

# M210/M211 | Voltage Transformer Test Set



Voltage Transformer Test Set **M210/M211** measures voltage transformer (VT) errors with the method based on high voltage capacitance bridge. This method provides accurate measurement of the VT errors in continuous ranges of primary and secondary voltages. The method allows to decrease dimensions and weight of the equipment significantly.

**M210/M211** can also be used as a capacitive high voltage bridge for measuring capacitance and dissipation factor ( $\tan\delta$ ) during testing of high voltage equipment \*

## FEATURES AND BENEFITS

- Measurement of VT errors in continuous ranges of primary and secondary voltages
- High measurement accuracy (VT testing): up to  $\pm 0,005 \%$  and  $\pm 0,3$  minutes
- High measurement accuracy (C& $\tan\delta$  testing): up to  $\pm 0,005 \%$  ( $C_x$ ) and  $\pm 0,00005$  ( $\tan\delta$ )\*
- Measurement of true RMS values of primary and secondary voltages, THD and n-th harmonic ratios (up to 40-th) measurement
- A more cost-effective solution than combination of standard voltage transformers or voltage divider and comparator
- Easy handling
- Small size and low weight

## APPLICATIONS

**M210/M211** is used by:

- Manufacturer of Voltage Transformers
- Calibration Laboratories
- On-site testing of Voltage Transformers
- Metrology Institutes

\* Additional function. Can be supplied upon customer's request

**VERSIONS**

Voltage Transformer Test Set M210/M211 is available in six versions, which differ in accuracy class and maximum primary voltage.

M210/M211 version	Primary voltage range ( $U_1$ ), kV	Secondary voltage range ( $U_2$ ), V	Rated voltage of High Voltage Capacitors ( $U_{CH}$ ), kV
M210.1	0,01...45	0,6...1000	45
M211.1			
M210.2	0,01...100		100
M211.2			
M210.3	0,01...230		230
M211.3			

The version of M210/M211 for higher voltage can be supplied upon customer's request.

**TEST ARRANGEMENT**

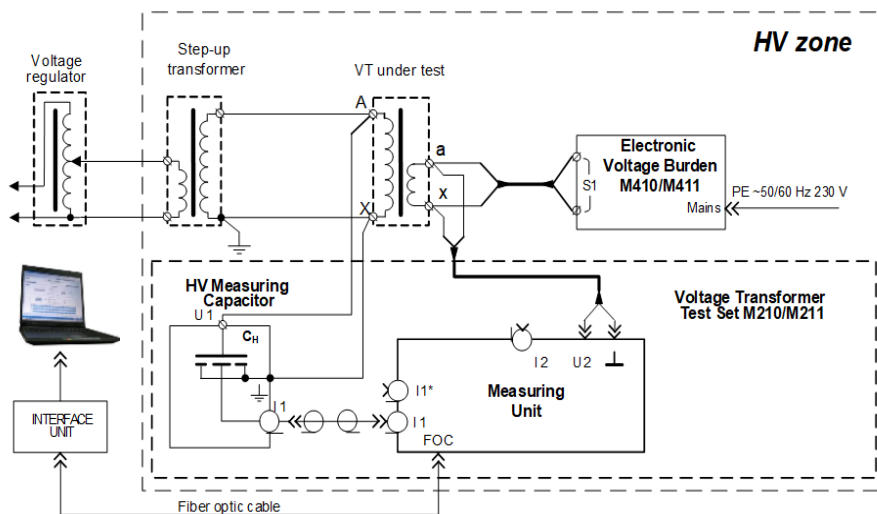


Fig.1 VT testing

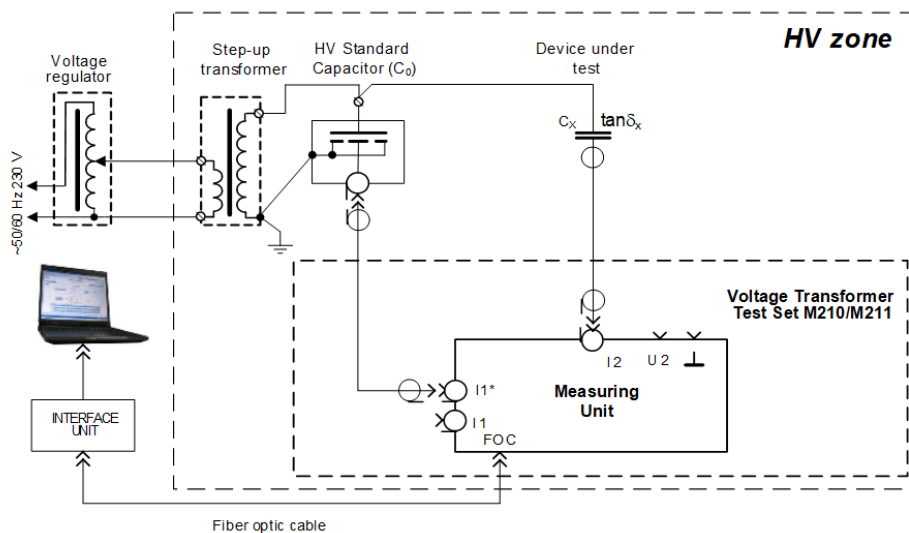


Fig. 2 C& $\tan\delta$  testing\*

\* Additional function. Can be supplied upon customer's request

**TECHNICAL SPECIFICATIONS**

Measurement ranges and error limits of VT Test Set **M210** – VT testing

Value	Measurement range	Limits of absolute measurement error	Additional conditions	
Ratio error, $\varepsilon$	- 100 % $\leq \varepsilon \leq$ 100 %	$\pm 0,015$ %	$ \Delta\varphi  \leq 100$ min	$300 \text{ V} \leq U_1 \leq U_{CH}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 0,05$ %	$ \Delta\varphi  \leq 100$ min	$100 \text{ V} \leq U_1 < 300 \text{ V}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 0,1$ %	$ \Delta\varphi  > 100$ min	$100 \text{ V} \leq U_1 \leq U_{CH}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 0,5$ %	$10 \text{ V} \leq U_1 < 100 \text{ V}$ and/or $0,6 \text{ V} \leq U_2 < 6 \text{ V}$	
Phase displacement, $\Delta\varphi$	- 300 min $\leq \Delta\varphi \leq$ 300 min	$\pm 1$ min	$ \Delta\varphi  \leq 100$ min	$300 \text{ V} \leq U_1 \leq U_{CH}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 3$ min	$ \Delta\varphi  \leq 100$ min	$100 \text{ V} \leq U_1 < 300 \text{ V}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 5$ min	$ \Delta\varphi  > 100$ min	$100 \text{ V} \leq U_1 \leq U_{CH}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 10$ min	$10 \text{ V} \leq U_1 < 100 \text{ V}$ and/or $0,6 \text{ V} \leq U_2 < 6 \text{ V}$	
Relative value of secondary voltage, $U_s/U_{sr}$	2...190 %	$\pm 1$ %*	$0,6 \text{ V} \leq U_2 \leq 1000 \text{ V}$	
Test voltage frequency, $f$	49...51 Hz**	$\pm 0,02$ Hz	-	

Measurement ranges and error limits of VT Test Set **M211** – VT testing

Value	Measurement range	Limits of absolute measurement error	Additional conditions	
Ratio error, $\varepsilon$	-100 % $\leq \varepsilon \leq$ 100 %	$\pm 0,005$ %	$ \Delta\varphi  \leq 30$ min	$300 \text{ V} \leq U_1 \leq U_{CH}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 0,01$ %	$30 \text{ min} <  \Delta\varphi  \leq 100$ min	
		$\pm 0,05$ %	$ \Delta\varphi  \leq 100$ min	$100 \text{ V} \leq U_1 < 300 \text{ V}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 0,1$ %	$ \Delta\varphi  > 100$ min	
		$\pm 0,5$ %	$10 \text{ V} \leq U_1 < 100 \text{ V}$ and/or $0,6 \text{ V} \leq U_2 < 6 \text{ V}$	
Phase displacement, $\Delta\varphi$	-300 min $\leq \Delta\varphi \leq$ 300 min	$\pm 0,3$ min	$ \Delta\varphi  \leq 30$ min	$300 \text{ V} \leq U_1 \leq U_{CH}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 1$ min	$30 \text{ min} <  \Delta\varphi  \leq 100$ min	
		$\pm 3$ min	$ \Delta\varphi  \leq 100$ min	$100 \text{ V} \leq U_1 < 300 \text{ V}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 5$ min	$ \Delta\varphi  > 100$ min	$100 \text{ V} \leq U_1 \leq U_{CH}$ , $6 \text{ V} \leq U_2 \leq 1000 \text{ V}$
		$\pm 10$ min	$10 \text{ V} \leq U_1 < 100 \text{ V}$ and/or $0,6 \text{ V} \leq U_2 < 6 \text{ V}$	
Relative value of secondary voltage, $U_s/U_{sr}$	2...190 %	$\pm 1$ %*	$0,6 \text{ V} \leq U_2 \leq 1000 \text{ V}$	
Test voltage frequency, $f$	49...51 Hz**	$\pm 0,02$ Hz	-	

\*relative error

\*\* measuring at the frequency of 60 Hz can be agreed with the customer

Measurement ranges and error limits of VT Test Set **M210** – C&tanδ testing

$C_x/C_0$	Limits of relative measurement error of $\delta_c$ , %	Limits of absolute measurement error of dissipation factor $\Delta_{\tan\delta}$	Test current, A
0,01...0,1	$\pm[1 \cdot 10^{-2} + 2 \cdot 10^{-4} \cdot (C_0/C_x - 10) +  \tan\delta_x - \tan\delta_0 ]$	$\pm[1 \cdot 10^{-4} + 2 \cdot 10^{-6} \cdot (C_0/C_x - 10) + 0,005 \cdot  \tan\delta_x - \tan\delta_0 ]$	up to 0,2
0,1...10 <sup>3</sup>	$\pm 1 \cdot 10^{-2} +  \tan\delta_x - \tan\delta_0 ]$	$\pm[1 \cdot 10^{-4} + 0,005 \cdot  \tan\delta_x - \tan\delta_0 ]$	

Measurement ranges and error limits of VT Test Set **M211** – C&tanδ testing

$C_x/C_0$	Limits of relative measurement error of $\delta_c$ , %	Limits of absolute measurement error of dissipation factor $\Delta_{\tan\delta}$	Test current, A
0,01...0,1	$\pm[5 \cdot 10^{-3} + 2 \cdot 10^{-4} \cdot (C_0/C_x - 10) +  \tan\delta_x - \tan\delta_0 ]$	$\pm[5 \cdot 10^{-5} + 2 \cdot 10^{-6} \cdot (C_0/C_x - 10) + 0,005 \cdot  \tan\delta_x - \tan\delta_0 ]$	up to 0,2
0,1...10 <sup>3</sup>	$\pm 5 \cdot 10^{-3} +  \tan\delta_x - \tan\delta_0 ]$	$\pm[5 \cdot 10^{-5} + 0,005 \cdot  \tan\delta_x - \tan\delta_0 ]$	

Measurement ranges and error limits of VT Test Set M210/M211 – voltage parameters testing

Value	Range	Error limits	Additional conditions
True RMS voltage, V	$U_1$	$\delta_U = \pm 0,5 \%$	CH using
	$U_2$		-
First harmonic true RMS voltage, V	$U_{11}$	$\delta_U = \pm 0,5 \%$	CH using
	$U_{21}$		-
Primary voltage THD ( $K_{U1}$ ), %	0...20	$\Delta_{Ku1} = \pm 0,2 \%$	CH using at $K_{U1} < 2$
		$\delta_{Ku1} = \pm 10 \%$	CH using at $K_{U1} \geq 2$
Secondary voltage THD ( $K_{U2}$ ), %	0...20	$\Delta_{Ku2} = \pm 0,05 \%$	at $K_{U2} < 2$
		$\delta_{Ku2} = \pm 5 \%$	at $K_{U2} \geq 2$
Primary voltage n-th harmonic ratio ( $K_{U1(n)}$ ), %	0...15	$\Delta_{Ku1(n)} = \pm 0,05 \%$	CH using at $K_{U1(n)} < 1$
		$\delta_{Ku1(n)} = \pm 5 \%$	CH using at $K_{U1(n)} \geq 1$
Secondary voltage n-th harmonic ratio ( $K_{U2(n)}$ ), %	0...15	$\Delta_{Ku2(n)} = \pm 0,05 \%$	at $K_{U2(n)} < 1$
		$\delta_{Ku2(n)} = \pm 5 \%$	at $K_{U2(n)} \geq 1$
Frequency (f), Hz	49...51	$\pm 0,02$	-







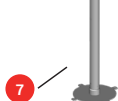





**Power mains**

Measuring Unit	built-in rechargeable battery			
Charging and Calibration Power Supply Units	220/230 V, 50 Hz			
Operating Temperature	- 10...40 °C			
Relative Humidity	up to 80 % non-condensing			
Size, mm	Measuring Unit	HV capacitor		
		45 kV	100 kV	230 kV
	250×350×185	170 × 425	260 × 610	390 × 995
Weight, kg	10	7	17	55
<b>Standards</b>				
Safety	EN 61010-1:2010			
EMC	EN 61326-1:2013			
Calibration Interval	3 years recommended			












### ORDERING INFORMATION

**Scope of supply**

The following items are supplied with the standard VTTs modification:

No	Item Name	Part no.	
1*	Measuring Unit	M210.1 M210.2 M210.3 M211.1 M211.2 M211.3	411722.006-01 411722.006-02 411722.006-03 411722.017-01 411722.017-02 411722.017-03
			
2*	High-voltage Measuring Capacitor 45 (in kit with M21x.1)	411634.032	
3*	High-voltage Measuring Capacitor 100 (in kit with M21x.2)	411634.033	
4*	High-voltage Measuring Capacitor 230 (in kit with M21x.3)	411634.034	
5	Extension 35 (in kit with M21x.3)	715531.037	
6	Extension 50 (in kit with M21x.3)	301568.057	
7	Extender (in kit with M21x.3)	301568.056	
8	End terminal 35 (in kit with M21x.3)	301127.008-01	
9	End terminal 50 (in kit with M21x.3)	301127.008	
10	Charging Unit	436112.016	
11	Interface Unit	411619.019	
12	Calibration Power Supply Unit	436112.027	

\* Please specify modification when ordering

No	Item Name	Part no.	
13*	FOC Fiber-optic cable, 5 m FOC Fiber-optic cable, 10 m FOC Fiber-optic cable, 30 m	468615.014-03 468615.014-04 468615.014-05	
* Please specify modification when ordering			
14	IC(U2) Secondary voltage instrument cable; 2,5 m	685612.061	
15	IC1(U2) Secondary voltage instrument cable; 5 m	685612.112	
16	SPIC Serial port interface cable	685614.087	
17	PC(C) Power cord for calibration	685611.143	
18	Package bag for Measuring Unit	323382.050	
19	Package bag for accessories	323382.051	
20	Package bag (in kit with M21x.1)	323382.054	
21	Package bag (in kit with M21x.2)	323382.055	
22	Case (in kit with M21x.3)	323362.043	
23	M210/M211 Software (installation disk)	411210.002 K	
24	Operating manual	411210.002 OM	
25	Passport	411210.002 P	
<b>Additional order</b>			
26	Fully installed Laptop		
27	Optional software for C&tanδ testing	M201.900.000.000	

**OLTEST LLC**

Development and production  
of measurement devices

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