Issue Date: 25 January 2019
Expiry Date: 25 January 2022

IA Certificate Number: **MASC M/11-220X**
Our ref: 11-220 S5

IA – CERTIFICATE

(Supplement Five: Supplemented for ARP Review)

(IN TERMS OF REGULATION 21.17.2 OF THE MINERALS ACT (INCORPORATION THE MINE HEALTH AND SAFETY ACT) AND REGULATION 9 (1) OF THE ELECTRICAL MACHINERY REGULATIONS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT)

TX913x Trip Amplifiers

This document is based on and must be read in conjunction with Sira 99ATEX2136X certificate.

Further to your request, we have evaluated the supplied documentation.

The following is applicable:

Description	**Detail**
Requested By :	Trolex Ltd. Newby Road, Hazel Grove, Stockport, Cheshire, SK7 5DY, UK
Equipment :	Trip Amplifiers
Manufacturer :	Trolex Ltd. Newby Road, Hazel Grove, Stockport, Cheshire, SK7 5DY, UK
Model(s) / Type(s) :	TX913x
Rating :	Ex I M1 EEx ia I T_a = -20ºC to +70ºC
Certification body :	Sira Certification Service (Sira)
Type Certificate No :	Sira 99ATEX2136X
Variations/Issue/Amendment :	Issue 8
Assessment Report No :	R52X6308A, 52V6983, R52A6519A, R52A8478A, 52V9206, R52V13167A, R20650A/00, R70135369A and R70176480A
Quality Assurance report (QAR) / Notification (QAN) :	It is a requirement under ATEX that all equipment for category 1 and 2 areas must have 3rd party quality assurance from a notified body. This is accepted to cover the equipment's quality requirements.

Standards:	- EN 50014	1997 (A1-A2)	"General requirements"
	- EN 50020	1994 (A1)	"Equipment protection by intrinsic safety 'i'"

/. The evaluation...

The evaluation was conducted according to the requirements of:

- **SANS (IEC) 60079-0 : 1997 "Explosive atmospheres – Part 0: Equipment — General requirements"**
- **SANS (IEC) 60079-11 : 1994 "Explosive atmospheres – Part 11: Equipment protection by intrinsic safety 'i'"**

COMPLIANCE:

The equipment as described below is hereby certified "Explosion Protected" "Ex ia I (Ta = -20ºC to +70ºC)" and is suitable for use in hazardous locations as stated below and as tested, assessed and inspected in accordance with the relevant requirements of SANS / IEC Standards:

Location	Zone 0, 1, 2	Mining / Underground
Hazard Frequency	---	Continuous as could occur under normal operating conditions in hazardous area
Environment	Group I	Methane / Coal dust
Surface Temperature	150ºC	
Service/Ambient Temperature	(-20ºC ≤ Ta ≤ +70ºC)	

DESCRIPTION OF EQUIPMENT (According to Sira Certificate):

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.). They 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.

/. Terminal...

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 = 16.5V	U_i = 16.5V	U_o = 0	U_o = 16.5V
C_i = 3.6nF	C_i = 3.6nF	U_i = 20V	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 = 16.5V	U_i = 16.5V	U_o = 0	U_o = 16.5V
C_i = 2.4nF	C_i = 2.4nF	U_i = 20V	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 = 16.5V	U_i = 16.5V	U_o = 0	U_o = 16.5V
I_o = 1.163A	C_i = 1.2nF	U_i = 20V	U_i = 0
P_o = 1.75W	L_i = 0	C_i = 0	C_i = 0
C_o = 80nF		L_i = 0	L_i = 0
L_o/R_o = 52µH/Ω			
C_i = 3.6nF			
L_i = 0			

TX9136

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

*Note: The internal inductance is in series with a resistance of at least 14.25Ω. 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...

TX9137

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

TX9139

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

Terminals T9-T10 (excluding the TX9139 and the TX9131)

The parameters depend on the variant as follows:

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

Terminals T9-T10 (TX9131 only)

Dual relay	4-20 mA	0.4-2 V	5-15 Hz
U_o = 0V	U_o = 16.5V	U_o = 16.5V	U_o = 0
U_i = 20V	I_o = 0.8A	C_i = 0	U_i = 20V
C_i = 0	P_o = 1.632W	L_i = 0	P_i = 2.5W
L_i = 0	C_i = 0		
	L_i = 0		
	U_i = 5.4V		
	I_i = 0.9mA		
	P_i = 1.2mW		

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...

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

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 = 0V U_i = 20V P_i = 2.3W C_i = 0 L_i = 0	U_o = 16.5V I_o = 472mA P_o = 1.95W C_o = 120nF L_o/R_o = 50µH/Ω	U_o = 16.5V I_o = 50mA P_o = 0.21W C_o = 120nF L_o/R_o = 50µH/Ω	U_o = 7.14V I_o = 50mA P_o = 0.21W C_o = 56µF L_o/R_o = 20µH/Ω	U_o = 0V U_i = 20V P_i = 2.5W C_i = 0 L_i = 0

Variation 1 - This variation introduced the following change:
i. The use of pad printing as an alternative method of marking was recognised.

Variation 2 - This variation introduced the following change:
i. The addition of the TX9151 Liquid Flow Trip Amplifier to the existing range of Trip Amplifiers was allowed, the description being amended accordingly.

Variation 3 - This variation introduced the following changes:
i. The recognition of minor drawing modifications; these amendments are administrative or involve changes to the design that do not affect the aspects of the product that are relevant to explosion safety.
ii. The removal of the input voltage from the marking drawing.

/. iii. The name...

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

Variation 4 - This variation introduced the following change:

i. A more detailed safety description for the TX9131/2/5 was specified.

Terminals T1-T8, T11-T12

T1-T2 (Sensor Power)	T3-T4 (Sensor Signal)	T5-T6 (Supply)	T7-T8 (Relay)	T11-T12 (Relay reset/ power on delay)
U_o = 16.5V C_i = 2.4nF L_i = 0	U_o = 16.5V I_o = 33mA P_o = 135mW C_i = 1.2nF L_o = 0	U_i = 16.5V C_i = 3.6nF L_i = 0	U_o = 0 U_i = 20V C_i = 0 L_i = 0	U_o = 16.5V 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 = 0V U_i = 20V C_i = 0 L_i = 0	U_o = 16.5V C_i = 0 L_i = 0	U_o = 16.5V C_i = 0 L_i = 0	U_o = 0 U_i = 20V P_i = 2.5W C_i = 0 L_i = 0

Variation 5 - This variation introduced the following changes:

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

Variation 6 - This variation introduced the following change:

i. To allow a modification to the TX9136 Programmable Trip Amplifier circuit so as to remove the fuse and replace it with resistive current limitation. Other minor circuit changes will enable the TX9136 to provide sensor cable fault diagnosis.

Variation 7 - This variation introduced the following change:

i. The control PCB was redesigned.

Variation 8 - This variation introduced the following change:

i. Assessment of the existing parameters for the TX9131 Trip amplifier (defining Io and Po parameters at terminal T9/T10 for the existing 4-20 mA output), the Product Description being amended.

ii. Assessment of the addition of input parameters for the TX9131 Trip Amplifier at terminal T9/T10 for connection with a certified barrier, as a result the Product Description was amended and a Specific Condition Of Use was introduced.

/. MARKING...

MARKING:

Sira marking remains applicable and the marking for the relevant models will be as above. The following MASC Certificate number (IA number) must be additionally applied to the equipment.

IA No: MASC M/11-220X

CONDITIONS OF MANUFACTURE:

- None

SPECIAL CONDITIONS OF USE (X):

- 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 (SANS 60079-0) 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 (Ta = -20ºC to +70ºC)
  Sira 99ATEX2136X
  If the enclosure is manufactured from plastics or incorporates a plastics component with a surface area in excess of 100 cm2, then it shall also be marked with a static warning label:
  "STATIC HAZARD! DO NOT RUB WITH A DRY CLOTH"
- 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.
- 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.
- The internal temperature of this apparatus may rise above 150ºC under normal or fault conditions; therefore, care shall be taken when the enclosure is opened to ensure that no dust enters the apparatus.
- Connection to any external supply at terminals T9/T10 for the TX9131 Trip amplifier shall be done in a parallel configuration only.

CONDITIONS OF CERTIFICATION:

1. This IA Certificate covers all units sold from the date of this document to 22 September 2022
2. As per ARP 0108 a three yearly review is required on this IA Certificate.
3. The apparatus must be additionally marked with the MASC marking details above.
4. This approval only covers the equipment as certified above and does not include any scheduled additions or variations / amendments / new issues to the certificate(s), made after the above date.
5. The equipment does not need to be re-tested when used on the conditions and with such restrictions as prescribed by Sira and in this approval.
6. The Sira certification must remain valid.
7. The extent of the requirements in the ARP 0108 (or regulations) and SANS 10108 on the certification of the equipment must remain unchanged.
8. The Ex quality assurance notification/report for the equipment must remain valid.

/. The use...

The use of apparatus in hazardous locations is subject to the following provisions as applicable, which shall be adhered to:

i. SANS 10086 requirements;
ii. Any conditions mentioned in the above document;
iii. Codes of Practice enforced in terms of Regulations 21.17.2 of Minerals Act, by Chief Inspector of Mines;
iv. Any restrictions and conditions enforced by Chief Inspectors of Mines, Principal Inspector (Group I equipment) of Chief Inspector of Factories (Group II equipment);
v. Any relevant requirements of the MHS Act or the OHS Act.

CONCLUSION:

From the above and the selective examination of the documentation, nothing contrary to the requirements of the applicable standards was found, provided that the equipment / component is used as described in the above document / certificate and according to the MASC conditions below. A MASC IA certificate is issued based on the work done by Sira.

The routine tests for production units according to the Sira Certificate must be complied with (if applicable).

Yours faithfully

A. Koekemoer
TECHNICAL SPECIALIST

Mining And Surface Certification

Mining And Surface Certification (Pty) Ltd Reg No: 2015/021934/07
Directors: Roelof Viljoen & Francoius du Toit
Unit #5, Lelyta Park, 45 Jurg Avenue, Hennopspark Ext 87, Centurion, 0157 ◊ P.O. Box 14344, Clubview, 0014
Tel: 012 653 2959 ◊ Fax: 086 605 8568
e-mail: **info@masc-ex.co.za**