TEST & MEASUREMENT DEVICES

Development and production of measurement devices

M210/M211 | Voltage Transformer Test Set



Voltage Transformer Test Set M210/M211 uses a high-voltage capacitance bridge method to deliver unmatched accuracy in measuring voltage transformer errors across continuous primary and secondary voltage ranges. By replacing bulky traditional designs, this technology provides reduced equipment size and weight for effortless field operation.

Voltage Transformer Test Set M210/M211 can also serve as a high-voltage capacitance bridge to measure capacitance and dissipation factor (tan δ) during high-voltage equipment testing*

FEATURES AND BENEFITS

- Measurement of voltage transformer errors in continuous primary and secondary voltage ranges
- High measurement accuracy (VTTS mode): up to ±0,005 % (ε) and ±0,3 min ($\Delta\varphi$)
- High measurement accuracy (HVB mode): up to ±0,005 % (C_x) and ±0,00005 (tan δ_x)*
- Measurement of true RMS values of primary and secondary voltages, *THD*, and n-th harmonic ratios (up to the 40th)
- A more cost-effective solution than combining standard voltage transformers or voltage divider and comparator
- Easy operation and handling
- Compact size and low weight

APPLICATIONS

M210/M211 is used by:

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



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

VERSIONS

Voltage Transformer Test Set M210/M211 is available in multiple versions, varying by accuracy class and maximum primary voltage.

M210/M211 version*	Primary voltage range (U_P), kV	Secondary voltage range (U_S), 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 other primary voltage can be supplied upon customer's request.

TEST ARRANGEMENT

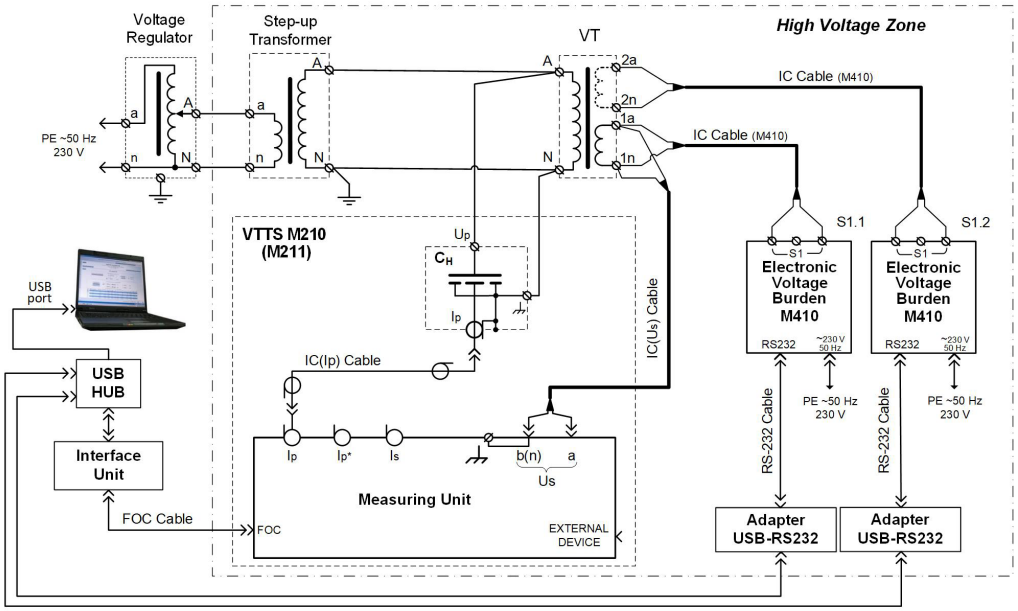


Fig. 1 VTTS mode

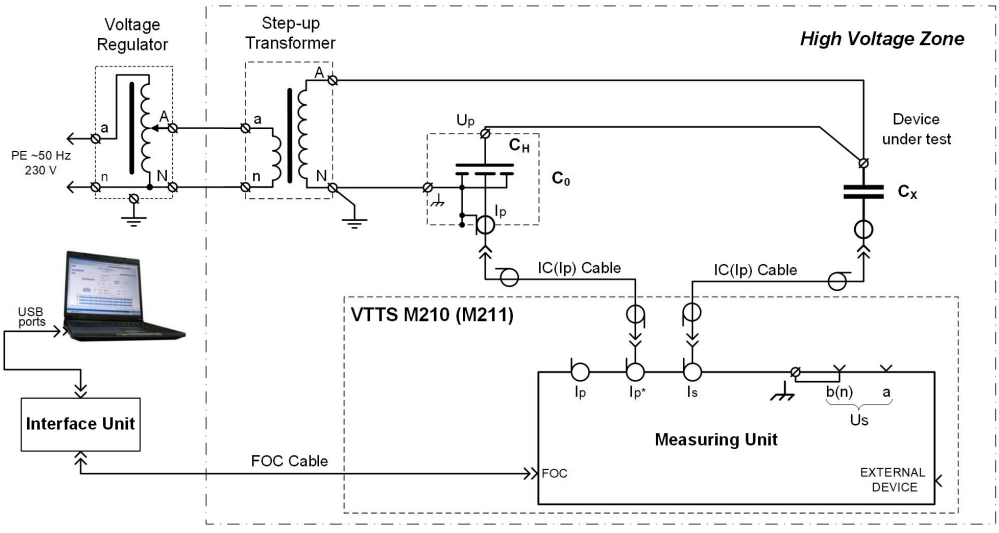


Fig. 2 HVB mode**

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

TECHNICAL SPECIFICATIONS

Measurement ranges and error limits of Voltage Transformer Test Set M210 – VTTS mode

Value	Range	Absolute error	Additional conditions	
Ratio error, ε	- 100 ≤ ε ≤ 100 %	± 0,015 %	$\lvert\Delta\varphi\rvert$ ≤ 100 min	300 V ≤ U_P ≤ U_{CH}, 6 ≤ U_S ≤ 1000 V
		± 0,05 %	$\lvert\Delta\varphi\rvert$ ≤ 100 min	100 ≤ U_P < 300 V, 6 ≤ U_S ≤ 1000 V
		± 0,1 %	$\lvert\Delta\varphi\rvert$ > 100 min	100 V ≤ U_P ≤ U_{CH}, 6 ≤ U_S ≤ 1000 V
		± 0,5 %	10 ≤ U_P < 100 V and/or 0,6 ≤ U_S < 6 V	
Phase displacement, $\Delta\varphi$	- 300 ≤ $\Delta\varphi$ ≤ 300 min	± 1 min	$\lvert\Delta\varphi\rvert$ ≤ 100 min	300 V ≤ U_P ≤ U_{CH}, 6 ≤ U_S ≤ 1000 V
		± 3 min	$\lvert\Delta\varphi\rvert$ ≤ 100 min	100 ≤ U_P < 300 V, 6 ≤ U_S ≤ 1000 V
		± 5 min	$\lvert\Delta\varphi\rvert$ > 100 min	100 V ≤ U_P ≤ U_{CH}, 6 ≤ U_S ≤ 1000 V
		± 10 min	10 ≤ U_P < 100 V and/or 0,6 ≤ U_S < 6 V	
Relative value of secondary voltage, U_S/U_{Sr}	2...190 %	± 1 %*	0,6 ≤ U_S ≤ 1000 V	
Test voltage frequency, f	49...51 Hz**	± 0,02 Hz	–	

Measurement ranges and error limits of Voltage Transformer Test Set M211 – VTTS mode

Value	Range	Absolute error	Additional conditions	
Ratio error, ε	-100 ≤ ε ≤ 100 %	± 0,005 %	$\lvert\Delta\varphi\rvert$ ≤ 30 min	300 V ≤ U_P ≤ U_{CH}, 6 ≤ U_S ≤ 1000 V
		± 0,01 %	30 < $\lvert\Delta\varphi\rvert$ ≤ 100 min	
		± 0,05 %	$\lvert\Delta\varphi\rvert$ ≤ 100 min	100 ≤ U_P < 300 V, 6 ≤ U_S ≤ 1000 V
		± 0,1 %	$\lvert\Delta\varphi\rvert$ > 100 min	
		± 0,5 %	10 ≤ U_P < 100 V and/or 0,6 ≤ U_S < 6 V	
Phase displacement, $\Delta\varphi$	-300 ≤ $\Delta\varphi$ ≤ 300 min	± 0,3 min	$\lvert\Delta\varphi\rvert$ ≤ 30 min	300 V ≤ U_P ≤ U_{CH}, 6 ≤ U_S ≤ 1000 V
		± 1 min	30 < $\lvert\Delta\varphi\rvert$ ≤ 100 min	
		± 3 min	$\lvert\Delta\varphi\rvert$ ≤ 100 min	100 ≤ U_P < 300 V, 6 ≤ U_S ≤ 1000 V
		± 5 min	$\lvert\Delta\varphi\rvert$ > 100 min	100 V ≤ U_P ≤ U_{CH}, 6 ≤ U_S ≤ 1000 V
		± 10 min	10 ≤ U_P < 100 V and/or 0,6 ≤ U_S < 6 V	
Relative value of secondary voltage, U_S/U_{Sr}	2...190 %	± 1 %*	0,6 ≤ U_S ≤ 1000 V	
Test voltage frequency, f	49...51 Hz**	± 0,02 Hz	–	

*Relative error.

**Measuring at the frequency of range 48...62 Hz can be agreed with the customer.

Measurement ranges and error limits of Voltage Transformer Test Set M210 – HVB mode

Range		Relative error of δ_C, %	Absolute error of dissipation factor $\Delta_{\tan\delta}$	Test current, A
C_X/C_0	$\tan\delta_X$			
0,01...0,1	0...1	$\pm[1\cdot10^{-2} + 2\cdot10^{-4}\cdot(C_0/C_X - 10) + \lvert\tan\delta_X - \tan\delta_0\rvert]$	$\pm[1\cdot10^{-4} + 2\cdot10^{-6}\cdot(C_0/C_X - 10) + 0{,}005\cdot\lvert\tan\delta_X - \tan\delta_0\rvert]$	up to 0,2
0,1...10^3	0...1	$\pm1\cdot10^{-2} + \lvert\tan\delta_X - \tan\delta_0\rvert]$	$\pm[1\cdot10^{-4} + 0{,}005\cdot\lvert\tan\delta_X - \tan\delta_0\rvert]$	

Measurement ranges and error limits of Voltage Transformer Test Set M211 – HVB mode

Range		Relative error of δ_C, %	Absolute error of dissipation factor $\Delta_{\tan\delta}$	Test current, A
C_X/C_0	$\tan\delta_X$			
0,01...0,1	0...1	$\pm[5\cdot10^{-3} + 2\cdot10^{-4}\cdot(C_0/C_X-10) + \lvert\tan\delta_X - \tan\delta_0\rvert]$	$\pm[5\cdot10^{-5} + 2\cdot10^{-6}\cdot(C_0/C_X-10) + 0{,}005\cdot\lvert\tan\delta_X - \tan\delta_0\rvert]$	up to 0,2
0,1...10^3	0...1	$\pm5\cdot10^{-3} + \lvert\tan\delta_X - \tan\delta_0\rvert]$	$\pm[5\cdot10^{-5} + 0{,}005\cdot\lvert\tan\delta_X - \tan\delta_0\rvert]$	

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

Value		Range	Error limits	Additional conditions
Effective voltage, V	U_P	300...U_{CH}	± 0,5 % (δ_U)	–
	U_S	6...1000		
Effective value of the first harmonic voltage, V	U_{P1}	300...U_{CH}	± 0,5 % (δ_U)	–
	U_{S1}	6...1000		
Voltage waveform distortion factor at the input U_P (THD_{Up}), %		0...20 %	± 0,2 % ($\Delta_{THD_{Up}}$)	at $THD_{Up} < 2$
			± 10 % ($\delta_{THD_{Up}}$)	at $THD_{Up} \geq 2$
Voltage waveform distortion factor at the input U_S (THD_{Us}), %		0...20 %	± 0,2 % ($\Delta_{THD_{Us}}$)	at $THD_{Us} < 2$
			± 10 % ($\delta_{THD_{Us}}$)	at $THD_{Us} \geq 2$
Coefficient of n-th voltage harmonic component at the input U_P ($THD_{Up(n)}$), %		0...15 %	± 0,05 % ($\Delta_{THD_{Up(n)}}$)	at $THD_{Up(n)} < 1$
			± 5 % ($\delta_{THD_{Up(n)}}$)	at $THD_{Up(n)} \geq 1$
Coefficient of n-th voltage harmonic component at the input U_S ($THD_{Us(n)}$), %		0...15 %	± 0,05 % ($\Delta_{THD_{Us(n)}}$)	at $THD_{Us(n)} < 1$
			± 5 % ($\delta_{THD_{Us(n)}}$)	at $THD_{Us(n)} \geq 1$
Frequency, f		49...51 Hz*	± 0,02	–

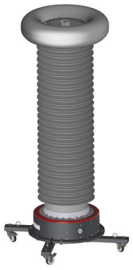
Power mains		
Measuring Unit		built-in rechargeable battery
Charging and Calibration Power Supply Units		220/230 V, 50 Hz
Operating temperature		-10...40 °C
Relative humidity		up to 80 % non-condensing
Size (W × H × D)	Measuring Unit	250 × 185 × 350 mm
(d × H)	HVC50**	230 × 480 mm
	HVC100**	375 × 740 mm
	HVC300**	750 × 2065 mm
Weight, less than	Measuring Unit	10,5 kg
	HVC50**	15 kg
	HVC100**	38 kg
	HVC300**	175 kg
Standards		
Safety		EN 61010-1:2010/A1:2019/AC:2019-04
EMC		EN 61326-1:2013

*Measuring at the frequency of range 48...62 Hz can be agreed with the customer.
**Capacitor weight and dimensions exclude stand/cart.

ORDERING INFORMATION

Scope of supply

The following items are supplied with the standard VTTS modification:

No	Item		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 Capacitor HVC50* (in set with M210.1/M211.1)		HVC50	
3	High Voltage Capacitor HVC100* (in set with M210.2/M211.2)		HVC100-02	
4	High Voltage Capacitor HVC300* (in set with M210.3/M211.3)		HVC300-03	
5	Charging Unit		436112.016	
6	Interface Unit		426477.003	
7	Calibration Power Supply Unit		M210.500	
8	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	
9	IC(Us) Secondary voltage instrument cable; 2,5 m**		685612.112-04	
10	IC(Is) Instrument cable; 2 m**		685612.062-04	

* Please specify modification when ordering.
**The length can be customized upon request.

No	Item	Part no.	
11	PC(C) Power cord for calibration	685611.143-01	
12	Bag for Measuring Unit	323382.050	
13	Bag for accessories	323382.051	
14	Bag HVC50	HVC50.200	
15	USB flash drive with software	408111.003	
16	Operating manual	411210.002 OM	
17	Passport	411210.002 P	
	Additional order		
18	Fully installed Laptop	–	
19	Optional software for HVB mode	M201.900	

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Development and production
of measurement devices

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