

TD-100 Position Indicator

1. Introduction

Position indication for power transformer on-load tap changers can be performed with analog or digital instruments. Analog instruments are typically more susceptible to indication deviations with time, since they manifest electrical and mechanical degradation as calibration errors. These may in turn cause indication errors, especially in tap changers with a large number of positions.

Digital instruments are considerably more stable with time, but are more sensitive to the electrical noise typically present in control panels, and may present limitations regarding the maximum distance from the transformer to the indicator.

The TD-100 system was developed to combine the advantages of analog and digital systems in a robust, low cost solution.

2. The TD-100 system

In the TD-100 system, the position information is encoded in BCD and transmitted at a distance. The transmission error probability reduces to the probability of losing a transmission cable, providing the greatest possible reliability for this application.

The electronic parts of the indicator do not require adjustment or calibration, and are isolated galvanically from the BCD lines and supply inputs. The BCD signals are extremely robust to electrical noise, and the indication circuit is very simple, consisting of a BCD / 7 segment converter. This conversion does not degrade, even under very adverse electrical, magnetic or environmental conditions.

The TD-100 system is essentially composed of 2 modules:

1. A diode matrix.
2. Isolation relays and a digital indicator.

2.1. Diode matrix

A diode matrix is a passive device built from silicon diodes over a printed circuit board. It receives decimal inputs and outputs a BCD (8421) encoded signal. Operational details and a truth table are contained in the MAT-8421 Diode Matrix operating manual.

Terminal blocks are soldered onto the diode matrix's printed circuit board, allowing direct connections to input and output cables. The matrix is housed in a plastic enclosure, proper for back panel assembly on 35 mm DIN rails.

2.2. Isolation relays and digital indicator

The isolation relay module consists of a simple electronic circuit and a power supply. The relays are driven according to the diode matrix's truth table, using binary signals with 24 Vdc and 0 Vdc levels. The relay contacts reproduce with isolation the BCD logic values as 5V signals at the inputs of a BCD / 7 segment converter. The 5V signals are also isolated from the power supply inputs. Therefore, transients applied to any inputs will not be retransmitted. The output of the BCD / 7 segment converter controls 20 mm LED displays, which indicate the tap changer's position.

It is possible for the isolation relays to have a second series of dry contacts, which can be accessed at the device's terminal block. These contacts allow the BCD signals to be used in another application, such as a remote control system.

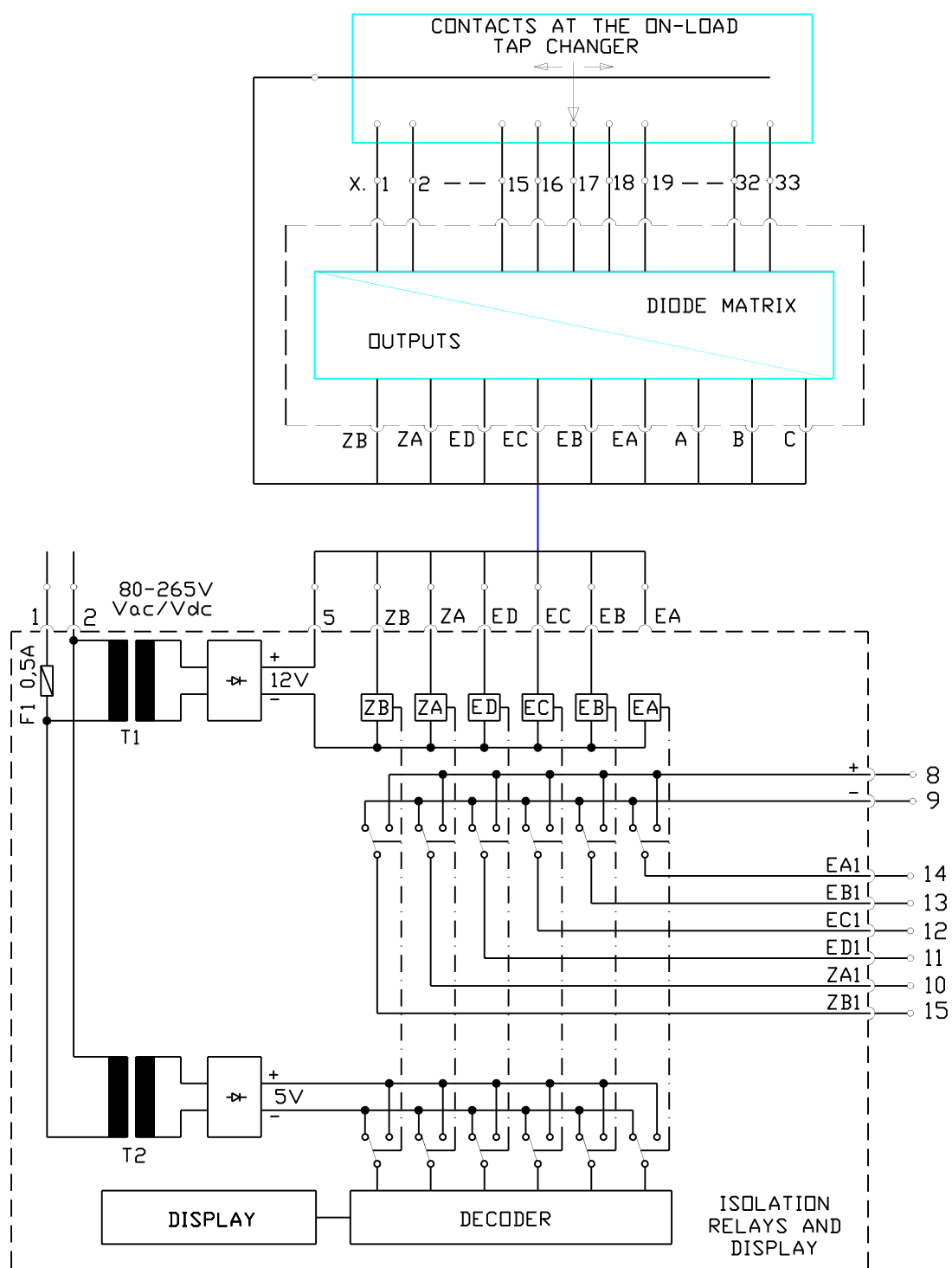
This module is housed in a 96x96x130 mm (WxHxD) enclosure.

2.3. Operating Principle

The diode matrix is connected to a row of contacts at the tap changer's drive. Each row corresponds to a tap changer position, and is connected to a matrix input.

The indicator module provides a +24 Vdc supply, which is connected to a cursor which scans the contact row as the tap changer switches positions. Therefore, the +24 Vdc potential is always applied to a diode matrix input. The diode matrix's output always presents the encoded BCD value, in accordance to its truth table.

The signals from the diode matrix are applied at the indicator module inputs, driving isolation relays according to the BCD truth table. The relay contacts update a BCD / 7 segment converter, which controls the LED displays showing the tap changer's position.

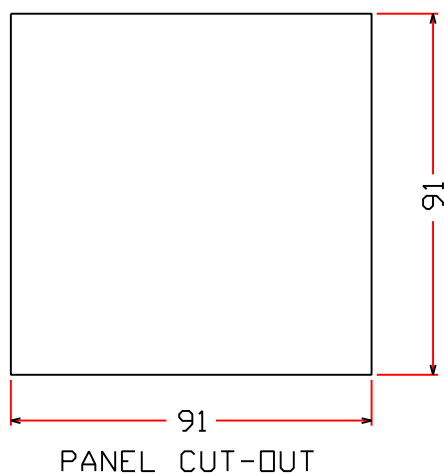
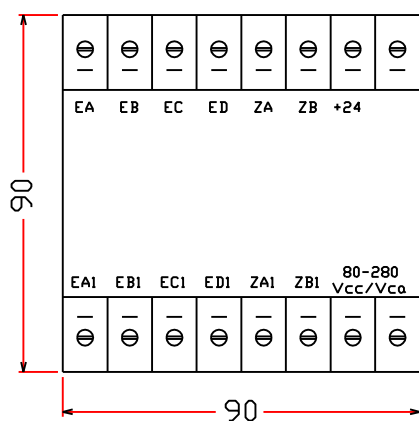
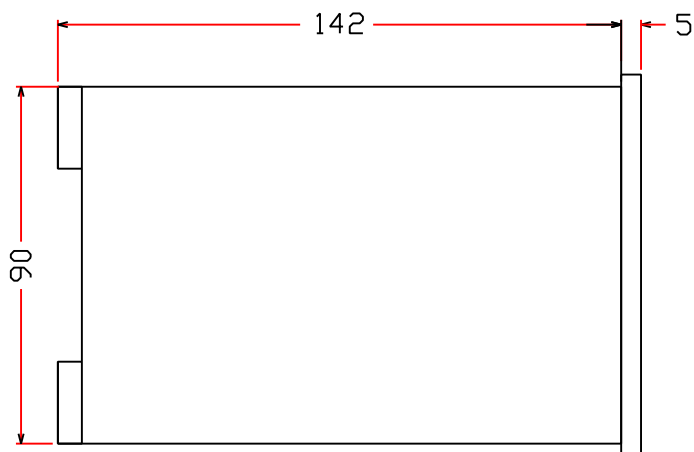
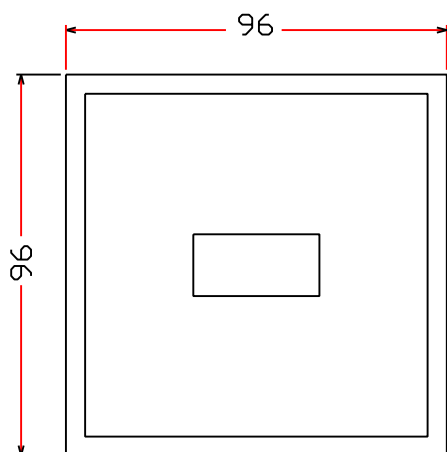


Acceito Cont. Qualid.	Aceito producao	DIGITAL POSITION INDICATOR MOD. TD100	Escala	
Projeto conf.	Des. por. N.A.		Ref.	
Des. conf.	Emit. Depto Data	TD100/0001-REV.A	Alt. num.	Folha
LICHT E. ELETRONICA				1/3

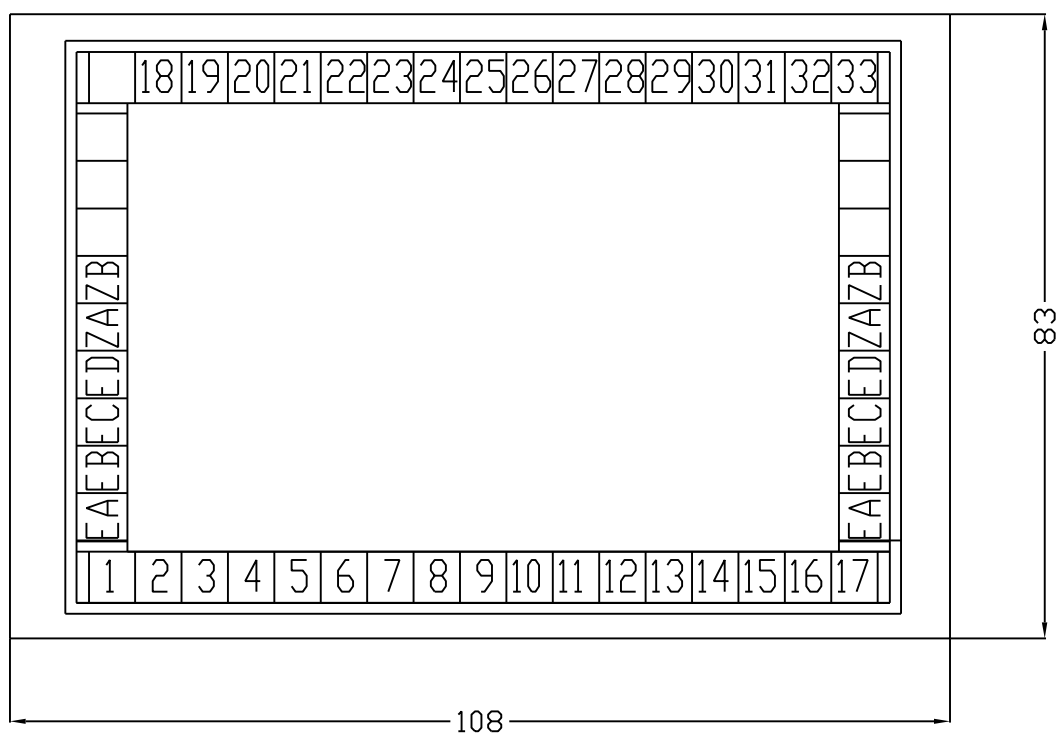
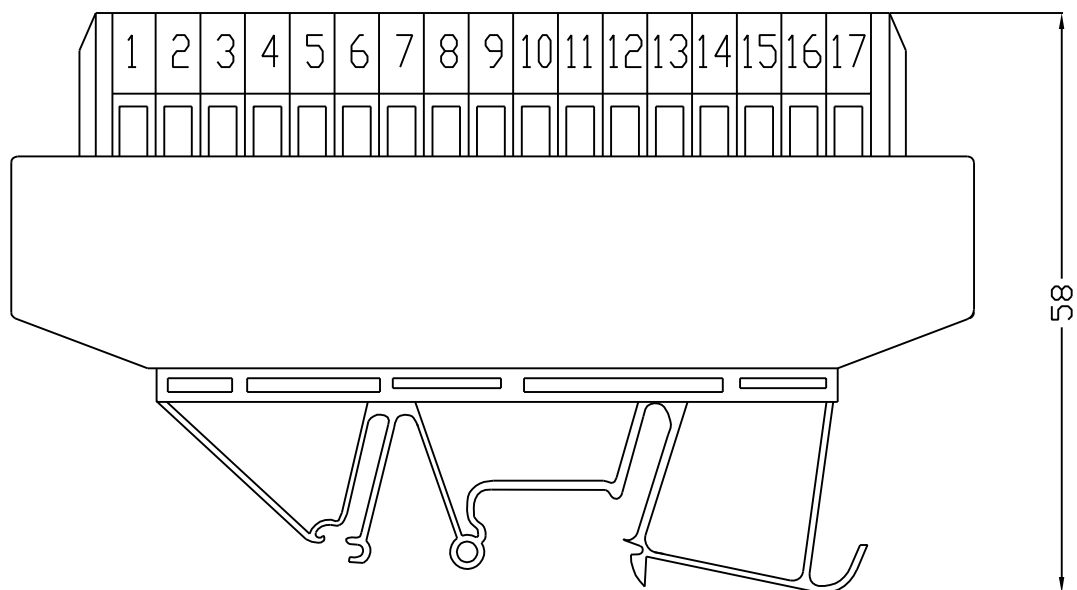
TAP CHANGER POSITION	CLOSED				RELAYS				DISPLAY
	TENS				UNITS				
	ZA	ZB	ZC	ZD	EA	EB	EC	ED	
1									1
2									2
3									3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
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29									29
30									30
31									31
32									32
33									33

 OUTPUT LEVEL HIGH
 OUTPUT LEVEL LOW

Acceito Cont. Qualid.	Aceito producao	DIGITAL POSITION INDICATOR MOD. TD100	Escala	
Projeto conf.	Des. por. N.A.		Ref.	
Des. conf.	Emit. Depto Data	TD100/0001-REV.A	Alt. num.	Folha
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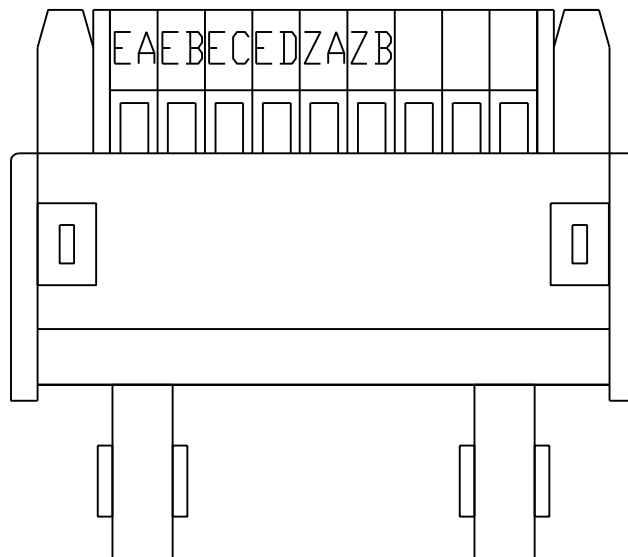
Acceito Cont. Qualid.	Aceito producao	DIGITAL POSITION INDICATOR MOD. TD100	Escala	
Projeto conf.	Des. por. N.A.		Ref.	
Des. conf.	Emit. Depto Data	TD100/0001-REV.A	Alt. num.	Folha
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DIMENSIONS IN MM

CABLE CROSS SECTION $\leq 2,5 \text{ mm}^2$

Acceito Cont. Qualid.	Aceito producao	DIODE MATRIX EXTERNAL DIMENSIONS DIAGRAM	Escala Ref.	
Projeto conf.	Des. por. N.A.			
Des. conf.	Emit. Depto Data	T0002 REV.03	Alt. num.	Folha
LICHT E. ELETRONICA				1/2



TAP CHANGER POSITION	OUTPUT TENS				OUTPUT STATES UNITS				DISPLAY
	ZA	ZB	ZC	ZD	EA	EB	EC	ED	
1					■				1
2					■	■			2
3					■	■			3
4							■		4
5					■		■		5
6						■	■		6
7					■	■	■		7
8								■	8
9					■			■	9
10	■				■				10
11	■				■				11
12	■					■			12
13	■				■				13
14	■						■		14
15	■				■		■		15
16	■					■	■		16
17	■				■	■	■		17
18	■							■	18
19	■				■			■	19
20		■			■				20
21		■				■			21
22		■			■	■			22
23		■					■		23
24		■			■		■		24
25		■				■	■		25
26		■			■	■	■		26
27		■			■	■	■		27
28		■						■	28
29		■			■			■	29
30	■	■			■				30
31	■	■			■	■			31
32	■	■				■			32
33	■	■			■	■			33

 OUTPUT HIGH
 OUTPUT LOW

DIODE MATRIX MOD. 8421 1kV/1A – REVERSE VOLTAGE: 1 kV
 MAX. DIRECT CURRENT: 1 A

Acceito Cont. Qualid.	Aceito producao	DIODE MATRIX EXTERNAL DIMENSIONS DIAGRAM	Escala	
Projeto conf.	Des. por. N.A.		Ref.	
Des. conf.	Emit. Depto Data	T0002 REV.03	Alt. num.	Folha
LICHT E. ELETRONICA				2/2