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)

TX9042 Programmable Sensor Controller

This document is based on and must be read in conjunction with Baseefa03ATEX0292X 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 :	Programmable Sensor Controller
Manufacturer :	Trolex Ltd. Newby Road, Hazel Grove, Stockport, Cheshire, SK7 5DY, UK
Model(s) / Type(s) :	TX9042
Rating :	I M1 Ex ia I Ma T_a = -20ºC to +40ºC
Certification body :	SGS Baseefa Limited (Baseefa)
Type Certificate No :	Baseefa03ATEX0292X
Variations/Issue/Amendment :	Issue 9
Assessment Report No :	02(C)0346, 05(C)0460, 06(C)0985, GB/BAS/ExTR15.0149/00, GB/BAS/ExTR17.0194/00
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 60079-0	(2012 /A11:2013)	"General requirements"
	- EN 60079-11	(2012)	"Equipment protection by intrinsic safety 'i'"

The evaluation was conducted according to the requirements of:

- **SANS (IEC) 60079-0 : 2012 "Explosive atmospheres – Part 0: Equipment — General requirements"**
- **SANS (IEC) 60079-11 : 2012 "Explosive atmospheres – Part 11: Equipment protection by intrinsic safety 'i'"**

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/. COMPLIANCE...

COMPLIANCE:

The equipment as described below is hereby certified "Explosion Protected" "Ex ia I Ma (Ta = -20ºC to +40ºC)" 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 ≤ +40ºC)	

DESCRIPTION OF EQUIPMENT (According to Baseefa Certificate):

The Programmable Sensor Controller Type TX9042 provides signal conditioning and monitoring for up to 8 transducers. Each transducer is connected via a dedicated input PCB which provides the signal conditioning. A programmable microprocessor circuit monitors the conditioned signals to provide local display, monitoring and control signals, and digital data transmission.

The electronic circuitry, comprising up to 13 PCBs (Power Supply module, Display PCB, Control PCB, Input PCB, Comms Module and up to 8 'Input' Modules), is housed in a moulded plastic enclosure which is itself housed in a stainless steel outer enclosure that provides facilities such as gland entries for restraining incoming cables. The enclosure has been assessed as providing a degree of protection of not less than IP54.

The Control PCB carries the microprocessor circuitry and the control relays and is mounted in the centre of the moulded enclosure, mounted over this, fixed to the top of the enclosure and connected to the Control PCB by a flat ribbon connector, is the Display PCB. An LCD is fitted on the Display PCB along with a connector to interface with a membrane keypad moulded into the top of the unit; the relay status LED's and a piezo- electric buzzer are also mounted on the Display PCB.

Optional data link circuitry is fitted onto a small daughter board (Digital Comms, RS485 Comms) which has pins for connection onto the Control PCB.

Beneath the Control PCB is fitted an Input PCB which carries up to eight transducer 'Input Modules' which can be selected from the following list and which may be fitted in any position on the Input PCB. Each Input Module is a small PCB fitted with input terminals and signal processing circuitry.

The Input Modules comprise:

- DC Analogue Input (that can be configured for voltage, current or temperature input)
- Digital Input (with an option of Vortex input)
- Digital Input (Failsafe)
- AC (RMS) Analogue Input
- Thermocouple Input
- Strain Gauge Input
- Flow Sensor Input
- Alternative Flow Sensor Module (Variation 1)

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/. A Power...

A Power Supply Module connects to the underside of both the Input PCB and the Control PCB.

Connections between the modules, Input PCB, Power Supply Module and Control PCB are by PCB mounted two part connectors.

Connections to external power sources can be made at:

a) Terminals A17, A18 – input to Power Supply Module
b) Terminals B1 to B6 – Digital comms
c) Terminals B7 to B18 – Relay contacts (3 contacts per relay)
d) Terminals A1 to A16, A19 to A34 – Input Modules (4 terminals per module)

Power Supply Connection

Terminals A17, A18 (Power)

U_i = 16.5V
C_i = 0
L_i = 0

Terminals A35, A36 (Control Function)

U_i = 0
I_i = 0
P_i = 0
C_i = 0
L_i = 0

DC Analogue Input Module Connections

This module may be configured, when ordered, for any one of three types of signal Input – voltage, current or temperature:

Voltage Input

Power Output Terminal T1 w.r.t T4

U_o = U_i (power supply connection)
I_o = *
P_o = *
C_o = *
L_o = *
L_o/R_o = *

Input Terminals T2, T3 w.r.t T4

U_i = 16.5V
C_i = 120nF
L_i = 0

U_o = 6.51V
I_o = 1.3mA
C_o = 300µF
L_o = 100mH

Note: parameters marked * are obtained from the certification of the power supply connected.

Current Input

Power Output Terminal T1 w.r.t T2

U_o = U_i (power supply connection)
I_o = *
P_o = *
C_o = *
L_o = *
L_o/R_o = *

Input Terminals T2 w.r.t T3 or T4

U_i = 16.5V
C_i = 120nF
L_i = 0

U_o = 6.51V
I_o = 1.3mA
C_o = 300µF
L_o = 100mH

Note: parameters marked * are obtained from the certification documents of the power supply connected.

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/. Temperature...

Temperature Input

Power Output Terminal T1 w.r.t T2, T3 or T4		**Input Terminal T2 w.r.t T3 or T4**			
U_o	= U_i (power supply connection)	U_i	= 16.5V	U_o	= 6.51V
I_o	= 10mA	C_i	= 120nF	I_o	= 1.3mA
P_o	= 42mW	L_i	= 0	C_o	= 100µF
C_o	= *			L_o	= 100mH
L_o	= *				
L_o/R_o	= *				

Note: parameters marked * are obtained from the certification of the power supply connected.

Digital Input Module Connections

This module can be configured as either of two versions, digital and vortex:

Digital Input

Power Output Terminal T1 w.r.t T4		**Input Terminals T2, T3**			
U_o	= U_i (power supply connection)	U_i	= 16.5V	U_o	= 6.51V
I_o	= 40mA	C_i	= 0	I_o	= 16mA
P_o	= 163mW	L_i	= 0	C_o	= 100µF
C_o	= 5µF			L_o	= 100mH
L_o	= 5mH				
L_o/R_o	= 100µH/Ω				

Vortex Input

Power Output Terminal T1 w.r.t T4		**Input Terminals T2, T3**			
U_o	= 6.51V	U_i	= 16.5V	U_o	= 6.51V
I_o	= 40mA	C_i	= 0	I_o	= 7mA
P_o	= 153mW	L_i	= 0	C_o	= 100µF
C_o	= 100µF			L_o	= 100mH
L_o	= 26mH				
L_o/R_o	= 240µH/Ω				

Digital Input (Failsafe) Module Connections

Power Output Terminals T1 or T3 w.r.t T2 or T4			**Input Terminals T2, T4**			
U_o	= 12.51V	U_i = 0V	U_i	= 16.5V	U_o	= 6.51V
I_o	= 3.4mA		C_i	= 12nF	I_o	= 3.6mA
P_o	= 10.5mW		L_i	= 0	C_o	= 100µF
C_o	= 5µF				L_o	= 100mH
L_o	= 10mH					

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/. AC(rms)...

AC (rms) Analogue Input Module Connections

Power Output Terminals T1 w.r.t T4

U_o = U_i (power supply connection)
I_o = *
P_o = *
C_o = *
L_o = *
L_o/R_o = *

Loop power Output Terminals T2 w.r.t T3 or T4

U_i = 16.5V
C_i = 12nF
L_i = 0

U_o = U_i (PSU Connections)
I_o = 121mA at U_i = 16.5V
P_o = 497mW at U_i = 16.5V
C_o = *
L_o = 30mH

Note: parameters marked * are obtained from the certification of the power supply connected.

Thermocouple Input Module Connections

Power output Terminals T1 w.r.t T4

U_o = U_i (power supply connection)
I_o = *
P_o = *
C_o = *
L_o = *
L_o/R_o = *

Input Terminals T2, T3 w.r.t T4

U_i = 6.88V
C_i = 0
L_i = 0

U_o = 6.51V
I_o = 16mA
C_o = 100µF
L_o = 100mH

Note: parameters marked * are obtained from the certification of the power supply connected

Strain Gauge Input Module Connections

Power Output Terminal T1 w.r.t T4

U_o = U_i (power supply connection)
I_o = 129mA at U_i = 16.5V
P_o = 0.53W at U_i = 16.5V
C_o = *
L_o = *
L_o/R_o = *

Input Terminals T2, T3 w.r.t T4

U_i = 16.5V
P_i = 0.53W
C_i = 10nF
L_i = 0

U_o = 6.88V
I_o = 21mA
C_o = 100µF
L_o = 100mH

Note: parameters marked * are obtained from the certification of the power supply connected.

Flow Sensor Input Module Connections

Power Output Terminal T1 w.r.t T4

U_o = 7.14V
I_o = 131mA
P_o = 234mW
C_o = 100µF
L_o = 10mH
L_o/R_o = 1834µH/Ω

Input Terminal T2 w.r.t T4

U_i = 7.14V
C_i = 1.1nF
L_i = 0

U_o = 6.88V
I_o = 3.3mA
C_o = 100µF
L_o = 100mH

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/. Input Terminal...

Input Terminal T3 w.r.t T4

U_i	= 16.5V	U_o	= 6.88V
C_i	= 1.1nF	I_o	= 3.3mA
L_i	= 0	C_o	= 100µF
		L_o	= 100mH

Alternative Flow Sensor Input Module Connections for connection to a Rosemount Pressure Senor 3051S to Certificate No. Baseefa05ATEX0193U.

U_o	= 16.5V	
I_o	= 242mA	
P_o	= 1W	
C_i	= 0	
L_i	= 0	
C_o	= 6.9µF	Based on U_o = 16.5V using tables for Group I, and reducing to 50%
L_o	= 4.4mH	Based on I_o = 242mA using 0.5 x L x I^2 = 260µJ and reducing to 50%
L_o/R_o	= 468µH/Ω	Based on formula in standard using R_s = 68.4Ω, e = 525µJ, U_o = 16.5V

RS485 Comms Connections
Terminals B2, B3 w.r.t B1

U_o	= 6.88V	U_i	= 12V
I_o	= 154mA	P_i	= 1.41W
P_o	= 265mW	C_i	= 0
C_o	= 10µF	L_i	= 0
L_o	= 4mH		
L_o/R_o	= 139µH/Ω		

Relay Output Connections

U_i = 23V

MARKING:

Baseefa 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/11-359X

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/. CONDITIONS...

CONDITIONS OF MANUFACTURE:

- None

SPECIAL CONDITIONS OF USE (X):

- The programmable Sensor Controller Type TX9042 must be mounted in a secondary enclosure as shown on drawing P5423.02 or in an alternative metal enclosure (not light alloys) which is appropriately certified as providing a degree of protection of IP54.

- Up to 11 RS485 Comms Modules (in separate Programmable Sensor Controllers type TX9042) may be daisy-chained together (i.e terminals B1 all linked together, terminals B2 all linked together and terminals B3 all linked together). Provided that the number of daisy-chained PSC's is reduced to 10, these comms lines may be connected to unspecified safe area equipment via an appropriately certified shunt zener diode safety barrier (dual channel a.c) whose output parameters do not exceed the following per channel:

  U_o = 9V, I_o = 100mA, P_o = 225mW
  OR U_o = 12V, I_o = 80mA, P_o = 240mW

  e.g. suitably certified MTL761, MTL766 to BAS01ATEX7202 or MTL7761ac, MTL7766ac to BAS01ATEX7217.
  For the purpose of this certificate, these shunt zener safety barriers may be considered equivalent to Category I (M1) equipment.

  The cable parameters shall not exceed the following: C_c = 2.8µF, L_c/R_c = 222µH/Ω

- For the purposes of this certificate, a P+F inductive sensor to PTB00ATEX2048X to Category II 1G Ex ia IIC T6 connected to terminals T1 to T4 of a Digital Input Module may be considered equivalent to Category I M1. In this instance, the power supply selected to power the PSC must have an output voltage not exceeding 16V.

CONDITIONS OF CERTIFICATION:

1. This IA Certificate covers all units sold from the date of this document to 22 September 2021.
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 Baseefa and in this approval.
6. The Baseefa 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.

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Mining And Surface Certification (Pty) Ltd Reg No: 2015/021934/07
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/. 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 Baseefa.

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

Yours faithfully

A. Koekemoer
TECHNICAL SPECIALIST

Mining And Surface Certification

This document is issued based on Mining And Surface Certification's Standard Contract terms and conditions available on request.

While every endeavour is made to ensure that a test / assessment is representative and accurately performed, and that a report is accurate in the quoted results and conclusions drawn from the test / assessment, MASC or its members/employees shall in no way be liable for any error made in carrying out the test / assessment or for any erroneous statement, whether in fact or in opinion, contained in a report issued pursuant to a test / assessment.

MASC takes no responsibility for any non-conformances, exclusions or any results / assessments not in compliance with the standards. By marking the equipment in accordance with the documentation / standard, the manufacturer attests on his own responsibility that the equipment has been constructed in accordance with the applicable requirements of the relevant standards and that the routine verifications and routine tests have been successfully completed and the product complies with the documentation and standard(s).

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