Ex EQUIPMENT TYPE EXAMINATION REPORT

2) TE Report Number: **KLPL/Ex/24-092 Issue no.00** **Dated: 30.11.2024**

3) **Ex Equipment:** **Repeater Power Supply**
Model: MTL4541, MTL4544, MTL4541A, MTL4541S, MTL4544D, MTL4541Y

4) **Manufacturer:** **MTL Instruments Private Limited,**
#3, Old Mahabalipuram Road, Shollinganallur, Chennai – 600119, INDIA.

5) This equipment and any acceptable variation thereto are specified in the schedule to this report and the documents therein referred to

6) Karandikar Laboratories Pvt. Ltd. reports that this equipment has been found to comply with requirements of the following standards relating to the design and construction of equipment for explosive gas/dust atmospheres as applicable.

7) This TE Report was issued as verification that a sample, was assessed, tested and found to comply with the IS / IEC standards listed below.
IS/IEC 60079-0: 2017 & IS/IEC 60079-11: 2023

8) The Examination and Test results are recorded in KLPL's confidential
Report No.: KLPL/Ex/ MTL-24/003 Dated: 30.11.2024

9) The sign X if placed after the TE report number; it indicates that the equipment is subject to specific conditions of use specified in the schedule to this TE Report.

10) This Report does not indicate compliance with electrical safety and performance requirements other than those expressly included in the above listed standards.

11) The marking of the Equipment shall include the following:
Ex Code:
[Ex ia Ma] I (-20°C ≤ Ta ≤ +60°C)
[Ex ia Ga] IIC (-20°C ≤ Ta ≤ +60°C)
[Ex ia Da] IIIC (-20°C ≤ Ta ≤ +60°C)

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12) Details of Type Examination Reports Issued: -

TE Report No.	Issue No.	Report No.	Date	Reason for Issue
KLPL/Ex/24-092	00	KLPL/Ex/MTL-24/003	30.11.2024	Original issue

13) Description of equipment

MTL4541 & MTL4544 Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters

The MTL4544 Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters is designed to provide a floating d.c. supply for energising two conventional 2 or 3-Wire 4/20mA transmitters or a 'smart' transmitter in the hazardous area and repeat these currents in the non-hazardous area, whilst restricting the transfer of energy from the unspecified non-hazardous area apparatus to the intrinsically safe circuits by the means of limitation of current and voltage. The apparatus also allows bi-directional signal communication between the hazardous and non-hazardous area by the connection of a hand-held communicator (HHC). The MTL4544 Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters comprises four isolating transformers that provide galvanic isolation between the hazardous and non-hazardous area circuitry, zener diode chains and resistors providing voltage and current limitation. The above, together with other electronic components, are mounted on a single printed circuit board (PCB) and housed in a moulded plastic enclosure. Polarised plug and sockets are provided for the hazardous and non-hazardous area connections. All models are fitted with a power indication LED. The MTL4541 Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters is a depopulated version of the MTL4544 and has only one channel populated. Both the MTL4541 and MTL4544 available in a number of model variants, denoted by the last digit in the model number. All model variants are built on a common PCB.

MTL4541A Single Channel Current Repeater

The MTL4541A Single Channel Current Repeater is designed to repeat up to two 4-20mA current signals from separately powered 4/20mA transmitters located in the hazardous area to unspecified apparatus in the non-hazardous area, whilst restricting the transfer of energy from the unspecified non-hazardous area apparatus to the intrinsically safe circuits by the means of limitation of current and voltage. The apparatus also allows bidirectional signal communication between the hazardous and non-hazardous area by connection of a handheld communicator (HHC). The MTL4541A Current Repeater comprises four isolating transformers that provide galvanic isolation between the hazardous and non-hazardous area circuitry, fuses, Zener diodes and resistors providing voltage and current limitation on each channel. The above, together with other electronic components are mounted on a single printed circuit board (PCB) and housed in a moulded plastic enclosure. Polarised plug and sockets are provided for hazardous and non-hazardous area connections. The apparatus is fitted with a Power-on LED indication.

MTL4541S & MTL4544D Repeater Power Supplies, 4/20mA

The MTL4541S Single Channel Repeater Power Supply, 4/20mA for 'Smart' Transmitters is designed to provides floating d.c. supplies for energising two 'Smart' 4/20mA Transmitters located in the hazardous area and repeat these currents in the non-hazardous area, whilst restricting the transfer of energy from the unspecified non-hazardous area apparatus to the intrinsically safe circuits by means of limitation of current

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and voltage. The apparatus also allows bi-directional signal communication between the hazardous and non-hazardous area by the connection of a hand-held communicator (HHC). The MTL4541S Single Channel Repeater Power Supply, 4/20mA for 'Smart' Transmitters comprises two isolate ng transformers that provide galvanic isolation between the hazardous and non-hazardous area circuitry, zener diode chains and resistors providing voltage and current limitation. The above, together with other electronic components are mounted on a single printed circuit board (PCB) and housed in a moulded plastic enclosure. Polarised plugs and sockets are provided for hazardous and non-hazardous area connections. LED indication is fitted to indicate power-on. The MTL4544D Repeater Power Supply, 4/20mA for 2 or 3 Wire Transmitters with two outputs is designed to provide a floating d.c. supplies for energising a 2 or 3-Wire 4/20mA Transmitter located in the hazardous area and repeat the current on two channels in the non-hazardous area, whilst restricting the transfer of energy from the unspecified non-hazardous area apparatus to the intrinsically safe circuits by means of limitation of current and voltage. The apparatus also allows bi-directional signal communication between the hazardous and non-hazardous area by the connection of a hand-held communicator (HHC). The apparatus uses the same printed circuit board and enclosure as the MTL4541S but is populated with only one hazardous area transmitter connection and two non-hazardous area outputs fitted.

MTL4541Y Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters

The MTL4541Y Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters is designed to provide a floating d.c. supply for energising a conventional 2 or 3-Wire 4/20mA Transmitter in the hazardous area and repeat these currents in the non-hazardous area, whilst restricting the transfer of energy from unspecified non-hazardous area equipment to the intrinsically safe circuits by means of limitation of current and voltage. The equipment also allows bi-directional signal communication between the hazardous and non-hazardous area by connection of a hand-held communicator (HHC). The MTL4541Y Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters comprises two isolating transformers that provide galvanic isolation between the hazardous and non-hazardous area circuitry, zener diode chains and resistors providing voltage and current limitation. The above, together with other electronic components, are mounted on a single printed circuit board (PCB) and housed in a moulded plastic enclosure. Polarised plug and sockets are provided for hazardous and non-hazardous area connections. A LED is fitted to provide power on indication. The degree of ingress protection of IP 20 as per IS/IEC 60529: 2001 is achieved by enclosure.

14) Model Designation:

Model No.	Product	Rating
MTL4541	Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters	Refer Point 17 below
MTL4544	Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters	
MTL4541A	Single Channel Current Repeater	
MTL4541S	Repeater Power Supplies, 4/20mA.	
MTL4544D	Repeater Power Supplies, 4/20mA.	
MTL4541Y	Repeater Power Supply, 4/20mA for 2 or 3-Wire Transmitters	

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15) Drawings & Documents

Document Number	No. of Pages	Rev. No.	Date	Drawing Title
CI4500-3 (I)	1	1	12.10	MTL4500 and MTL5500- Alternate Zener Diode (Panjit)
CI4500-6 (I)	1	1	12.10	MTL4500 and MTL5500 Conformal Coating
CI4500-100 (I)	1	2	01.13	MTL 4500 Case
CI4541-1 (I)	2	5	07.09	Circuit diagram for MTL4541/MTL4544
CI4541-1 (I)	1	7	08.21	MTL4541 Certification Label Details
CI4541-1 (I)	1	6	01.13	MTL4541 COMPONENT LAYOUT
CI4541-1 (I)	1	4	09.15	PARTS LIST FOR MTL4541/MTL4544
CI4541-1(I)	1	5	01.18	MTL4541/MTL4544 TRACK LAYOUT
CI4541-1(I)	1	2	01.07	PCB DETAIL FOR TPL300
CI4541-1(I)	1	2	01.07	PCB DETAIL FOR TPL301
CI4541-2 (I)	2	1	11.08	Certification diagram for MTL4544A & MTL4541A
CI4541-2 (I)	1	2	01.13	MTL4541A Certification Label Details
CI4541-2 (I)	1	2	01.13	MTL4541A & MTL4544A COMPONENT LAYOUT
CI4541-2 (I)	1	1	10.08	PARTS LIST FOR MTL4541A/MTL4544A
CI4541-2(I)	1	1	11.08	MTL4541A & MTL4544A TRACK LAYOUT
CI4541-2(I)	1	1	11.08	PCB DETAIL FOR TPL300
CI4541-2 (I)	1	1	11.08	PCB DETAIL FOR TPL301
CI4541-3 (I)	1	5	08.21	MTL4541S, MTL4541T, MTL4544S, MTL4544D, Certification Label Details
CI4541-3 (I)	2	2	10.12	Circuit diagram for MTL 4541S, MTL5541S, MTL4544S, MTL5544S, MTL4544D, MTL5544D, MTL4541T
CI4541-3 (I)	1	3	01.14	COMPONENT LAYOUT FOR MTL 4541S, MTL5541S, MTL4544S, MTL5544S, MTL4544D, MTL5544D, MTL4541T
CI4541-3 (I)	1	3	09.15	PARTS LIST FOR MTL 4541S, MTL5541S, MTL4544S, MTL5544S, MTL4544D, MTL5544D, MTL4541T
CI4541-3 (I)	1	1	06.09	TRACK LAYOUT FOR MTL4541S, MTL5541S, MTL4544S, MTL5544S, MTL4544D, MTL5544D
CI4541-3 (I)	1	1	06.09	PCB DETAIL FOR TPL300
CI4541-3 (I)	1	1	06.09	PCB DETAIL FOR TPL301
CI4541Y-1 (I)	1	1	11.14	Circuit diagram for MTL4541Y
CI4541Y-2 (I)	2	1	10.14	MTL4541Y PARTS LIST
CI4541Y-3 (I)	1	1	11.14	TRACK LAYOUT FOR MTL4541Y
CI4541Y-4 (I)	2	1	10.14	MTL4541Y COMPONENT LAYOUT
CI4541Y-5 (I)	1	1	10.14	PCB DETAIL FOR TPL300
CI4541Y-6 (I)	1	1	10.14	PCB DETAIL FOR TPL301
CI4541Y-7 (I)	1	3	02.23	MTL4541Y Certification Label Details

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Drawings listed above are finally accepted as accurately representing the product for which *this evaluation report has been prepared. These drawings provide necessary information as required by the above referred standards.*

16) Temperature Class:

Repeater Power Supply Model: MTL4541, MTL4544, MTL4541A, MTL4541S, MTL4544D, MTL4541Y are an associated apparatus which will be placed in a non-Hazardous area and does not require a temperature class.

17) Electrical Rating:

For MTL4541, MTL4544, MTL4541S, MTL4544D, MTL4541Y models:

Non-Hazardous Area Terminals 8, 9, 11, 12, 13 & 14 (10 to 14 on MTL4541 model)

Um = 253V r.m.s.

The apparatus is designed to operate on the above terminals from a d.c. Supply voltage of up to 35V.

Hazardous Area Terminals 2 w.r.t. 1 or
Hazardous Area Terminals 5 w.r.t. 4 (MTL4544 model)

Uo = 28 V, Io = 93 mA, Po = 0.65 W, Ci = 0, Li = 0

Hazardous Area Terminals 3 w.r.t. 1 or
Hazardous Area Terminals 6 w.r.t. 4 (MTL4544 model)

Uo = 1.1 V, Io = 53 mA, Po = 15 mW, Ui= 30 V, Ii= 121 mA Ci = 0, Li = 0

When an external intrinsically safe source is connected to these terminals it should have a source resistance of Ui / and the capacitance and either the inductance or inductance to resistance ratio (LIR) of the hazardous area connections must not exceed the values detailed in the certificate of the intrinsically safe source. Hazardous area terminals 2 and 5 must not be used when the above source is connected to terminals 3 & 6.

Hazardous Area Terminals 2 w.r.t. 3 or
Hazardous Area Terminals 5 w.r.t. 6 (MTL4544 model)

Uo = 28 V, Io = 87 mA, Po = 0.61 mW, Ci = 0, Li = 0

Each channel must be considered as a separate intrinsically safe circuit.

The capacitance and either the inductance or inductance to resistance ratio (LIR) of the hazardous area load connected must not exceed the following values for either channel:

TABLE 1

GROUP	CAPACITANCE (µF)	INDUCTANCE (mH)	L/R RATIO (µH/ohm)
Hazardous Area Terminals 2 w.r.t. 1 or 5 w.r.t. 4			
IIC	0.083	4.2	56
IIB**	0.65	12.6	210
IIA	2.15	33.6	444
I	3.76	53.7	668

SCHEDULE

Hazardous Area Terminals 3 w.r.t. 1 or 6 w.r.t 4			
IIC	100	12.8	2438
IIB**	1000	47.8	8932
IIA	1000	104.7	18140
I	1000	156.2	28229
Hazardous Area Terminals 2 w.r.t. 3 or 5 w.r.t 6			
IIC	0.083	4.9	59
IIB**	0.65	20.0	222
IIA	2.15	40.9	469
I	3.76	59.1	710

**Group IIB parameters also applicable for associated apparatus [Ex ia Da] IIIC

Note:

1. The above load parameters apply when one of the two conditions below is given:
   - The total Li of the external circuit (excluding the cable) is < 1% of the Lo, value or
   - The total Ci of the external circuit (excluding the cable) is < 1% of the Co, value.
2. The above parameters are reduced to 50% when both of the two conditions below are given:
   - The total Li of the external circuit (excluding the cable) is ≥ 1 % of the Lo, value and
   - The total Ci of the external circuit (excluding the cable) is ≥ 1 % of the Co value.

The reduced capacitance of the external circuit (including cable) shall not be greater than 1 µF for Groups IIB, IIA & I and 600 nF for Group IIC.

For MTL4541A model:

Non-Hazardous Area Terminals 8, 9, 11, 12, 13 & 14

Um = 253V r.m.s.

The apparatus is designed to operate on the above terminals from a d.c. Supply voltage of up to 35V.

Hazardous Area Terminals 2 w.r.t. 1

Uo = 8.6 V, Io = 0, Po = 0, Ci = 0, Li = 0

This output voltage does not contribute to the short circuit spark risk, but must be considered for the calculation of load capacitance. Although the apparatus does not itself comply with the simple apparatus requirements of Clause 5.5 of IS/IEC 60079-11: 2023, when each hazardous area channel is connected in an intrinsically safe circuit the internal stored energy, voltage and current of the interface will not add more than the values specified in Clause 5.5 of IS/IEC 60079-11: 2023 to the parameters of the circuit into which it is connected.

Each hazardous area channel is also considered suitable for the connection of an external intrinsically safe source with a Uo = 30V and Io = 100mA having a source resistance of Uo/Io to be connected to hazardous area terminals 2 w.r.t. 1 - Channel 1. The capacitance and either the inductance or inductance to resistance ratio (L/R) of the hazardous area cable must not exceed the values as detailed in the original schedule or the certificate relating to the external intrinsically safe source. Each channel must be considered as a separate intrinsically safe circuit.

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Hazardous Area Terminals 5 w.r.t. 1

Uo = 17.2 V, Io = 0, Po = 0, Ci = 0, Li = 0

This output voltage does not contribute to the short circuit spark risk, but must be considered for the calculation of load capacitance.

The connection of channel 1 is considered suitable for the connection of an external intrinsically safe source with a Uo = 30V and Io = 100mA having a source resistance of Uo/Io to be connected to hazardous area terminals 5 w.r.t. 1. The capacitance and either the inductance or inductance to resistance ratio (L/R) of the hazardous area cable must not exceed the values as detailed in the original schedule or the certificate relating to the external intrinsically safe source.

Load Parameters

The capacitance and either the inductance or inductance to resistance ratio (LIR) of the hazardous area load connected must not exceed the following values for either channel:

TABLE 1

GROUP	CAPACITANCE (µF)	INDUCTANCE (mH)	L/R RATIO (µH/ohm)
Hazardous Area Terminals 2 w.r.t. 1			
IIC	6.2	5.01	1351
IIB**	55	20.06	5406
IIA	1000	40.12	10813
I	1000	65.82	17740
Hazardous Area Terminals 5 w.r.t. 1			
IIC	0.36	5.01	675
IIB**	2.1	20.06	2703
IIA	8.7	40.12	5406
I	12.16	65.82	8870

**Group IIB parameters also applicable for associated apparatus [Ex ia Da] IIIC

Note:

1. The above load parameters apply when one of the two conditions below is given:
   - The total Li of the external circuit (excluding the cable) is < 1% of the Lo, value or
   - The total Ci of the external circuit (excluding the cable) is < 1% of the Co, value.
2. The above parameters are reduced to 50% when both of the two conditions below are given:
   - The total Li of the external circuit (excluding the cable) is ≥ 1 % of the Lo, value and
   - The total Ci of the external circuit (excluding the cable) is ≥ 1 % of the Co value.

The reduced capacitance of the external circuit (including cable) shall not be greater than 1 µF for Groups IIB, IIA & I and 600 nF for Group IIC.

18) **Specific conditions of use:** Nil

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19) **Routine test:**

- Routine test is to be carried out on each infallible switching transformer, it shall comply the dielectric test of Cl 10.3.1 IS/IEC 60079-11: 2023.
  - At 1500 Vac between the primary and secondary windings.
  - At 500 Vac between all the windings and the core or screen.

  During these tests, there shall be no breakdown of the insulation between windings.
- Apply two coats of HumiSeal® 1B73EPA Acrylic Conformal Coating after cleaning the surface. Visual inspection after cure time shall be conducted for
  - Cracks
  - Non-homogenous covering

END OF DOCUMENT

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