IMD 300/1

IMPEDANCE MEASUREMENT DEVICE

The relating applications:

Measurement of the mains impedance up to 150 kHz

Measurement of the sub-cycle impedance

Measurement of upstream and downstream impedances

Impedance Measurement Device IMD 300/1

- ✓ Measurement of the frequency-dependent mains impedance up to 150 kHz
- ✓ Measurement of the mains impedance variation within one period (sub-cycle impedance)
- ✓ Device's power supply is disconnected from mains during measurements to not influence the measurement results
- ✓ External current measurement input to evaluate upstream and downstream impedances
- ✓ Adaptive measurement method to limit mains disturbances
- ✓ Extension unit for three-phase impedance measurement available
- ✓ Device control via webinterface and interface commands
- ✓ Test and evaluation software available

WIDE FREQUENCY RANGE IMPEDANCE MEASUREMENT

IMD 300/1 FUNCTIONAL PRINCIPLE

The IMD 300/1 can be used to measure the frequency dependent mains impedance up to 150 kHz. During the impedance measurement the IMD's internal power supply is disconnected from the grid to avoid any measurement inaccuracy. An external input for current measurement is available to allow the use of an external current probe.

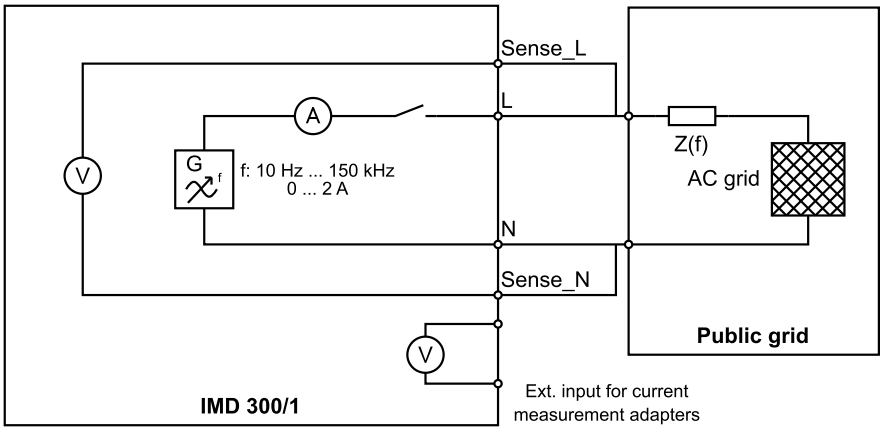

Fig. 1: Impedance Measurement Device principle schematic

UM 300 FUNCTIONAL PRINCIPLE

The UM 300 is a measurement adaptation for automated sequential 3-phase impedance measurements. It supplies additional voltage measurements, input plugs for all phases and automated switching of the measurement unit to the relevant phase.

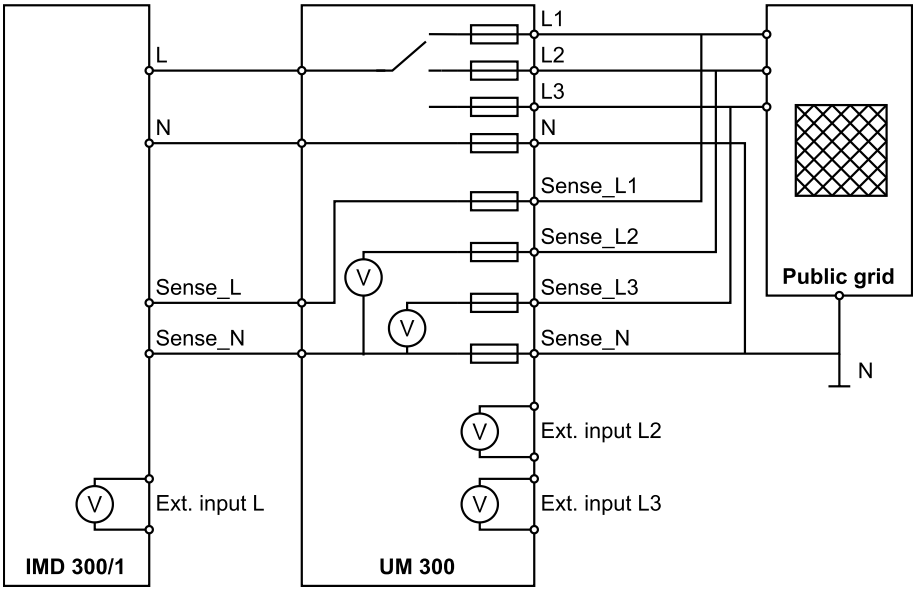

Fig. 2: UM 300 principle schematic

TOUCHSCREEN USER INTERFACE

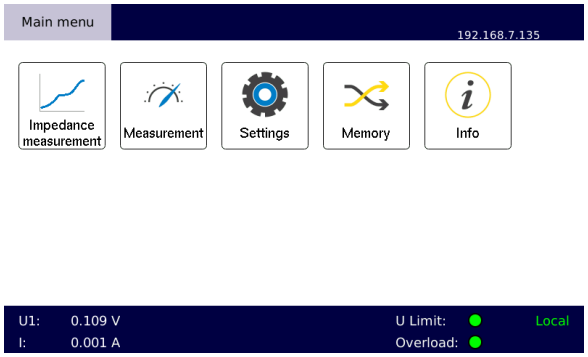

Fig. 3: Main menu

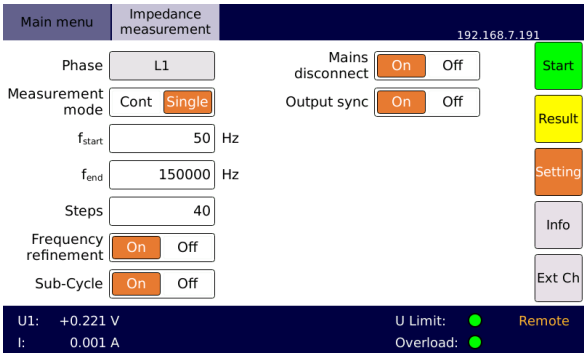

Fig. 4: Impedance measurement

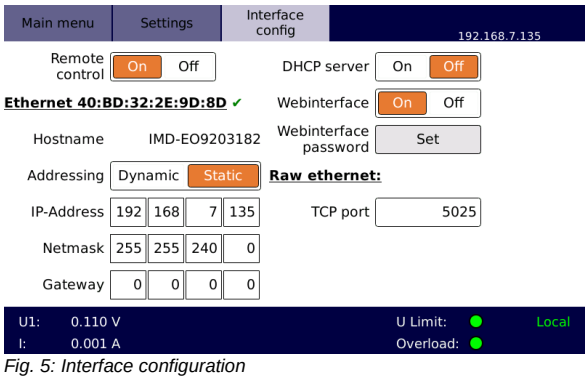

Fig. 5: Interface configuration

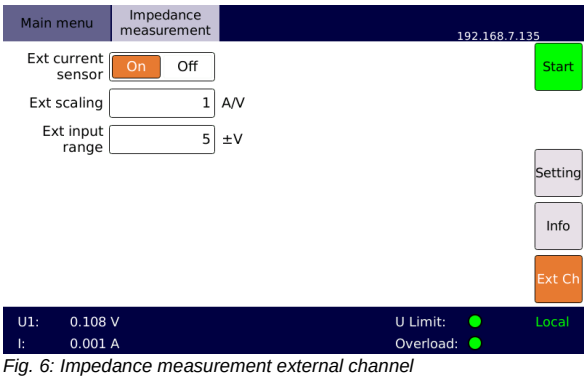

Fig. 6: Impedance measurement external channel

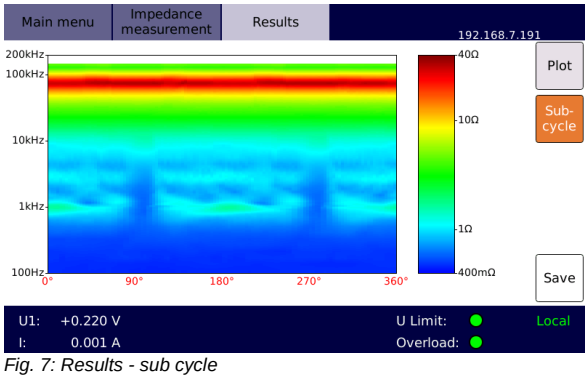

Fig. 7: Results - sub cycle

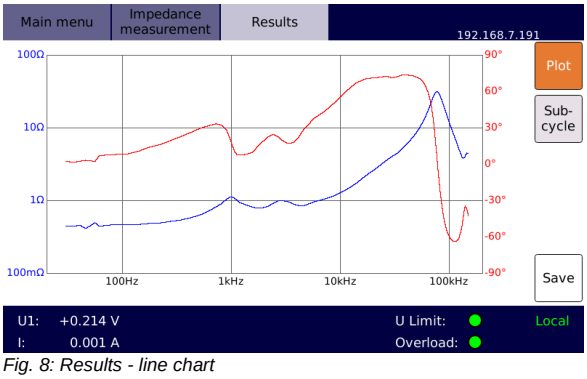

Fig. 8: Results - line chart

SOFTWARE CONTROL

SPS IMD Control

- ✓ Control and evaluate measurements remotely
- ✓ Visualise the measurement results
- ✓ Live update of the diagram during the measurement

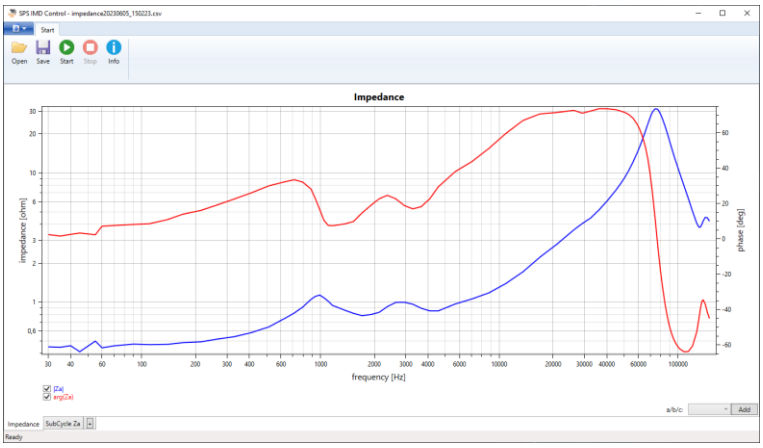

Fig. 9: SPS IMD Control impedance diagram

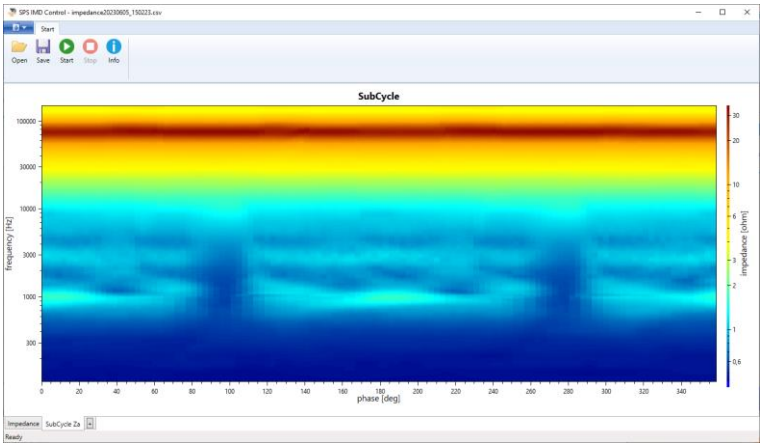

Fig. 10: SPS IMD Control sub cycle heat map

Command interface

- ✓ Easily integrate the device into your own software applications
- ✓ Remote control commands are based on the SCPI standard

Webinterface

- ✓ Monitor and control the connected device via a web browser

TECHNICAL DATA - IMD 300/1

			IMD 300/1			
Measurement performance						
Channels	single phase					
Frequency range	10 Hz … 150 kHz					
Accuracy						
Impedance magnitude	Measuring range	*f* < 100 Hz	100 Hz ≤ *f* < 1 kHz	1 kHz ≤ *f* < 10 kHz	10 kHz ≤ *f* < 50 kHz	50 kHz ≤ *f* < 150 kHz
	30 mΩ ≤ Z < 50 mΩ	20 %	15 %	15 %	15 %	20 %
	50 mΩ ≤ Z < 200 mΩ	10 %	10 %	10 %	10 %	15 %
	200 mΩ ≤ Z < 500 mΩ	5 %	5 %	5 %	5 %	10 %
	500 mΩ ≤ Z < 5 Ω	2 %	2 %	2 %	2 %	4 %
	5 Ω ≤ Z < 50 Ω	2 %	2 %	3 %	3 %	6 %
	50 Ω ≤ Z < 100 Ω	2 %	2 %	3 %	3 %	6 %
Impedance phase	Measuring range	*f* < 100 Hz	100 Hz ≤ *f* < 1 kHz	1 kHz ≤ *f* < 10 kHz	10 kHz ≤ *f* < 50 kHz	50 kHz ≤ *f* < 150 kHz
	30 mΩ ≤ Z < 50 mΩ	5°	5°	5°	10°	20°
	50 mΩ ≤ Z < 200 mΩ	3°	3°	3°	8°	16°
	200 mΩ ≤ Z < 500 mΩ	1°	1°	1°	6°	12°
	500 mΩ ≤ Z < 5 Ω	1°	1°	1°	5°	10°
	5 Ω ≤ Z < 50 Ω	1°	1°	2°	5°	10°
	50 Ω ≤ Z < 100 Ω	1°	1°	3°	8°	16°
Max. voltage at measurement output *RMS (peak)*	300 V (±450 V)					
Voltage measurement range *RMS (peak)*	300 V (±450 V)					
Peak current measurement ranges	± 3 A / ± 6 A					
Max. RMS output current	2 A [1), 2)]					
Synchronisation range	10 V ... 287 V / 45 Hz ... 65 Hz					
Output current modes	single frequency measurement multiple frequency measurement (superimposition of various frequencies)					
Measurement cycle duration	200 ms measurement with current injection followed by 200 ms measurement without current injection					
Total measurement duration *(typical)*	3 min					
Display of measurement results	frequency dependent value of the mains impedance (magnitude and phase) heat map of the sub-cycle impedance (resolution: 3° related to the voltage fundamental) CSV export					
External current measurement input	± 2 V … ± 25 V measure the downstream impedance (device/customer system) or upstream impedance (mains/grid) by using an external current probe					

TECHNICAL DATA - IMD 300/1

		IMD 300/1			
Internal control unit					
	Display	7.0" touchscreen (17.8 cm, resolution 800 x 480)			
	User interface	touchscreen / front panel button / incremental encoder webinterface			
	Digital I/O	8 digital DC inputs: U_{DC} = +5 V … +24 V 8 digital DC outputs: U_{DC} = +5 V (internal U_{CC}), I_L = 40 mA (external DC input U_{CC}: +5 V … +24 V, I_L = 250 mA)			
Monitoring unit		voltage		current	
	Max. peak output	±10 V			
	Scaling factor 'sf' (adjustable)	sf: 0.2 … 1000		sf: 0.1 … 1000	
	Bandwidth	300 kHz		200 kHz	
	Monitoring accuracy	± (% of reading + % of range + error(sf))			
	Frequency	DC 45 Hz … 450 Hz	10 Hz … 45 Hz 450 Hz … 5 kHz	5 kHz … 15 kHz	15 kHz … 30 kHz
	Voltage monitor accuracy	0.12 + 0.02 + 2 mV * sf	0.3 + 0.2 + 2 mV * sf	0.7 + 0.4 + 2.2 mV * sf	1.4 + 0.8 + 2.3 mV * sf
	Current monitor accuracy	0.22 + 0.04 + 2 mA * sf	0.5 + 0.4 + 2 mA * sf	1.1 + 0.8 + 2.2 mA * sf	2.2 + 1.6 + 2.3 mA * sf
	Noise of ADC measurement (RMS)	< 20 mV (DC … 300 kHz)		< 1.5 mA (DC … 300 kHz)	
	Noise DAC output (RMS)	< 0.2 mV (DC … 300 kHz)			
	Delay time	< 1 µs			
	Output impedance	47 Ω			
	Isolation	earth / remaining electronics / each other			
	Protection	short circuit			
Interface		Ethernet 100 Mbit/s (HiSLIP SCPI) USB 2.0 Host			
Insulation resistance		> 1 MΩ			
Peak withstand voltage *(max. 10 s, output to earth)*		> 2000 V			
Protection circuits		overcurrent (circuit breaker and electronic) overtemperature (electronic)			
Cooling		temperature-controlled forced air cooling			
Ambient temperature		+10 °C up to +40 °C			
Storage temperature		-25 °C up to +60 °C			
Relative humidity		non condensing, max. 80 % for temperature < 31 °C, decreasing linearly to 50 % at 40 °C			
Ingress protection		IP20			
Power supply *(±10 %, 50/60 Hz)*		230 V			
Line protection, connection		4 A, Schuko			
Housing		plug-in unit, light grey (RAL 7035)			
	IMD 300/1 approx. dimensions (H x W x D)	19", 7 U 311 x 483 x 360 mm			
	UM 300 approx. dimensions (H x W x D)	19", 4 U 178 x 483 x 360 mm			
Weight	*IMD 300/1 (approx.)* *UM 300 (approx.)*	31 kg 12 kg			

OPTIONS AND ACCESSORIES

Options		
OPT.01	IEEE488	Not in combination with OPT.02
OPT.02	RS232	Not in combination with OPT.01
UM 300	Additional measurement	Measurement adaptation for automated sequential 3-phase impedance measurements. It supplies additional voltage measurements, input plugs for all phases and automated switching of the measurement unit to the relevant phase.

Remarks:

1) At low frequencies up to 10 Hz the maximum RMS input current is limited to 1.4 A.
2) Injected current is adjusted to limit the voltage drop at the mains impedance to 1 V per spectral line.