



# Mining And Surface Certification CC

CC 2008/202081/23



Certificate Number: MASC MS/11-293  
Issued: 10 August 2012  
Expire: 10 August 2013  
Page: 1 of 6

## IA – CERTIFICATE

(Annual review required)  
(Revision 1)

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

Ex – Type Examination

Certificate number:

**MASC MS/11-293**

Equipment:

**TX6383 Flammable Gas Sensor / Transmitter**

Serial No:

(see “Conditions of Certification”)

Applicant:

Troxel Limited.

Address:

Hazel Grove  
Stockport  
Cheshire  
SK7 5DY  
United Kingdom

Manufacturer:

Troxel Limited.

Address:

Hazel Grove  
Stockport  
Cheshire  
SK7 5DY  
United Kingdom

### DESCRIPTION:

The output PCB circuit and artwork of the Group I and Group II builds have been modified, in addition, the safety description of both builds has also been changed. Specifically, the output board circuit has been altered by addition of C203, R211, LK14, LK15 and their associated tracks (see drawing P5486.110.1, issue C). For the Group II build only, safety resistor R210 is replaced by zero ohm link.

The purpose of this report is therefore to assess these modifications and to use the report as the basis for the re issue of certification Sira 01ATEX2299 and 01ATEX2300.

### 2. ASSESSMENT

#### 2.1 Addition of C203

Although the pads and associated tracks have been added to the PCB, C203 is not fitted to any versions of the TX6383. The only effect on compliance is therefore safety-critical segregations on the PCB – see section 2.5.

**/ . 2.2 Addition...**

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**IA CERTIFICATE NUMBER: MASC MS/11-293**  
**TX6383 Flammable Gas Sensor / Transmitter**  
(INTRINSIC SAFETY)  
(Revision 1)

Page 2 of 6

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## 2.2 Addition of R211

R211 is only fitted in the 4-20mA 4-wire version. From an intrinsic safety perspective, R211 has the same effect as R201, i.e. it limits power transfer between the 'V\_MAIN' and 'V\_SUPPLY' sectors. R201 is no longer used for this function. Since R211 has the same value as R201, its addition has no effect on compliance. R211 should be regarded as a safety component.

## 2.3 Addition of links LK14 and Lk15

LK14 and LK15 affects circuit function only and have no effect on compliance. This part of the circuit is only utilized in the 4-20mA Group I and Group II builds and only LK14 is fitted.

## 2.4 Minor parts list Corrections

In addition to the modifications assessed in 2.1, 2.2 and 2.3, some minor corrections have been made to the parts list:

- R3, R25 and U7 have been included
- The notes have been re-numbered

These changes have no affect on intrinsic safety assessment.

## 2.5 Artwork re-assessment

The additional components affect the artwork and it was verified that the track changes maintain the required segregations.

## 2.6 Reverse polarity protection

Diode D1 protects the supply terminals T4/T3 in Group I builds. There is no such protection on the signal terminals.

For Group I builds, the two supplies may be derived from the same or different sources, in which case reverse polarity connection does not invalidate intrinsic safety for the following reasons:

1. Group I 4-20mA build: it is assumed that twice the supply voltage invades the 'V\_MAIN' sector. Certain non-grounded capacitors (C4 and C16, totaling 68.4nF) are assumed to be charged to 33V but this capacitance is below the permitted maximum of 2.4 $\mu$ F (including a safety factor on voltage) permitted by IEC 60079-11:1999 Figure A.2. The limitations on I and P at the signal terminals have been introduced to the safety description to ensure that the affected safety components are not over-driven.

2. Group I 0.4-2V build: it is assumed T1 can be 16.5V below that the 'V\_SUPPLY' sector can be at (5.88 + 16.5) = 22.38V. The total circuit capacitance (excluding C8, which is directly clamped to 5.88V) is 1.1 $\mu$ F, which is below the permitted maximum of 5 $\mu$ F (including a 1.5 safety factor on voltage) permitted by IEC 60079-11:1999 Figure A.2. The limitations on Ii and Pi at the signal terminals have been introduced to the safety description to ensure that the affected safety components are not over-driven.

- Group I 5-15 Hz build: OPTO1 isolates signal from main circuit.

## /. 2.7 Replacement...

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**IA CERTIFICATE NUMBER: MASC MS/11-293**  
**TX6383 Flammable Gas Sensor / Transmitter**  
 (INTRINSIC SAFETY)  
 (Revision 1)

**2.7 Replacement of R210 by a zero ohm link**

This modification affects the Group II 4-20mA 4-wire build only. R207 and R210 limit the power into the 'V\_MAIN' sector, but a minimum source resistance of 113Ω is also used as part of the safety case. To compensate for R210 being zero ohms, the specified source resistance must be increased to a minimum of 139Ω. This affects the safety description and also notes 2 and 3 (refer to certificate Sira 01ATEX2300), whereby the minimum resistance between terminals T1 and T4 is reduced to 25.65Ω. This value can be rounded down to 25Ω for simplicity.

**2.8 Revised safety descriptions**

The provision of reverse polarity protection, see section 2.6, requires changes to group I safety descriptions. The modification assessed in section 2.7 requires a change to group II safety description

The revised safety description is shown below:

**Group I (Sira 01ATEX2299)**

	T4/T3 (power) (See note 1)		
Ui	16.5V		
Ci	0 (see note 3)		
Li	0		
	T1/T2 (sensor output signal)		
	4-20mA 4-wire	0.4-2V	5-15Hz
Ui	16.5V	16.5V	16.5
Ii	200mA	200mA	
Pi	0.271W	0.271W	
Ci	-	-	0
Li	-	-	0
Uo	16.5V (See note 2)	5.88V	-
Io (peak)	322mA	24mA	-
Io continuous	213mA		
Po	1.328W	35mW	-
Co	9.7μF	9.7μF	-
Lo/Ro	≤20μH/Ω	≤20μH/Ω	-

**Note 1:** The TX6383 may be connected to supplies derived from a single power source or from two separate power sources. Where two separate power sources are used, the power and signal supplies should be regarded as separate intrinsically safe circuits.

**Note 2:** The quoted Uo, Io(peak) Po parameters are worst-case values based on a Ui value of 16.5V. Uo has the same values as Ui, so, if a Ui value of less than 16.5V is used, the same lower value may be used for Uo, Io(peak), and Po are also reduced. Terminals T4 and T1 are connected via a minimum resistance of 51.3Ω. Terminal T4 has a Uo value of zero on account of blocking diodes.

**Note 3:** There is no terminal capacitance at the supply voltage but, for system assessment purposes the installer should note that there is a terminal capacitance of 7.0μF at 5.88V with one countable fault.

/. Group II...

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**IA CERTIFICATE NUMBER: MASC MS/11-293**  
**TX6383 Flammable Gas Sensor / Transmitter**  
 (INTRINSIC SAFETY)  
 (Revision 1)

**Group II, 4-20mA 4-wire (Sira 01ATEX2300)**

	<b>T4/T3 (power) and T1/T2 (sensor output signal)</b>
<b>U<sub>i</sub></b>	<b>28V</b>
<b>I<sub>i</sub></b>	<b>299mA</b>
<b>P<sub>i</sub></b>	<b>1.41W</b>
<b>R<sub>source</sub></b>	<b>≥139Ω</b>
<b>C<sub>i</sub></b>	<b>12nF (see note 4)</b>
<b>L<sub>i</sub></b>	<b>0</b>
	<b>T1/T2 Sensor output signal) (see note 2)</b>
<b>U<sub>o</sub></b>	<b>28V</b>
<b>I<sub>o</sub></b>	<b>171mA</b>
<b>P<sub>o</sub></b>	<b>1.194W</b>
<b>C<sub>o</sub></b>	<b>237nF (see note 3)</b>
<b>L<sub>o</sub></b>	<b>200μH (see note 3)</b>

**Note 1:** The TX6383 may be connected to supplies derived from a single power source or from two separate power source. Where two separate power sources are used, the combined current and power shall not exceed the stated values and they shall be referenced to the same zero volts.

**Note 2:** The quoted **U<sub>o</sub>**, **I<sub>o</sub>** and **P<sub>o</sub>** parameters are worst-case values based on **U<sub>i</sub>** value of 28V. **U<sub>o</sub>** has the same value as **U<sub>i</sub>**, so, if **U<sub>i</sub>** value of less than 28V is used, the same lower value may be used for **U<sub>o</sub>**, **I<sub>o</sub>**(peak) and **P<sub>o</sub>** are also reduced. Terminals T4 and T1 are connected via minimum resistance of 25Ω. Terminal T4 has a **U<sub>o</sub>** value of zero on account of blocking diodes.

**Note 3:** For system assessment purposes, it should be noted that terminals T1 and T4 are connected via minimum resistance of 25Ω. Thus, calculations of external capacitance and inductance connected to terminals T1/T2 should take account of capacitance and inductance connected to terminals T4 and T3.

**Note 4:** In addition to terminal capacitance at the supply voltage, for system assessment purposes, the installer should note that there is a terminal capacitance of 7.0μF at 5.88V.

**Variation 1**

**To permit:**

1. The use of 'Faradex' stainless steel filled nylon 6 as an alternative anti-static enclosure material.

**Variation 2A**

1. An increase in the **L<sub>o</sub>/R<sub>o</sub>** value at terminals T1/T2 from 20μH/Ω to 40μH/Ω.

**MARKING:**

The marking of the units are as follows:

**Troxel Limited.**

**TX6383 Flammable Gas Sensor / Transmitter**

Ex Rating            Ex ia I (Ta = -20°C to +40°C) or  
                          Ex ia d IIB T4 (Ta = -20°C to +40°C)  
 IA No:                MASC MS/11-293  
 Serial No:            (See conditions of Certification)

**/ . Compliance...**

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**IA CERTIFICATE NUMBER: MASC MS/11-293**  
**TX6383 Flammable Gas Sensor / Transmitter**  
**(INTRINSIC SAFETY)**  
**(Revision 1)**

Page 5 of 6

**COMPLIANCE:**

The unit as described above and in MASC Letter **11-293** is hereby certified "Explosion Protected" Ex ia I (Ta = -20°C to +40°C) or Ex ia d IIB T4 (Ta = -20°C to +40°C), 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 Standards:

SANS / IEC 60079: "Electrical apparatus for explosive gas atmospheres",

- **SANS/(IEC) 60079-0 : 2000 "General Requirements";**
- **SANS/(IEC) 60079-1 : 2003 "Flameproof Enclosure 'd'";**
- **SANS/(IEC) 60079-11: 1999 "Intrinsic Safety 'i'";**
- **ARP 0108 (Edition 1.1) "Regulatory requirements for explosion protected apparatus".**
- **SANS10108: 2005, "The classification of hazardous locations and the selection of apparatus for use in such locations"**

Location	Zone 0,1 & 2	Mining (Ex ia I)
Hazard Frequency		Continuous as could occur under normal operations
Environment	Group I	Methane / Coal dust
or		
Location	Zone 1 & 2	Surface/Gas
Hazard Frequency		Intermittent as could occur under normal operations
Environment	Group IIB	Ethylene
Limiting Temperature	T4	135°C
Ambient Temperature	-20°C to +40°C	

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

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

**SPECIAL CONDITIONS OF USE ("X"):**

None

**CONDITIONS OF CERTIFICATION:**

1. This Certificate remains valid based on an annual review indicated in an official MASC letter.
2. The apparatus must be additionally marked in a clear, legible, visible and indelible manner with the MASC marking details above.
3. This certificate of 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.

**/ . 4. The equipment...**

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**IA CERTIFICATE NUMBER: MASC MS/11-293**  
**TX6383 Flammable Gas Sensor / Transmitter**  
**(INTRINSIC SAFETY)**  
**(Revision 1)**

Page 6 of 6

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4. 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.
  5. The Sira certification must remain valid.
  6. The bearing of the requirements in the ARP 0108 (or regulations) and SANS 10108 on the certification of the equipment must remain unchanged.
  7. All production units must be covered by a QAN, Mark Scheme or Batch Evaluation.

Approved on behalf of MASC



**F du Toit**  
**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.*

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