / ABCD / T5; Type 4X

S/II/2/FG/ T5 Ta = 60°C; Type 4X

S/III/ T5 Ta = 60°C; Type 4X

aa = TB, ML.

bb = Input: PH, EC, TE, or TC

c = Programming Option: 1,2.

d = Digital Communications Option: 0,1.

e = Lightning Suppressor: 0,1.

f = Housing Type: 0.

g = Mounting Hardware: 0,1,2,3,4.

h = Agency Approval: 1.

i = Identification Tag: 0, 1, 2.

j = Language: 1, 2.

k = Keypad (ML Version Only): 1,2.

II DESCRIPTION

- 2.1 The TB/ML82 and TB/ML84series transmitters have been Approved in Factory Mutual Research Approval reports J.I. 3008122, 3004044, and 3000671. This report covers the addition of the Toroidal Conductivity (TC) input board and sensor, as well as minor revisions to the circuits and documentation that do not effect the Intrinsic safety, Nonincendive or general safety evaluation.

III EXAMINATION AND TESTS

- 3.1 General - The toroidal conductivity input board and sensor is used for measuring conductivity on the principle of energizing a drive coil in the sensor and measuring the output of a sensor coil which is proportional to the conductivity of the process. Representative samples of the transmitters with the TC input board and sensor were examined by CSA to determine their acceptability for use in the Hazardous Area specified. The CSA examination was conducted under normal, one and two fault conditions with applicable factors and consisted of circuit and thermal analysis and a review of the manufacturer's documentation and the unit's physical construction. All were satisfactory and summarized in the following sections.

IV MARKING

Marking information was reviewed and found to meet the Standard's requirements. Manufacturer's drawings E1817 Revision E and E1924 Revision C are included as attachments to this report.

V REMARKS

- 5.1 Installation shall be in accord with the manufacturer's instructions and the National Electrical Code (ANSI/NFPA 70).
- 5.2 Tampering and replacement with nonfactory components may adversely affect the safe use of the system.

VI FACILITIES AND PROCEDURES AUDIT

ABB Instrumentation Division maintains facilities in Carson City, NV; that is subject to follow-up audit inspections. The facilities and quality control procedures in place have been found satisfactory to manufacture product identical to that examined and tested as described herein.

VII MANUFACTURER'S RESPONSIBILITIES

- 7.1 Documentation that is applicable to this Approval is on file at Factory Mutual Research and listed in Section VIII of this report. No changes of any nature shall be made unless notice of the proposed change has been given and written authorization obtained from Factory Mutual Research. The Approved Product - Revision Report, Factory Mutual Research Form 797, shall be forwarded to Factory Mutual Research as notice of proposed changes.
- 7.2 On 100% of production the primary supply terminals of the power supply and the outputs of the relay modules shall withstand for one minute, with no insulation breakdown, the application of 1000 Vac or 1400 Vdc with respect to the protective ground terminal. Alternatively, test potentials 20% higher may be applied for at least one second.
- 7.3 On 100% of production shall be dielectric tested. The supply and output terminals with respect to the protective ground terminal of each unit shall withstand for one minute, with no insulation breakdown the following test voltages as Follows:
- 7.3.1 The TB82 and ML82 versions are subject to the application of 75 Vdc or 75 Vrms. Alternatively, test potentials 20% higher may be applied for at least one second.
- 7.3.2 The TB84 and ML84 versions are subject to the application of 450 Vdc or 450 Vrms. Alternatively, test potentials 20% higher may be applied for at least one second.

WARNING: The dielectric test required may present a hazard of injury to personnel and/or property and should only be performed under controlled conditions, and by persons knowledgeable of the potential hazards of such testing to minimize the likelihood of shock and/or fire.

FACTORY MUTUAL RESEARCH
Job Identification: J.I. 3008810

VIII DOCUMENTATION FILE

Document No.	Title	Revision
P0807	installation Drawing	E
E1817	FM Nameplate 82	E
E1924	FM Nameplate 84	C
E1964	Universal Nameplate TB82TC	B
E1965	Universal Nameplate ML82TC	B
E1917	Universal Nameplate TB84TC	A
E1918	Universal Nameplate ML84TC	A
E1732	82 Final Assembly	J
E1900	84 Final Assembly	C
E1844	Display Lens	B
E2033	82TC Interconnect Diagram	A
E2021	84TC Interconnect Diagram	A
E1713	Power Supply Board, Assembly	E
E1705	μ P/ Display Board, Schematic	E
E1723	μ P/ Display Board, Assembly	F
E1724	μ P/ Display Board, Artwork	D
E1958	TC Input Board, Schematic	A
E1961	TC Input Board, Assembly	A
E1959	TC Input Board, fabrication	A
P0869	TC Sensor Anatomy	A

IX CONCLUSION


The apparatus described in Section 1.2 meets Factory Mutual Research requirements. Approval is granted when the Approval Agreement is signed and received by Factory Mutual Research Corporation.

EXAMINATION AND TESTS BY: Yakov Khitrov, Canadian Standards Association

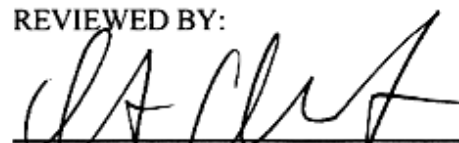
ORIGINAL DATA: Project Data Record 3008810
CSA Project No. 1106479

ATTACHMENTS: CSA Test Report, File No. 1106479
Label Drawing: E1924 Revision C, E1817 Revision E
Installation Drawing: P0807 Revision E

WRITTEN BY:


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REVIEWED BY:


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Electrical Section
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**Revised Construction
of
TYPE xx82xx and xx84xx TRANSMITTERS
for
HAZARDOUS (CLASSIFIED) LOCATIONS**

Prepared For:

**ABB Instrumentation Division
2175 Lockheed Way
Carson City, NV 89706**

CSA FILE NO: 1106479

FM J.I. Number: 3008810
(3610, 3611)

Prepared by: Ron Wildish
CSA Hazardous Location Product Team

Date: June 27, 2000

I INTRODUCTION

1.1 ABB Instrumentation Division requested Approval of the apparatus listed in Section 1.2 to be in compliance with the applicable requirements of the following standards:

<u>Title</u>	<u>Class No.</u>	<u>Issue Date</u>
Electrical Equipment for Use in Hazardous (Classified) Locations, General Requirements	FMRC 3600	November 1998
Intrinsically Safe Apparatus and Associated Apparatus for use in Class I,II and III, Division 1 Hazardous (Classified) Locations Note: 1.5 factor applied to voltage and current rather than energy.	FMRC 3610	October 1999
Electrical Equipment for Use in Class I, Div. 2, Class II, Div. 2 and Class III, Divisions 1 and 2 Hazardous Locations	FMRC 3611	October 1999
Electrical and Electronic Test, Measuring and Process Control Equipment	FMRC 3810 Includes Supplement # 1 (1995)	March 1989
Enclosures for Electrical Equipment (1000 V max)	NEMA Pub. 250	1991

1.2 This report supplements Approval Report J.I. 300671, J.I. 3004044 and J.I. 3008122 which covers approval of the **82PH, **82EC and xx82TE Series transmitters. This report covers the addition of the Toroidal Conductivity (TC) input board and sensor.

- 1.3 The following equipment was examined as intrinsically safe apparatus for use in Classes I, II and III, Division 1, Groups A,B,C,D,E,F and G in accordance with entity requirements and TBI-Bailey Controls Drawing No. PO807; non-incendive for Class I, Division 2, Groups A,B,C and D; suitable for Class II, III, Division 2, Group F and G hazardous indoor/outdoor (NEMA 4X) locations.

aa82bb cdefghijk, where;

- aa = TB for Advantage Series Transmitter
ML for Multi Language Advantage Series Transmitter
- bb = Input
PH pH/ORP/PION
EC Four Electrode Conductivity
TE Two Electrode Conductivity
TC Toroidal Conductivity
- c = Programming Options
1 Basic; 2 Advanced
- d = Digital Communication Option
0 None; 1 HART
- e = Lightning Suppressor
0 None; 1 Included
- f = Housing Type
0 Front Bezel
- g = Mounting Hardware
0 None; 1 Pipe; 2 Hinge; 3 Panel; 4 Wall
- h = Agency Approval
1 Factory Mutual
- i = Identification Tag
0 None; 1 Stainless Steel; 2 Mylar
- j = Language (ML version only)
1 English; 2 German
- k = Keypad (ML version only)
1 TBI-Bailey; 2 Hartmann & Braun

Maximum Entity Parameters:

- V_{max} = 42 V;
I_{max} = 200 mA;
C_i = 0;
L_i = 0.4 mH;
P_i = 1.2 W.

- 1.4 The following equipment was examined as non-incendive for Class I, Division 2, Groups A,B,C and D; suitable for Class II, III, Division 2, Group F and G hazardous indoor/outdoor (NEMA 4X) locations.

aa84bb cdefghijk, where;

- aa = TB for Advantage Series Transmitter
ML for Multi Language Advantage Series Transmitter
- bb = Input
PH pH/ORP/PION
EC Four Electrode Conductivity
TE Two Electrode Conductivity
TC Toroidal Conductivity
- c = Programming Options
1 Basic; 2 Advanced
- d = Digital Communication Option
0 None; 1 HART
- e = Lightning Suppressor
0 None; 1 Included
- f = Housing Type
0 Front Bezel
- g = Mounting Hardware
0 None; 1 Pipe; 2 Hinge; 3 Panel; 4 Wall
- h = Agency Approval
1 Factory Mutual
- i = Identification Tag
0 None; 1 Stainless Steel; 2 Mylar
- j = Language (ML version only)
1 English; 2 German
- k = Keypad (ML version only)
1 TBI-Bailey; 2 Hartmann & Braun

II DESCRIPTION

- 2.1 The TB/ML82 and TB84/ML84 Series transmitters have been Approved in FMRC Approval Reports J.I. 300671, J.I. 3004044 and J.I.3008122. This report covers the addition of the Toroidal Conductivity input board and sensor, as well as minor revisions to circuits and documentation that do not effect the intrinsic safety, nonincendive or general safety evaluation. Updated drawings are included in the Documentation File of this report.

III EXAMINATION AND TESTS

- 3.1 The toroidal conductivity input board and sensor is used for measuring conductivity on the principle of energizing a drive coil in the sensor and measuring the output of a sense coil which is proportional to the conductivity of the process. Representative samples of the transmitters with the TC input board and TC sensor were examined and tested by CSA to determine their acceptability for use for the hazardous locations specified. The CSA examination was conducted under normal, one and two fault conditions with applicable factors and consisted of circuit and thermal analysis and a review of the manufacturer's documentation and the units physical construction. All were satisfactory and are summarized in the following sections. Appendix A contains the actual test data and evaluation notes.

- 3.2 Intrinsic Safety Evaluation -Entity - Under "entity" requirements, the concept allows interconnection of intrinsically safe apparatus to associated apparatus, not specifically examined in such combination. The criteria for interconnection is that the voltage (V_{max}) and current (I_{max}) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal to or greater than the voltage (V_{oc} or V_t) and current (I_{sc} or I_t) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of the intrinsically safe apparatus, including interconnecting wiring, must be equal or less than the capacitance (C_a) and the inductance (L_a) which can be safely connected to the associated apparatus. If these criteria are met, then the combination may be connected.

- 3.2.1 Capacitance Assessment - The previous capacitance assessment is still considered representative for the revised circuit. No further tests were considered necessary.

- 3.2.2 Inductance Assessment - The previous inductance assessment is still considered representative for the revised circuit. No further tests were considered necessary.

The internal inductance of the TC input board, primarily T1, as well as that of the sensor windings (including the max. length of 50 feet of sensor cable) was determined to be incapable of causing ignition in a Group A,B hazardous location based on testing and analysis.

- 3.2.3 Protective Component Derating - No additional protective components were considered on the TC input board or TC sensor.

- 3.2.4 Construction/Creepage and Clearance - All protective components are adequately spaced and meet all creepage and clearance requirements for the applicable circuit voltages in accordance with Table 6.1 of FMRC Standard 3610. The comparative tracking index (CTI) of all pcb's is specified to be not less than 175, exceeding the FMRC requirements of 90.
- 3.2.5 Temperature Evaluation - Previous testing is still considered representative for the additional circuitry. Therefore the existing temperature code rating does not change.
- 3.3 Nonincendive Examination - Based on the results of the intrinsic safety testing of the sensor inductance, the TC sensor was deemed to be acceptable as a nonincendive field device. No further tests were considered necessary.

IV MARKING

Marking was examined and found to meet standard requirements. Manufacturer's marking drawing E1817 is included in the Documentation File.


V DOCUMENTATION FILE

<u>Document No.</u>	<u>Revision or Issue Date</u>	<u>Title</u>
PO807	E	Installation Drawing
E1817	E	FM Nameplate (xx82)
E1924	C	FM Nameplate (xx84)
E1964	B	Universal nameplate (TB82TC)
E1965	B	Universal nameplate (ML82TC)
E1917	A	Universal nameplate (TB84TC)
E1918	A	Universal nameplate (ML84TC)
E1732	J	xx82 Final Assembly
E1900	C	xx84 Final Assembly
E1844	B	Display Lense
E2033	A	xx82TC Interconnect Diagram
E2021	A	xx84TC Interconnect Diagram
E1713	E	Power Supply board, assembly
E1705	E	uP/Display board, schematic
E1723	F	uP/Display board, assembly
E1724	D	uP/Display board, artworks
E1958	A	TC Input Board, schematic
E1961	A	TC Input board, assembly
E1959	A	TC Input board, fabrication
P0856	B	Sensors Suitable for Non-Incend. Wiring
P0653	C	Comb. pH Sensor Anatomy
P0654	C	External Thermocompensator Sensor Anat.
P0655	D	Four Electrode Conductivity Sensor Anat.
P0819	B	Advantage Series Sensor Comb. pH....
P0831	B	Two Electrode Conductivity Sensor Anat.
PO869	B	TC Sensor Anatomy

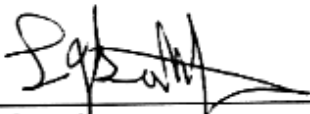


FMRC Job Identification J.I. 3008810

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