1 **EC-TYPE EXAMINATION CERTIFICATE**

2 Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

3 Certificate Number: SIRA99ATEX2136X

4 Equipment: TX913x Trip Amplifiers

5 Applicant: Trolex Limited

6 Address: Newby Road
Hazel Grove
Stockport
Cheshire
SK7 5DY

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Sira Certification Service, notified body number 0518 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report number R52X6308A.

9 Compliance with the Essential Health and Safety Requirements, with exception to those listed in the schedule to this certificate, has been assured by compliance with the following documents:

EN 50014:1997 (amendments A1-A2)
EN 50020:1994 (amendment A1)

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

Project Number 52X6308A
Date 2 December 1999
C. Index 12

M D Shearman
Certification Manager

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EC-TYPE EXAMINATION CERTIFICATE NUMBER SIRA99ATEX2136X

11 This EC-Type Examination Certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment.

12 The marking of the equipment shall include the following:

I M1
EEx ia I (T_a = -20°C to +70°C)

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SCHEDULE

EC-TYPE EXAMINATION CERTIFICATE NUMBER SIRA99ATEX2136X

13 DESCRIPTION OF EQUIPMENT

The TX913x Programmable Trip Amplifiers are intended to accept signals from a range of external sensors (e.g. 4-20 mA signals, 0.4-2 V signals, temperature sensors, flammable gas sensors, accelerometers, etc.)

The TX913x Trip Amplifiers are housed in an ABS enclosure and contain a standard Control PCB that is connected to one of a range of I/O PCBs depending on the application. The different versions of the Trip Amplifiers listed below each contain the control PCB connected to a different I/O PCB:

TX9131 4-20 mA Input Trip Amplifiers
TX9132 Voltage Input Trip Amplifiers
TX9133 Thermocouple Input Trip Amplifiers
TX9134 PT100 Temperature Sensor Input Trip Amplifiers
TX9135 Semiconductor Temperature Sensor Input Trip Amplifiers
TX9136 Bridge Input Trip Amplifiers
TX9137 A.C. (Peak) Input Trip Amplifiers
TX9137 A.C. (RMS) Input Trip Amplifiers
TX9139 Interposing Relay Trip Amplifier

Apart from the TX9139, each version of the Trip Amplifier has 4 variants:

Dual relay output
4-20 mA output
0.4-2 V output
5-15 Hz output

The Control PCB remains the same for all versions and contains a micro-controller, EPROM and EEPROM memories, other logic circuits and an alpha-numeric LCD module, which is mounted directly onto the PCB. A keypad is fitted to the front panel of the Trip Amplifier and is connected to the Control PCB via a flexible ribbon cable.

The I/O PCBs contain some common circuitry as well as circuitry specific to the application. Some versions are based on the same artwork but with different builds to achieve the desired configuration; other versions use different artwork and builds. The safety description of the equipment is shown overleaf.

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EC-TYPE EXAMINATION CERTIFICATE NUMBER SIRA99ATEX2136X

Terminals T1-T8, T11-T12

TX9131/2/5

T1–T4 (sensor)	T5-T6 (supply)	T7-T8 (relay)	T11-T12 (relay reset/power on delay)
U_o = 16.5 V	U_i = 16.5 V	U_o = 0	U_o = 16.5 V
C_i = 3.6 nF	C_i = 3.6 nF	U_i = 20 V	U_i = 0
L_i = 0	L_i = 0	C_i = 0	C_i = 0
		L_i = 0	L_i = 0

Note: terminals T1 and T2 are connected directly to the supply terminals T5-6, so have the same output parameters as the mining power supply.

TX9133

T1–T4 (sensor)	T5-T6 (supply)	T7-T8 (relay)	T11-T12 (relay reset/power on delay)
U_o = 16.5 V	U_i = 16.5 V	U_o = 0	U_o = 16.5 V
C_i = 2.4 nF	C_i = 2.4 nF	U_i = 20 V	U_i = 0
L_i = 0	L_i = 0	C_i = 0	C_i = 0
		L_i = 0	L_i = 0

Note: terminals T1 and T2 are connected directly to the supply terminals T5-6, so have the same output parameters as the mining power supply.

TX9134

T1–T4 (sensor)	T5-T6 (supply)	T7-T8 (relay)	T11-T12 (relay reset/power on delay)
U_o = 16.5 V	U_i = 16.5 V	U_o = 0	U_o = 16.5 V
I_o = 1.163 A	C_i = 1.2 nF	U_i 20 V	U_i = 0
P_o = 1.75 W	L_i = 0	C_i = 0	C_i = 0
C_o = 80 nF		L_i = 0	L_i = 0
L_o/R_o = 52 µH/Ω			
C_i = 3.6 nF			
L_i = 0			

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SCHEDULE

EC-TYPE EXAMINATION CERTIFICATE NUMBER SIRA99ATEX2136X

TX9136

T1–T4 (sensor)	**T5-T6 (supply)**	**T7-T8 (relay)**	**T11-T12 (relay reset/power on delay)**
U_o = 16.5 V	U_i = 16.5 V	U_o = 0	U_o = 16.5 V
I_o = 1.163 A	C_i = 1.2 nF	U_i = 20 V	C_o = 12 µF
C_o = 300 nF	L_i = 245 µH *	C_i = 0	L_o/R_o = 52 µH/Ω
L_o = 80 µH		L_i = 0	U_i = 0
C_i = 12.48 µF			C_i = 0
L_i = 165 µH			L_i = 0

* Note: the internal inductance is in series with a resistance of at least 14.25 Ω. This is inductively non-incendive when the apparatus is used in conjunction with a power supply having a peak output voltage (U_o) not exceeding 16.5 V.

TX9137

T1–T4 (sensor)	**T5-T6 (supply)**	**T7-T8 (relay)**	**T11-T12 (relay reset/power on delay)**
U_o = 16.5 V	U_i = 16.5 V	U_o = 0	U_o = 16.5 V
I_o = 183 mA	C_i = 1.2 nF	U_i = 20 V	U_i = 0
P_o = 752 mW	L_i = 0	C_i = 0	C_i = 0
C_o = 80 nF		L_i = 0	L_i = 0
L_o/R_o = 52 µH/Ω			
C_i = 1.2 nF			
L_i = 0			

TX9139

T4 & T6 (signal)	**T5-T6 (supply)**	**T1-T3, T7-T12 (relay)**
U_o = 16.5 V	U_i = 16.5 V	U_o = 0
I_o = 8 mA	C_i = 1.2 nF	U_i = 20 V
P_o = 33 mW	L_i = 0	C_i = 0
C_o = 11 µF		L_i = 0
$L_o/R_o \leq$ 52 µH/Ω		
C_i = 0		
L_i = 0		

Date 2 December 1999

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SCHEDULE

EC-TYPE EXAMINATION CERTIFICATE NUMBER SIRA99ATEX2136X

Terminals T9-T10 (excluding the TX9139)

The parameters depend on the variant as follows:

Dual relay	**4-20 mA**	**0.4-2 V**	**5-15 Hz**
U_o = 0	U_o = 16.5 V	U_o = 16.5 V	U_o = 0
U_i = 20 V	C_i = 0	C_i = 0	U_i = 20 V
C_i = 0	L_i = 0	L_i = 0	P_i = 2.5 W
L_i = 0			C_i = 0
			L_i = 0

14 DESCRIPTIVE DOCUMENTS

14.1 DRAWINGS

14.1.1 All versions

Drawing No.	Rev.	Sheet	Date	Title
P5093.27	1 of 1	C	21 Jan 97	Reed Relay
P5460.01	1 of 1	A	07 Jul 97	Circuit Diagram Control P.C.B.
P5460.07	1 of 2	B	25 Feb 99	General Assembly
P5460.07	2 of 2	B	25 Feb 99	General Arrangement of Enclosure
P5460.45	1 of 1	A	21 Jan 98	Interconnection Block Diagram
P5460.109	1 of 1	A	18 May 98	Circuit Diagram 5-15 Hz ModulebP.C.B.
P5460.111	1 of 1	A	25 Sep 98	Circuit Diagram Modifications for 5-15 Hz Modules Output P.C.B.
P5460.127	1 of 1	A	25 Nov 99	Label Details

14.1.2 TX9131/2/5

Drawing No.	Rev.	Sheet	Date	Title
P5460.29	1 to 7	A	09 Jan 98	Output PCB
P5460.38	1 to 3	A	09 Jan 98	Circuit Diagram Output P.C.B. (V, I, KTY81 Input)

14.1.3 TX9133

Drawing No.	Rev.	Sheet	Date	Title
P5460.40	1 to 7	A	09 Jan 98	Output PCB
P5460.100	1 to 3	A	09 Jan 98	Circuit Diagram Output P.C.B. (Thermocouple Input)

Date 2 December 1999

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EC-TYPE EXAMINATION CERTIFICATE NUMBER SIRA99ATEX2136X

14.1.4 **TX9134**

Drawing No.	Rev.	Sheet	Date	Title
P5460.41	1 to 3	A	09 Jan 98	Circuit Diagram Output P.C.B. (PT100 Input)
P5460.82	1 to 7	A	09 Jan 98	Output PCB

14.1.5 **TX9136**

Drawing No.	Rev.	Sheet	Date	Title
P5460.28	1 to 7	A	09 Jan 98	Output PCB
P5460.37	1 to 3	A	09 Jan 98	Circuit Diagram Output P.C.B. (Bridge Input)

14.1.6 **TX9137 (RMS)**

Drawing No.	Rev.	Sheet	Date	Title
P5460.02	1 of 3	A	09 Jan 98	Circuit Diagram Output P.C.B. (A.C. RMS Input)
P5460.02	2 of 3	A	09 Jan 98	Circuit Diagram Output P.C.B. (A.C. RMS Input)
P5460.02	3 of 3	B	26 Nov 99	Circuit Diagram Output P.C.B. (A.C. RMS Input)
P5460.5	1 to 7	A	09 Jan 98	Output PCB

14.1.7 **TX9137 (PEAK)**

Drawing No.	Rev.	Sheet	Date	Title
P5460.23	1 to 7	A	09 Jan 98	Output PCB
P5460.26	1 to 3	A	09 Jan 98	Circuit Diagram Output P.C.B. (A.C. Peak Input)

14.1.8 **TX9139**

Drawing No.	Rev.	Sheet	Date	Title
P5460.113	1 to 4 of 5	A	25 Feb 99	Output PCB
P5460.114	1 of 1	A	26 Feb 99	Certified Circuit Diagram

14.2 Report No. R52X6308A.

Date 2 December 1999

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SCHEDULE

EC-TYPE EXAMINATION CERTIFICATE NUMBER SIRA99ATEX2136X

15 **SPECIAL CONDITIONS FOR SAFE USE** *(denoted by X after the certificate number)*

15.1 The TX913x Trip Amplifiers shall be installed in an outer enclosure that provides an ingress protection of at least IP54 to EN 60529:1991. Metallic enclosures shall also comply with clause 8.1 of EN 50014:1997.

The outer enclosure shall be marked in a visible, external location with an additional label that displays at least the following information:

Contains Trolex TX913x Programmable Trip Amplifiers
EEx ia I (T_a = -20°C to +70°C)
SIRA99ATEX2136X

If the enclosure is manufactured from plastics or incorporates a plastics component with a surface area in excess of 100 cm^2, then it shall also be marked with a static warning label:

"STATIC HAZARD! DO NOT RUB WITH A DRY CLOTH"

15.3 If the outer enclosure has a carries a static warning label, then it shall not be installed in a location where it is likely to be subjected to conditions that may induce static charges, e.g. high velocity dust laden air.

15.4 This certificate only relates to the TX913x Trip Amplifiers and does not cover the function of any other electrical apparatus installed in the outer enclosure.

15.5 The internal temperature of this apparatus may rise above 150°C under normal or fault conditions; therefore, care shall be taken when the enclosure is opened to ensure that no dust enters the apparatus.

16 **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS OF ANNEX II** (EHSR'S)

The table below lists all relevant EHSR's not addressed by the standards listed in this certificate. These EHSR's have been assessed in Report No. R52X6308A.

Annex II Clause Number	Title
1.2.4	Dust deposits
1.2.5	Additional means of protection
1.4.1	Safe function in changing external conditions
1.4.2	Withstanding attach by aggressive substances
2.0.1.2	Protection against dust ingress
2.0.1.3	Surface temperatures to be delow AIT of dust

Date 2 December 1999

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SCHEDULE

EC-TYPE EXAMINATION CERTIFICATE NUMBER SIRA99ATEX2136X

17 **CONDITIONS OF CERTIFICATION**

17.1 The use of this certificate is subject to the Regulations Applicable to Holders of SCS Certificates.

17.2 In affixing the Sira certificate number to the apparatus the applicant attests on his own responsibility that the apparatus conforms to the documents listed herein.

If the marked apparatus is found not to comply Sira Certification Service should be notified immediately at its offices at South Hill, Chislehurst, Kent BR7 5EH, England.

17.3 This certificate relies on the following previously-certified products. When used as part of the TX913x, the key attributes listed in the table below shall still be maintained by their original certificate.

Product	Certificate number	Key attributes
Littelfuse fuse	BAS Ex 832302U	EEx ia IIC
Bedford OPI11264D opto-isolator	BAS Ex 89C2096U/2	EEx ia IIC

17.4 It is the manufacturer's responsibility to take all reasonable steps to ensure that the user or installer complies with the requirements detailed in Special Conditions for Safe Use 15.1 and retains evidence to this effect.

Date 2 December 1999

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EC TYPE-EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER	Sira 99ATEX2136X	Dated	2 December 1999
VARIATION NUMBER	1 (ONE)	Dated	16 November 2000

VARIATION TO EQUIPMENT

To permit:

1 The use of pad printing as an alternative method of marking.

DESCRIPTIVE DOCUMENTS

Number	Sheet	Rev	Date	Description
P5460.07	1 of 1	C	13 Jun 00	General Assembly

ADDITIONAL CONDITIONS OF CERTIFICATION

None

File No 52V6983

Report No. NA

R Cooper IEng LInstMC
Deputy Chief Executive

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EC TYPE EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER	Sira 99ATEX2136X	Dated	2 December 1999
VARIATION NUMBER	2 (TWO)	Dated Re-issued	4 July 2001 15 March 2002

VARIATION TO EQUIPMENT

To permit:

1 The addition of the TX9151 Liquid Flow Trip Amplifier to the existing range of Trip Amplifiers.

Description of TX9151

The TX9151 Liquid Flow Trip Amplifier is typically designed to interface with a Liquid Flow Sensor (LFS) via a sensor measuring the differential pressure inside the LFS, this parameter is then used to calculate the flow rate. This gives a voltage output up to 5 V at 10 mA maximum. In conjunction with this, a second sensor measures the line pressure. The Control PCB, which is the same for all Trip Amplifiers, contains a micro-controller, EPROM & EEPROM memories, other logic circuits and an alpha-numeric LCD module that is mounted directly onto the PCB. A keypad is fitted to the front panel of the Trip Amplifier and is connected to the Control PCB via a flexible ribbon cable.

The TX9151 has 5 variants, depending on the output at terminals T9-10:

Dual relay output
4-20 mA output
0.4-2 V output – standard
0.4-2 V output – PD543
5-15 Hz output

The TX9151 has the following safety description:

Terminals T1-T8, T11-T12

T1 (sensor 1 supply), T2 (sensor 1 signal in) & T6 (zero volts)	**T5 (supply), T4 (sensor 2 signal in) & T3 (zero volts)** [See note 1]	**T5 (supply) T6 (zero volts)**	**T7-T8 (relay)**	**T11 (relay reset) & T6 (zero volts)**	**T12 (power on delay) & T6 (zero volts)**
U_o = 7.14 V I_o = 75 mA P_o = 0.31 W C_o = 5 µF L_o = 100 µH	U_i = 16.5 V C_i = 1.2 nF L_i = 0 U_o = 16.5 V I_o = 5 mA P_o = 20 mW C_o = 120 nF L_o/R_o = 50µH/Ω	U_i = 16.5 V C_i = 1.2 nF L_i = 0	U_o = 0 U_i = 20 V P_i = 2.3W C_i = 0 L_i = 0	U_o = 16.5 V I_o = 5 mA P_o = 20 mW C_o = 120 nF L_o/R_o = 50µH/Ω U_i = 0 C_i = 0 L_i = 0	U_o = 16.5 V I_o = 5 mA P_o = 20 mW C_o = 120 nF L_o/R_o = 50µH/Ω U_i = 0 C_i = 0 L_i = 0

Note 1: For the purpose of system assessment, it should be noted that cable connected to terminal T5 from the supply also feeds sensor 2 (typically a line pressure sensor).

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EC TYPE EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER Sira 99ATEX2136X Dated 2 December 1999

VARIATION NUMBER 2 (TWO) Dated 4 July 2001
Re-issued 15 March 2002

Terminals T9/T10: the parameters depend on the variant as follows:

Dual relay (TX9151.31)	**4-20 mA (TX9151.32)**	**0.4-2 V (TX9151.33) [standard version]**	**0.4-2 V (TX9151.33.PD543)**	**5-15 Hz (TX9151.34)**
U_o = 0	U_o = 16.5 V	U_o = 16.5 V	U_o = 7.14 V	U_o = 0
U_i = 20 V	I_o = 472 mA	I_o = 50 mA	I_o = 50 mA	U_i = 20 V
P_i = 2.3W	P_o = 1.95 W	P_o = 0.21 W	P_o = 0.21 W	P_i = 2.5 W
C_i = 0	C_o = 120 nF	C_o = 120 nF	C_o = 56 µF	C_i = 0
L_i = 0	L_o/R_o = 50µH/Ω	L_o/R_o = 50µH/Ω	L_o/R_o = 20 µH/Ω	L_i = 0

DESCRIPTIVE DOCUMENTS

Drawing no.	**Sheets**	**Rev.**	**Date**	**Description**
P5460.07	1 of 1	C	13 Jun 00	General Assembly
P5514.01	1 to 3	B	04 Feb 02	Certified Circuit Diagram Output PCB (Flow Sensor Input)
P5514.03	1 of 1	B	04 Feb 02	Output PCB, Flow Sensor Input [artwork]

ADDITIONAL CONDITIONS OF CERTIFICATION

None

Re-issued 15 March 2002
To correct the safety parameters applicable to terminals T9/T10 and incorporate a modified output PCB circuit.

File No. 52A6519 and 52A8478

Report No. R52A6519A and R52A8478A

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EC TYPE EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER	Sira 99ATEX2136X	Dated	2 December 1999
VARIATION NUMBER	3 (THREE)	Dated	5 March 2002

VARIATION TO EQUIPMENT

To permit:

1 The correction and clarification of the parts lists and general arrangement drawings.

2 The removal of the input voltage from the marking drawing.

3 The name of the equipment to become the TX91xx Series Trip Amplifiers, thereby encompassing the type TX9151.

DESCRIPTIVE DOCUMENTS

Drawing no.	Sheets	Rev.	Date	Description
P5460.07	1 of 2	D	20 Feb 02	All versions: general assembly
P5460.02	3 of 3	C	06 Feb 02	TX9137 (RMS) output board parts list
P5460.26	3 of 3	B	06 Feb 02	TX9137 (Peak) output board parts list
P5460.37	3 of 3	B	06 Feb 02	TX9136 output board parts list
P5460.38	3 of 3	B	06 Feb 02	TX9131/2/5 output board parts list
P5460.41	3 of 3	B	06 Feb 02	TX9134 output board parts list
P5460.100	3 of 3	B	06 Feb 02	TX9133 output board parts list
P5460.127	1 of 1	B	26 Feb 02	Label details
P5514.01	3 of 3	B	06 Feb 02	TX9151 output board parts list

ADDITIONAL CONDITIONS OF CERTIFICATION

None

File No. 52A8478

Report No. R52A8478A and AX4300

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EC TYPE EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER Sira 99ATEX2136X Dated 2 December 1999

VARIATION NUMBER 4 (FOUR) Dated 9 August 2002

VARIATION TO EQUIPMENT

To permit:

1 The specification of a more detailed safety description for the TX9131/2/5:

Terminals T1-T8, T11-T12

T1–T2 (sensor power)	**T3-4 (sensor signal)**	**T5-T6 (supply)**	**T7-T8 (relay)**	**T11-T12 (relay reset/power on delay)**
U_o = 16.5 V C_i = 2.4 nF L_i = 0	U_o = 16.5 V I_o = 33 mA P_o = 135 mW C_i = 1.2 nF L_i = 0	U_i = 16.5 V C_i = 3.6 nF L_i = 0	U_o = 0 U_i = 20 V C_i = 0 L_i = 0	U_o = 16.5 V U_i = 0 C_i = 0 L_i = 0

Note: terminals T1 and T2 are connected directly to the supply terminals T5-6, so have the same output parameters as the mining power supply.

Terminals T9-T10

Dual relay	**4-20 mA**	**0.4-2 V**	**5-15 Hz**
U_o = 0 U_i = 20 V C_i = 0 L_i = 0	U_o = 16.5 V C_i = 0 L_i = 0	U_o = 16.5 V C_i = 0 L_i = 0	U_o = 0 U_i = 20 V P_i = 2.5 W C_i = 0 L_i = 0

DESCRIPTIVE DOCUMENTS

None

ADDITIONAL CONDITIONS OF CERTIFICATION

None

File No. 52V9206

Report No. NA

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EC TYPE-EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER	Sira 99ATEX2136X	Dated	2 December 1999
VARIATION NUMBER	5 (FIVE)	Dated	14 March 2005

VARIATION TO EQUIPMENT

To permit:

1 The value of the output voltage of any terminal that has a previously designated Uo of 16.5 V to be equal to the Uo of the equipment connected to the supply terminals T5-T6 up to a maximum of 16.5 V.

DESCRIPTIVE DOCUMENTS

None

ADDITIONAL CONDITIONS OF CERTIFICATION

None

File No. 52V13167

Report No. R52V13167A

C Ellaby
Certification Officer

Sira Certification Service
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