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Data Sheet 5.91-3/1

Transformer Loss Measuring System, Type LiMOS MS

Application

Testing of distribution transformers and small power transformers:

- Measurement of no-load loss and current
- Measurement of load loss and impedance voltage
- Temperature rise tests
- Measurement of zero-sequence impedances
- Induced voltage tests

Benefits

- Voltage and current sensors with electronic burden and parameter memory
- Data acquisition and evaluation unit close to voltage and current sensors for lowest interferences
- Highest accuracy and long term stability due to fully digital signal processing
- Automatic correction of systematic errors for highest accuracy
- Signal transmission via Ethernet with fiber-optic cables
- Field instrumentation function for direct signal feedback to test voltage source

Description

The transformer loss measuring system LiMOS MS consists of up to three voltage sensors LiMO WVS, up to three current sensors LiMO WCS and one measuring and control unit LiMO MS MCU.
Each LiMO WVS voltage sensor comprises a wideband voltage divider and an electronic burden. The LiMO WCS current sensor consists of a wideband current sensor and an electronic burden as well. The digitizing, correction and evaluation of the sensor signals is performed by the LiMO MS MCU which is located close to the voltage and current sensors to avoid electromagnetic interferences. The evaluated signals and data are transmitted by Ethernet to a PC or laptop for visualization and data recording. The Ethernet connection can be realized via fiber-optic cable to avoid interferences in harsh test bay environments. The field instrumentation function of the LiMO MS MCU provides direct feedback signals for the HIGHVOLT control system, thus enabling the performance of fully automatic test sequences with different reference values.

The loss measuring system LiMOS MS is designed for indoor application only.

System Software iMOS:

The LiMOS MS comes with the system software iMOS that serves to operate the whole measuring system and to read out, process and visualize the measured data. This software enables channel-wise access to operating elements and status.

The iMOS software allows the remote-controlled change of the measuring range of all coarse voltage and current ranges in standalone operation mode and optionally offers sequence-controlled measurements.
If used with multi-phase systems the software is capable of multi-channel data processing making also relations between the measured values of the several phases available.

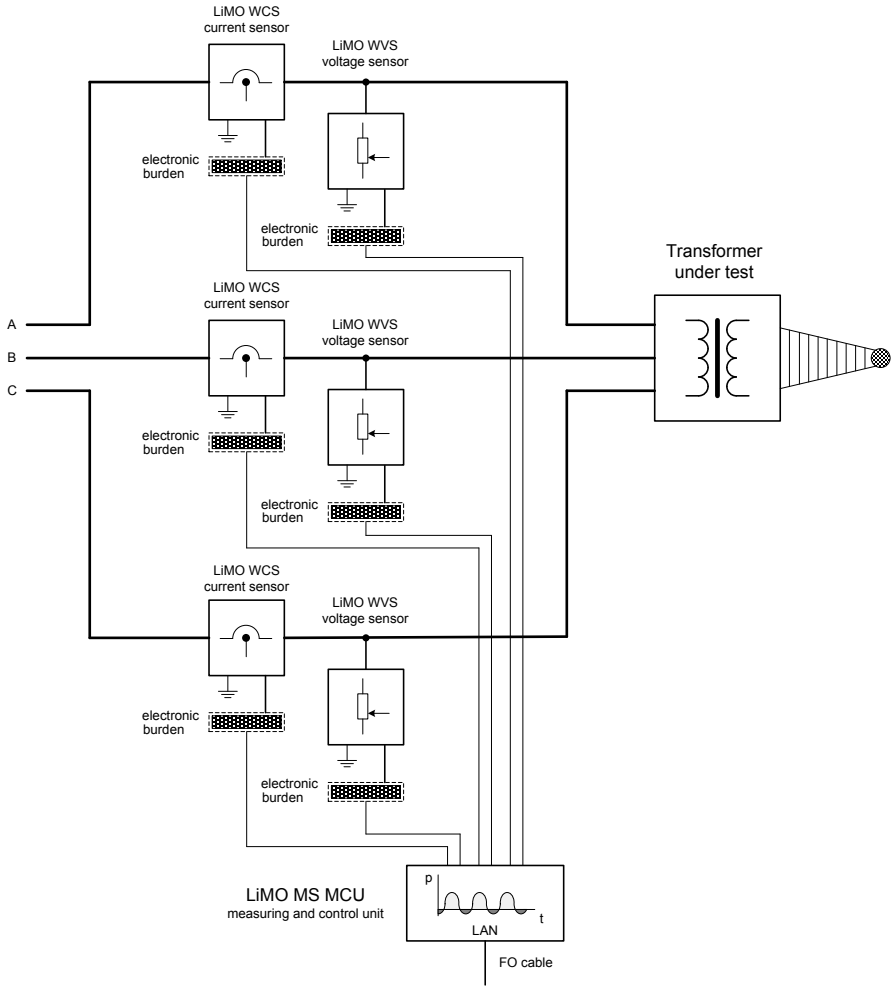

Figure 1: Transformer Loss Measuring System LiMOS MS - block diagram

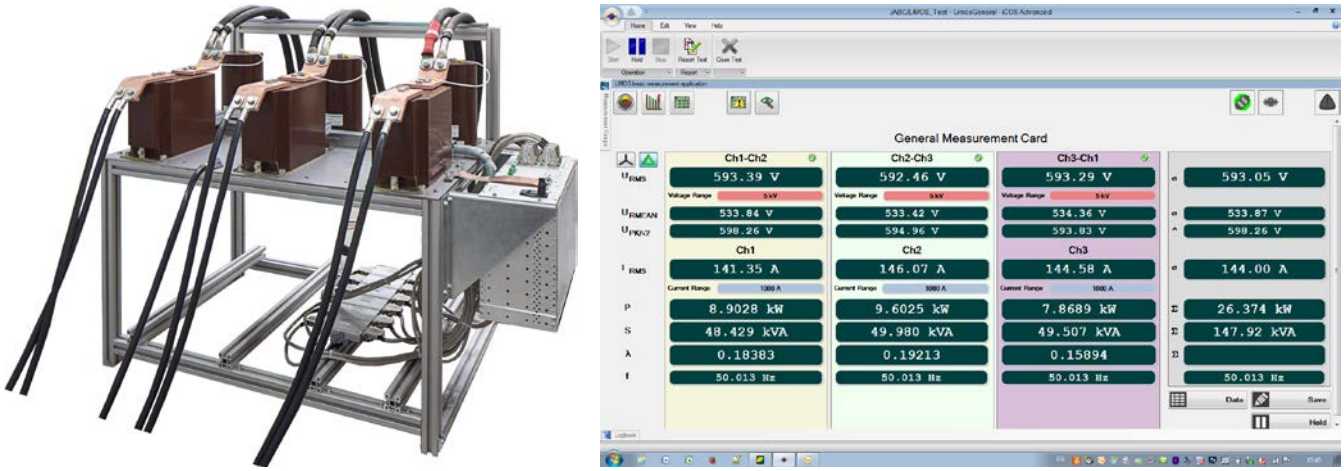

Figure 2: Transformer Loss Measuring System LiMOS MS 1000/5-3 (left: rack arrangement; right: software iMOS)

Table 1: Main parameters - 5 kV Types

Type		LiMOS MS 1000/5-3	LiMOS MS 2000/5-3	LiMOS MS 1000/5-1	LiMOS MS 2000/5-1
LiMOS MS system					
Phases		3		1	
Rated voltage (phase-to-ground)	kV	5			
Rated current	A	1000	2000	1000	2000
Measuring frequency	Hz	50, 60 [1)]			
Operating frequency	Hz	40 – 200 [1)]			
Voltage measurement					
Ranges (coarse)	kV	0.5 – 5			
Measuring accuracy	%	0.1 [2)]			
Current measurement					
Ranges (coarse)	A	10 – 100 – 1000	20 – 200 – 2000	10 – 100 – 1000	20 – 200 – 2000
Measuring accuracy	%	0.1 [2)]			
Loss measurement – Accuracy					
cos φ = 1.000	%	0.3		0.3	
cos φ = 0.100	%	1		1	
cos φ = 0.020	%	5		5	
Environmental conditions					
Operating temperature	°C	+ 5 - + 40			
Storage temperature	°C	-20 - +50			
Relative humidity	%	30 – 80 (non condensing)			
Altitude	m	≤ 1000			
Safety clearances					
to grounded components	mm	≥ 220		≥ 220	
phase-to-phase	mm	≥ 380		-	
LiMO WVS wide range voltage sensor LiMO WVS 5S					
Quantity		3		1	
Primary connections		HV: Screw M10x20; GND: baseplate 4x Ø14			
Lead length (electr. burden)	m	2			
Connector (electr. burden)		Sub-D-25 M			
Dimensions (L x W x H)	mm	150 x 150 x 260			
Weight	kg	9.6			
LiMO WCS wide range current sensors LiMO WCS 1000/5S and LiMO WCS 2000/5S					
Quantity		3		1	
Primary connections P1, P2		2x Screw M12x23	4x Screw M12x23	2x Screw M12x23	4x Screw M12x23
Primary connections GND		baseplate 4x Ø12			
Lead length (electr. burden)	m	2			
Connector (electr. burden)		Sub-D-25 M			
Dimensions (L x W x H)	mm	380 x 148 x 220			
Weight	kg	21.5			
LiMO MS MCU measuring and control unit					
Supply voltage	V	110 – 240			
Frequency	Hz	50 / 60			
Power	VA	< 80 (Fuse T 3.15 A)			
Interface		Ethernet LAN (TCP/IP; FOC 1x FSC Duplex)			
Dimensions (L x W x H)	mm	484 x 320 x 178			
Weight	kg	5.3		5.1	
Safety contacts					
Operating voltage	V	≤ 240 (Fuse T 3.15 A)			
Quantity		2			

[1)] - other frequencies available on request

[2)] - at 10 % to 110 % range utilization

Table 2: Main parameters - 10 kV Types

Type		LiMOS MS 1000/10-3	LiMOS MS 2000/10-3	LiMOS MS 1000/10-1	LiMOS MS 2000/10-1
LiMOS MS system					
Phases		3		1	
Rated voltage (phase-to-ground)	kV	10			
Rated current	A	1000	2000	1000	2000
Measuring frequency	Hz	50, 60 [1)]			
Operating frequency	Hz	40 – 200 [1)]			
Voltage measurement					
Ranges (coarse)	kV	0.1 – 1 - 10			
Measuring accuracy	%	0.1 [2)]			
Current measurement					
Ranges (coarse)	A	10 – 100 – 1000	20 – 200 – 2000	10 – 100 – 1000	20 – 200 – 2000
Measuring accuracy	%	0.1 [2)]			
Loss measurement – Accuracy					
cos φ = 1.000	%	0.3		0.3	
cos φ = 0.100	%	1		1	
cos φ = 0.020	%	5		5	
Environmental conditions					
Operating temperature	°C	+ 5 - + 40			
Storage temperature	°C	-20 - +50			
Relative humidity	%	30 – 80 (non condensing)			
Altitude	m	≤ 1000			
Safety clearances					
to grounded components	mm	≥ 260		≥ 260	
phase-to-phase	mm	≥ 420		-	
LiMO WVS wide range voltage sensor LiMO WVS 10S					
Quantity		3		1	
Primary connections		HV: Screw M10x20; GND: baseplate 4x Ø14			
Lead length (electr. burden)	m	2			
Connector (electr. burden)		Sub-D-25 M			
Dimensions (L x W x H)	mm	150 x 150 x 260			
Weight	kg	9.6			
LiMO WCS wide range current sensors LiMO WCS 1000/10S and LiMO WCS 2000/10S					
Quantity		3		1	
Primary connections P1, P2		2x Screw M12x23	4x Screw M12x23	2x Screw M12x23	4x Screw M12x23
Primary connections GND		baseplate 4x Ø14			
Lead length (electr. burden)	m	2			
Connector (electr. burden)		Sub-D-25 M			
Dimensions (L x W x H)	mm	415 x 178 x 280			
Weight	kg	29.5			
LiMO MS MCU measuring and control unit					
Supply voltage	V	110 – 240			
Frequency	Hz	50 / 60			
Power	VA	< 80 (Fuse T 3.15 A)			
Interface		Ethernet LAN (TCP/IP; FOC 1x FSC Duplex)			
Dimensions (L x W x H)	mm	484 x 320 x 178			
Weight	kg	5.3		5.1	
Safety contacts					
Operating voltage	V	≤ 240 (Fuse T 3.15 A)			
Quantity		2			

[1)] - other frequencies available on request

[2)] - at 10 % to 110 % range utilization

Table 3: Main parameters - 24 kV Types

Type		LiMOS MS 1000/24-3	LiMOS MS 2000/24-3	LiMOS MS 1000/24-1	LiMOS MS 2000/24-1
LiMOS MS system					
Phases		3		1	
Rated voltage (phase-to-ground)	kV	24			
Rated current	A	1000	2000	1000	2000
Measuring frequency	Hz	50, 60 [1)]			
Operating frequency	Hz	40 – 200 [1)]			
Voltage measurement					
Ranges (coarse)	kV	0.24 – 2.4 - 24			
Measuring accuracy	%	0.1 [2)]			
Current measurement					
Ranges (coarse)	A	10 – 100 – 1000	20 – 200 – 2000	10 – 100 – 1000	20 – 200 – 2000
Measuring accuracy	%	0.1 [2)]			
Loss measurement – Accuracy					
cos φ = 1.000	%	0.3		0.3	
cos φ = 0.100	%	1		1	
cos φ = 0.020	%	5		5	
Environmental conditions					
Operating temperature	°C	+ 5 - + 40			
Storage temperature	°C	-20 - +50			
Relative humidity	%	30 – 80 (non condensing)			
Altitude	m	≤ 1000			
Safety clearances					
to grounded components	mm	≥ 260		≥ 260	
phase-to-phase	mm	≥ 420		-	
LiMO WVS wide range voltage sensor LiMO WVS 24S					
Quantity		3		1	
Primary connections		HV: Screw M10x20; GND: baseplate 4x Ø14			
Lead length (electr. burden)	m	2			
Connector (electr. burden)		Sub-D-25 M			
Dimensions (L x W x H)	mm	150 x 150 x 260			
Weight	kg	9.6			
LiMO WCS wide range current sensors LiMO WCS 1000/24S and LiMO WCS 2000/24S					
Quantity		3		1	
Primary connections P1, P2		2x Screw M12x23	4x Screw M12x23	2x Screw M12x23	4x Screw M12x23
Primary connections GND		baseplate 4x Ø14			
Lead length (electr. burden)	m	2			
Connector (electr. burden)		Sub-D-25 M			
Dimensions (L x W x H)	mm	415 x 178 x 280			
Weight	kg	29.5			
LiMO MS MCU measuring and control unit					
Supply voltage	V	110 – 240			
Frequency	Hz	50 / 60			
Power	VA	< 80 (Fuse T 3.15 A)			
Interface		Ethernet LAN (TCP/IP; FOC 1x FSC Duplex)			
Dimensions (L x W x H)	mm	484 x 320 x 178			
Weight	kg	5.3		5.1	
Safety contacts					
Operating voltage	V	≤ 240 (Fuse T 3.15 A)			
Quantity		2			

[1)] - other frequencies available on request

[2)] - at 10 % to 110 % range utilization

Table 4: Main parameters - 46 kV Types

Type		LiMOS MS 1000/46-3	LiMOS MS 2000/46-3	LiMOS MS 1000/46-1	LiMOS MS 2000/46-1
LiMOS MS system					
Phases		3		1	
Rated voltage (phase-to-ground)	kV	46			
Rated current	A	1000	2000	1000	2000
Measuring frequency	Hz	50, 60 [1)]			
Operating frequency	Hz	40 – 200 [1)]			
Voltage measurement					
Ranges (coarse)	kV	0.46 – 4.6 - 46			
Measuring accuracy	%	0.1 [2)]			
Current measurement					
Ranges (coarse)	A	10 – 100 – 1000	20 – 200 – 2000	10 – 100 – 1000	20 – 200 – 2000
Measuring accuracy	%	0.1 [2)]			
Loss measurement – Accuracy					
cos φ = 1.000	%	0.3		0.3	
cos φ = 0.100	%	1		1	
cos φ = 0.020	%	5		5	
Environmental conditions					
Operating temperature	°C	+ 5 - + 40			
Storage temperature	°C	-20 - +50			
Relative humidity	%	30 – 80 (non condensing)			
Altitude	m	≤ 1000			
Safety clearances					
to grounded components	mm	≥ 390		≥ 390	
phase-to-phase	mm	≥ 580		-	
LiMO WVS wide range voltage sensor LiMO WVS 46S					
Quantity		3		1	
Primary connections		HV: Screw M10x20; GND: baseplate 4x Ø14			
Lead length (electr. burden)	m	2			
Connector (electr. burden)		Sub-D-25 M			
Dimensions (L x W x H)	mm	170 x 170 x 390			
Weight	kg	18.5			
LiMO WCS wide range current sensors LiMO WCS 1000/46S and LiMO WCS 2000/46S					
Quantity		3		1	
Primary connections P1, P2		2x Screw M12x23	4x Screw M12x23	2x Screw M12x23	4x Screw M12x23
Primary connections GND		baseplate 4x Ø14			
Lead length (electr. burden)	m	2			
Connector (electr. burden)		Sub-D-25 M			
Dimensions (L x W x H)	mm	463 x 249 x 390			
Weight	kg	71.5			
LiMO MS MCU measuring and control unit					
Supply voltage	V	110 – 240			
Frequency	Hz	50 / 60			
Power	VA	< 80 (Fuse T 3.15 A)			
Interface		Ethernet LAN (TCP/IP; FOC 1x FSC Duplex)			
Dimensions (L x W x H)	mm	484 x 320 x 178			
Weight	kg	5.3		5.1	
Safety contacts					
Operating voltage	V	≤ 240 (Fuse T 3.15 A)			
Quantity		2			

[1)] - other frequencies available on request

[2)] - at 10 % to 110 % range utilization

Type designation

LiMOS MS loss measuring system

LiMOS MS 1000/5-1	LiMOS MS loss measuring system for 1000 A, 5 kV , 1 phase
LiMOS MS 2000/5-1	LiMOS MS loss measuring system for 2000 A, 5 kV , 1 phase
LiMOS MS 1000/5-3	LiMOS MS loss measuring system for 1000 A, 5 kV , 3 phases
LiMOS MS 2000/5-3	LiMOS MS loss measuring system for 2000 A, 5 kV , 3 phases
LiMOS MS 1000/10-1	LiMOS MS loss measuring system for 1000 A, 10 kV , 1 phase
LiMOS MS 2000/10-1	LiMOS MS loss measuring system for 2000 A, 10 kV , 1 phase
LiMOS MS 1000/10-3	LiMOS MS loss measuring system for 1000 A, 10 kV , 3 phases
LiMOS MS 2000/10-3	LiMOS MS loss measuring system for 2000 A, 10 kV , 3 phases
LiMOS MS 1000/24-1	LiMOS MS loss measuring system for 1000 A, 24 kV , 1 phase
LiMOS MS 2000/24-1	LiMOS MS loss measuring system for 2000 A, 24 kV , 1 phase
LiMOS MS 1000/24-3	LiMOS MS loss measuring system for 1000 A, 24 kV , 3 phases
LiMOS MS 2000/24-3	LiMOS MS loss measuring system for 2000 A, 24 kV , 3 phases
LiMOS MS 1000/46-1	LiMOS MS loss measuring system for 1000 A, 46 kV , 1 phase
LiMOS MS 2000/46-1	LiMOS MS loss measuring system for 2000 A, 46 kV , 1 phase
LiMOS MS 1000/46-3	LiMOS MS loss measuring system for 1000 A, 46 kV , 3 phases
LiMOS MS 2000/46-3	LiMOS MS loss measuring system for 2000 A, 46 kV , 3 phases

LiMO WVS wide range voltage sensor

LiMO WVS 5S	Wide range voltage sensor for 5 kV
LiMO WVS 10S	Wide range voltage sensor for 10 kV
LiMO WVS 24S	Wide range voltage sensor for 24 kV
LiMO WVS 46S	Wide range voltage sensor for 46 kV

LiMO WCS wide range current sensor

LiMO WCS 1000/5S	Wide range current sensor for 1000 A / 5 kV
LiMO WCS 2000/5S	Wide range current sensor for 2000 A / 5 kV
LiMO WCS 1000/10S	Wide range current sensor for 1000 A / 10 kV
LiMO WCS 2000/10S	Wide range current sensor for 2000 A / 10 kV
LiMO WCS 1000/24S	Wide range current sensor for 1000 A / 24 kV
LiMO WCS 2000/24S	Wide range current sensor for 2000 A / 24 kV
LiMO WCS 1000/46S	Wide range current sensor for 1000 A / 46 kV
LiMO WCS 2000/46S	Wide range current sensor for 2000 A / 46 kV

Measuring and Control Unit – LiMO MS MCU

LiMO MS MCU-1	Measuring and control unit, single channel
LiMO MS MCU-3	Measuring and control unit, three channels

System Software

iMOS	Software for LiMOS loss measuring system