

# 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**

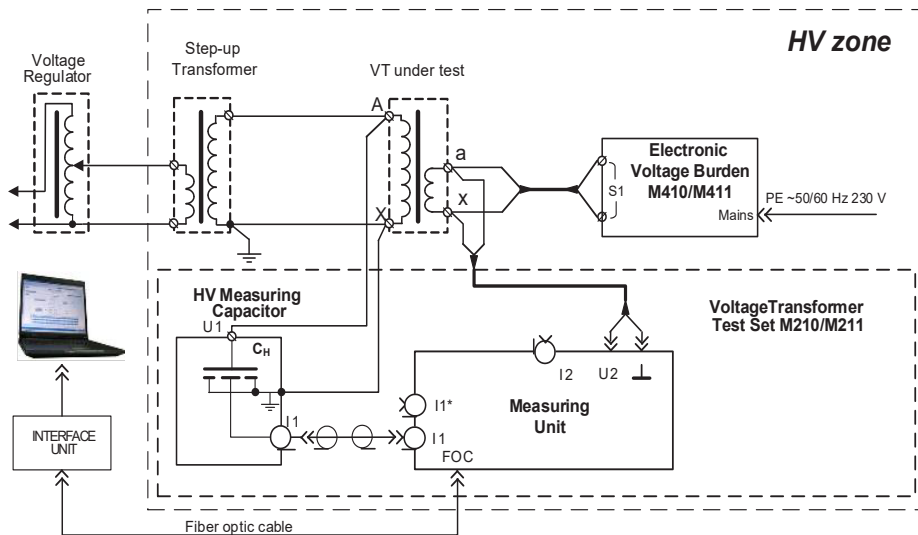


Fig.1 VT testing

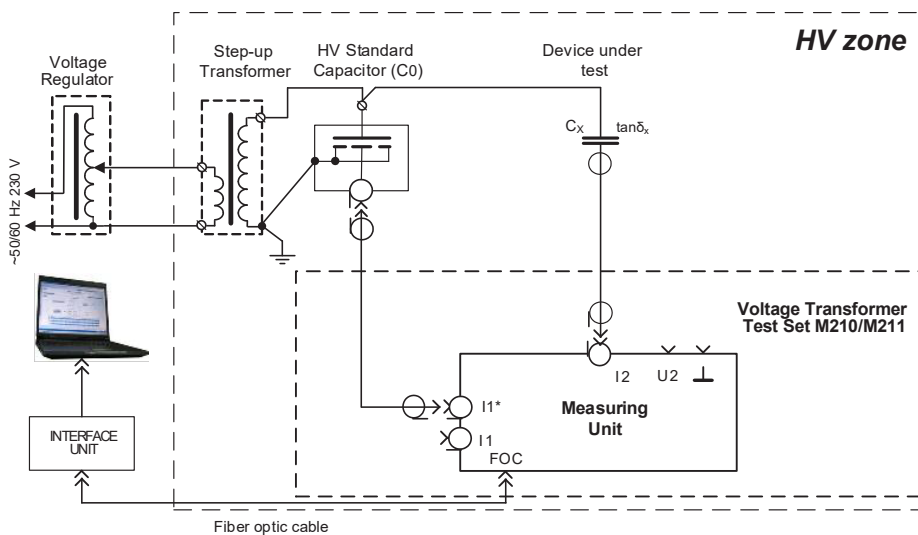


Fig. 2 C & tan delta testing\*

\* 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, $\epsilon$                             | - 100 % $\leq \epsilon \leq$ 100 %       | $\pm 0,015$ %                        | $ \Delta\phi  \leq 100$ min   | $300 \text{ V} \leq U_1 \leq U_{CH'}$<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$      |
|   |  | $\pm 0,05$ %                         | $ \Delta\phi  \leq 100$ min   | $100 \text{ V} \leq U_1 < 300 \text{ V}$ ,<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$ |
|   |  | $\pm 0,1$ %                          | $ \Delta\phi  > 100$ min  | $100 \text{ V} \leq U_1 \leq U_{CH'}$<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$      |
|   |  | $\pm 0,5$ %                          | $10 \text{ V} \leq U_1 < 100 \text{ V}$ and/or $0,6 \text{ V} \leq U_2 < 6 \text{ V}$ |  |
| Phase displacement, $\Delta\phi$                    | - 300 min $\leq \Delta\phi \leq$ 300 min | $\pm 1$ min                          | $ \Delta\phi  \leq 100$ min   | $300 \text{ V} \leq U_1 \leq U_{CH'}$<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$      |
|   |  | $\pm 3$ min                          | $ \Delta\phi  \leq 100$ min   | $100 \text{ V} \leq U_1 < 300 \text{ V}$ ,<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$ |
|   |  | $\pm 5$ min                          | $ \Delta\phi  > 100$ min  | $100 \text{ V} \leq U_1 \leq U_{CH'}$<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$      |
|   |  | $\pm 10$ 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, $\epsilon$                             | -100 % $\leq \epsilon \leq$ 100 %       | $\pm 0,005$ %                        | $ \Delta\phi  \leq 30$ min  | $300 \text{ V} \leq U_1 \leq U_{CH'}$<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$      |
|   |   | $\pm 0,01$ %                         | $30 \text{ min} <  \Delta\phi  \leq 100$ min  |  |
|   |   | $\pm 0,05$ %                         | $ \Delta\phi  \leq 100$ min   | $100 \text{ V} \leq U_1 < 300 \text{ V}$ ,<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$ |
|   |   | $\pm 0,1$ %                          | $ \Delta\phi  > 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, $\Delta\phi$                    | -300 min $\leq \Delta\phi \leq$ 300 min | $\pm 0,3$ min                        | $ \Delta\phi  \leq 30$ min  | $300 \text{ V} \leq U_1 \leq U_{CH'}$<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$      |
|   |   | $\pm 1$ min                          | $30 \text{ min} <  \Delta\phi  \leq 100$ min  |  |
|   |   | $\pm 3$ min                          | $ \Delta\phi  \leq 100$ min   | $100 \text{ V} \leq U_1 < 300 \text{ V}$ ,<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$ |
|   |   | $\pm 5$ min                          | $ \Delta\phi  > 100$ min  | $100 \text{ V} \leq U_1 \leq U_{CH'}$<br>$6 \text{ V} \leq U_2 \leq 1000 \text{ V}$      |
|   |   | $\pm 10$ 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                                      | $U_1$    | 300... $U_{CH}$                 | $\delta_U = \pm 0,5 \%$        | CH using |
|  | $U_2$    | 10...1000                       |                                | -        |
| First harmonic true RMS voltage, V                       | $U_{11}$ | 300... $U_{CH}$                 | $\delta_U = \pm 0,5 \%$        | CH using |
|  | $U_{21}$ | 10...1000                       |                                | -        |
| 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<br>M210.2<br>M210.3<br>M211.1<br>M211.2<br>M211.3 | 411722.006-01<br>411722.006-02<br>411722.006-03<br>411722.017-01<br>411722.017-02<br>411722.017-03 |
|    |  |  |                 |
| 2* | High-voltage Measuring Capacitor 45<br>(in kit with M21x.1)  | 411634.032   |                 |
| 3* | High-voltage Measuring Capacitor 100<br>(in kit with M21x.2) | 411634.033   |                |
| 4* | High-voltage Measuring Capacitor 230<br>(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.         |   |
|-------------------------|--|------------------|---|
|                         | FOC Fiber-optic cable, 5 m                       | 468615.014-03    |    |
|                         | FOC Fiber-optic cable, 10 m                      | 468615.014-04    |   |
|                         | FOC Fiber-optic cable, 30 m                      | 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 ENERGO Sp z o.o.**

Development and production of  
measurement devices

**POSTAL ADDRESS**

Oltest Energo Sp z o.o.,  
Warsaw, 00-680,  
Zurawia str., 43, 109

**TEL and E-MAIL**

(+48 22) 60-22-998  
market@oltest.pl