TESTRANO 600

Technical Data

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1 Technical data

At the time of factory adjustment all units are within the typical accuracy values specified in this document.

Typical accuracy means that 98 % of all units meet the specified values at 23 °C ± 5 °C/73 ºF ± 10 ºF, after a warm-up time of more than 25 min., and in a frequency range of 45 Hz to 65 Hz or DC.

The typical accuracy values multiplied by 3 are guaranteed at an ambient temperature of 23 ºC ± 5 ºC/73 ºF ± 10 ºF, after a warm-up time more than 25 min., and in a frequency range of 45 Hz to 65 Hz or DC.

Accuracy values indicate that the error is smaller than:

± (value read × reading error [rd] + full scale of range × range error [rg]).

For mains voltages below 190 V AC the system is subject to power restrictions.

OMICRON suggests that you send in your unit for calibration at least once a year.

Technical data are subject to change without notice.

CAT level

The CAT level required depends on the *TESTRANO 600* application. All CAT ratings are defined for sea levels below 2000 m. There are some limitations between 2000 m and 5000 m sea level (see section 1.4 "Environmental conditions" on page 14).

CAT I is required when the measured voltage is generated by the test set itself. No voltages from other sources are measured.

CAT II is required when measuring within electrical devices or between mains supply and devices.

CAT III is required when measuring in electrical installations such as control cubicles that are still connected to the station battery or mains. The electrical installations are protected by a fuse.

1.1 *TESTRANO 600* specifications

1.1.1 Output specifications

Table 1-1: General output specifications

Characteristic	Rating		
Frequency	DC or 15 Hz … 599 Hz		
Power	**Vmains**	**$P_{30\ s}$**	**$P_{continuous}$**
	>100 V_{RMS}	1500 W	1000 W
	>190 V_{RMS}	4000 W	2400 W

Table 1-2: Voltage source (HV and LV connectors)

Source	Range	$I_{max,\ continuous}$
DC high range	3 × 0 … ±113 V_{DC}[1] 1 × 0 … ±340 V_{DC}[2]	16 A_{DC}
DC low range	3 × 0 … ±56 V_{DC}[1] 1 × 0 … ±170 V_{DC}[2]	33 A_{DC}
AC high range low current	3 × 0 … 230 V_{RMS} (LN)[3]	100 mA_{RMS}
AC high range	3 × 0 … 80 V_{RMS} (LN)[4] 1 × 0 … 240 V_{RMS}[5]	16 A_{RMS}
AC low range	3 × 0 … 40 V_{RMS} (LN)[5] 1 × 0 … 120 V_{RMS}	33 A_{RMS}

1. See Figure 1-3: "Permitted operating range 3 x DC 113 V 16 A" on page 7
2. See Figure 1-1: "Permitted operating range 1 x DC 340 V 16 A" on page 6
3. See Figure 1-5: "Derating of output power and output voltage 3 x 230 V_{RMS}" on page 8
4. See Figure 1-4: "Permitted operating range 3 x AC 80 V 16 A" on page 7
5. See Figure 1-2: "Permitted operating range 1 x AC 240 V 16 A" on page 6

Table 1-3: Voltage source accuracy

Characteristic	Accuracy[1]
Voltage accuracy DC	0.033 % rd ± 0.017 % range
Voltage accuracy AC (50 Hz) at burden open load	0.33 % rd ± 0.17 % range
Phase accuracy AC (50 Hz) burden open load, V>20 V_{RMS}	± 0.36°

1. Typical accuracy at 23 °C ±5 K

Table 1-4: Current source (HV and LV)

Source	Range	$V_{max, continuous}$
DC source high range	3 × 0 ... ±33 A_{DC}[1] or 1 × 0 ... ±100 A_{DC} (3 × 33.33 A_{DC})	56 V_{DC}
	1 × 0 ... ±33 A_{DC}[2]	170 V_{DC}
DC source low range	3 × 0 ... ±16 A_{DC}[1]	113 V_{DC}
	1 × 0 ... ±50 A_{DC} (3 × 16.66 A_{DC})[1]	
	1 × 0 ... ±16 A_{DC}[2]	340 V_{DC}
AC source high range	3 × 0 ... 33 A_{RMS} (LN)[3]	40 V_{RMS}
	1 × 0 ... 33 A_{RMS}[4]	120 V_{RMS}
AC source low range	3 × 0 ... 16 A_{RMS} (LN)[3] or 1 × 0 ... 50 A_{RMS} (3 × 16.66 A_{RMS})	80 V_{RMS}
	1 × 0 ... 16 A_{RMS}[4]	240 V_{RMS}

1. See Figure 1-3: "Permitted operating range 3 x DC 113 V 16 A" on page 7
2. See Figure 1-1: "Permitted operating range 1 x DC 340 V 16 A" on page 6
3. See Figure 1-4: "Permitted operating range 3 x AC 80 V 16 A" on page 7
4. See Figure 1-2: "Permitted operating range 1 x AC 240 V 16 A" on page 6

Table 1-5: Current source accuracy

Characteristic	Accuracy[1]
Current accuracy DC	0.033 % rd ± 0.017 % range
Current accuracy AC 50/60 Hz at burden 0.1 Ω	0.33 % rd ± 0.17 % range

1. Typical accuracy at 23 °C ±5 K

Table 1-6: Voltage source (Booster)

Source	Range	$I_{max, cont.}$[1]	$I_{max, 30 s}$[1]
Power	–	3 kVA	4.4 kVA
AC high voltage	1 × 0 ... 240 V_{RMS}	16 A_{RMS}	20 A_{RMS}
Characteristic		**Rating**	
Channels		1	
Voltage accuracy[2] AC (50/60 Hz) at burden open load		0.33 % rd ± 0.16 % range	

1. Within the above specified power limit
2. Typical accuracy at 23 °C ±5 K

The following figures display the output characteristics of *TESTRANO 600*.

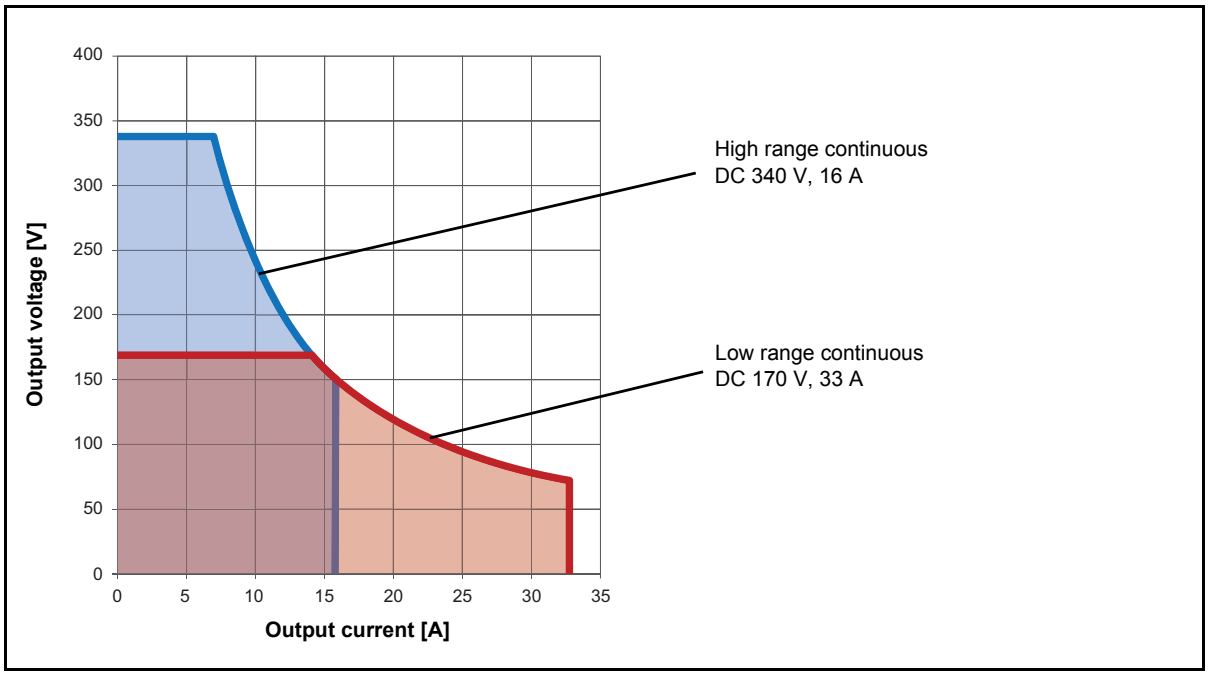


Figure 1-1: Permitted operating range 1 x DC 340 V 16 A

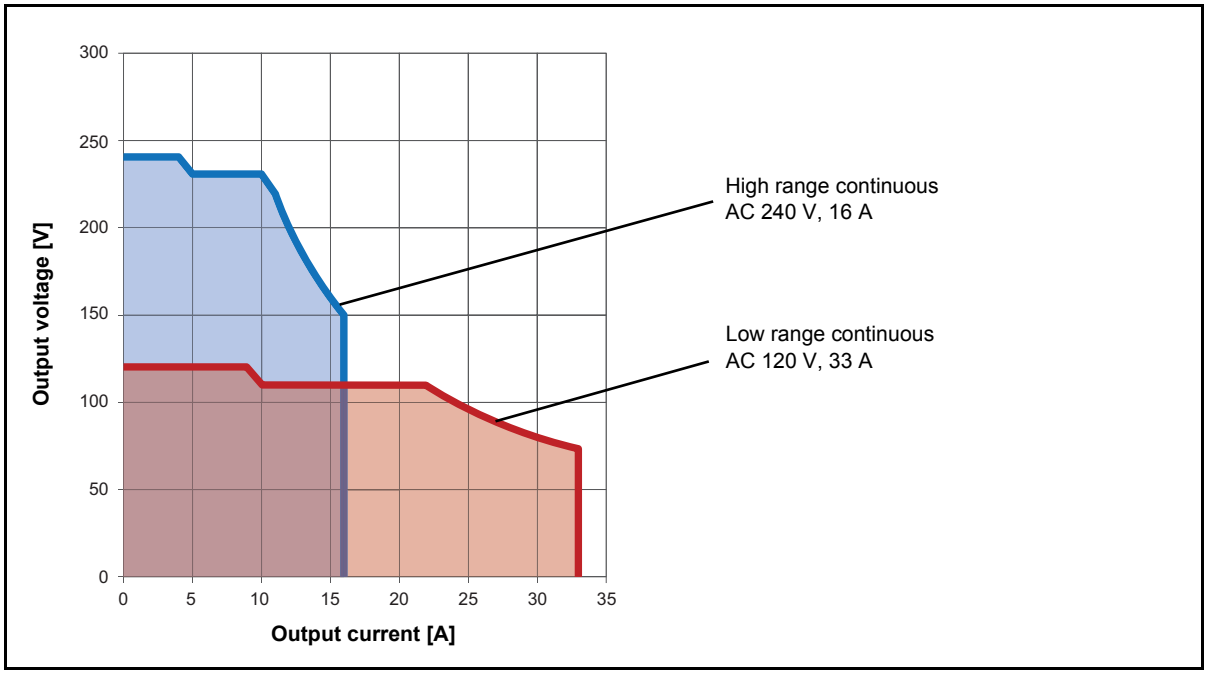


Figure 1-2: Permitted operating range 1 x AC 240 V 16 A

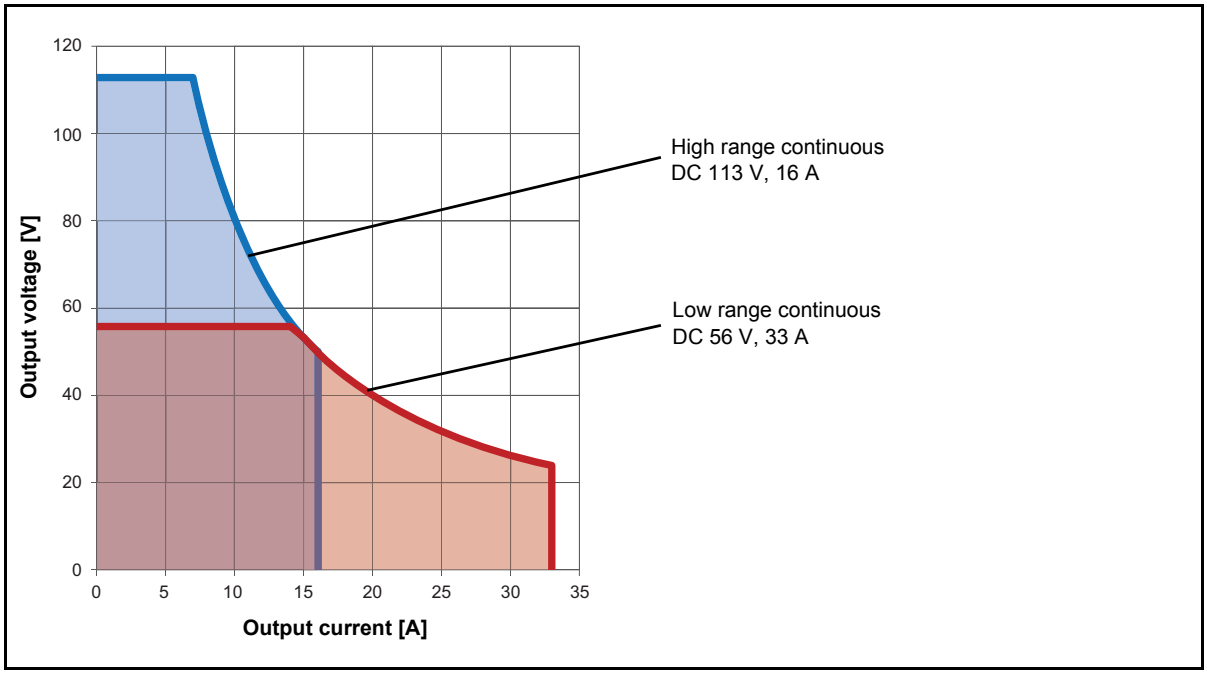


Figure 1-3: Permitted operating range 3 x DC 113 V 16 A

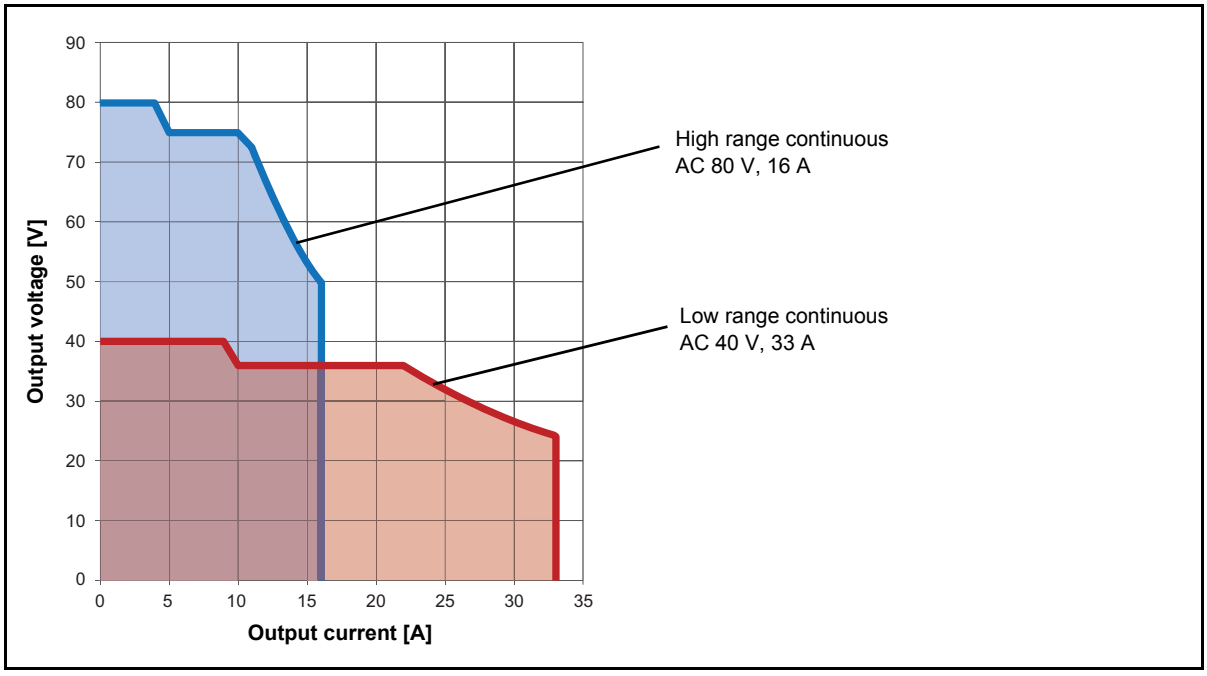


Figure 1-4: Permitted operating range 3 x AC 80 V 16 A

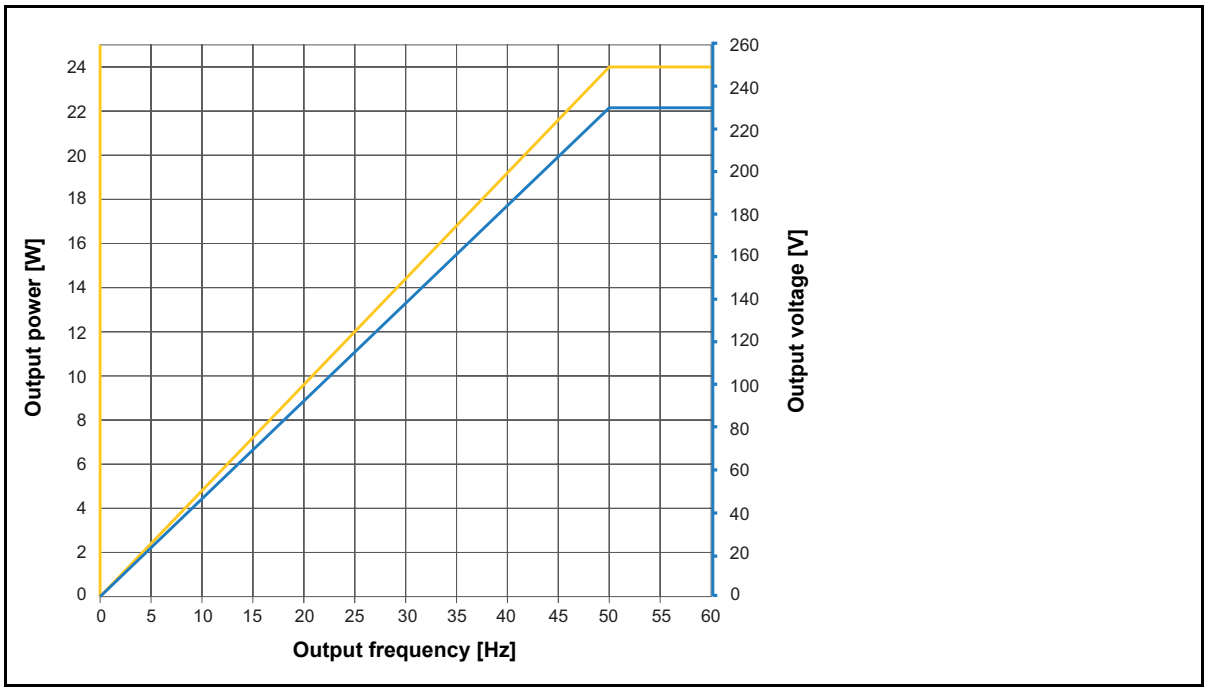


Figure 1-5: Derating of output power and output voltage 3 x 230 V_{RMS}

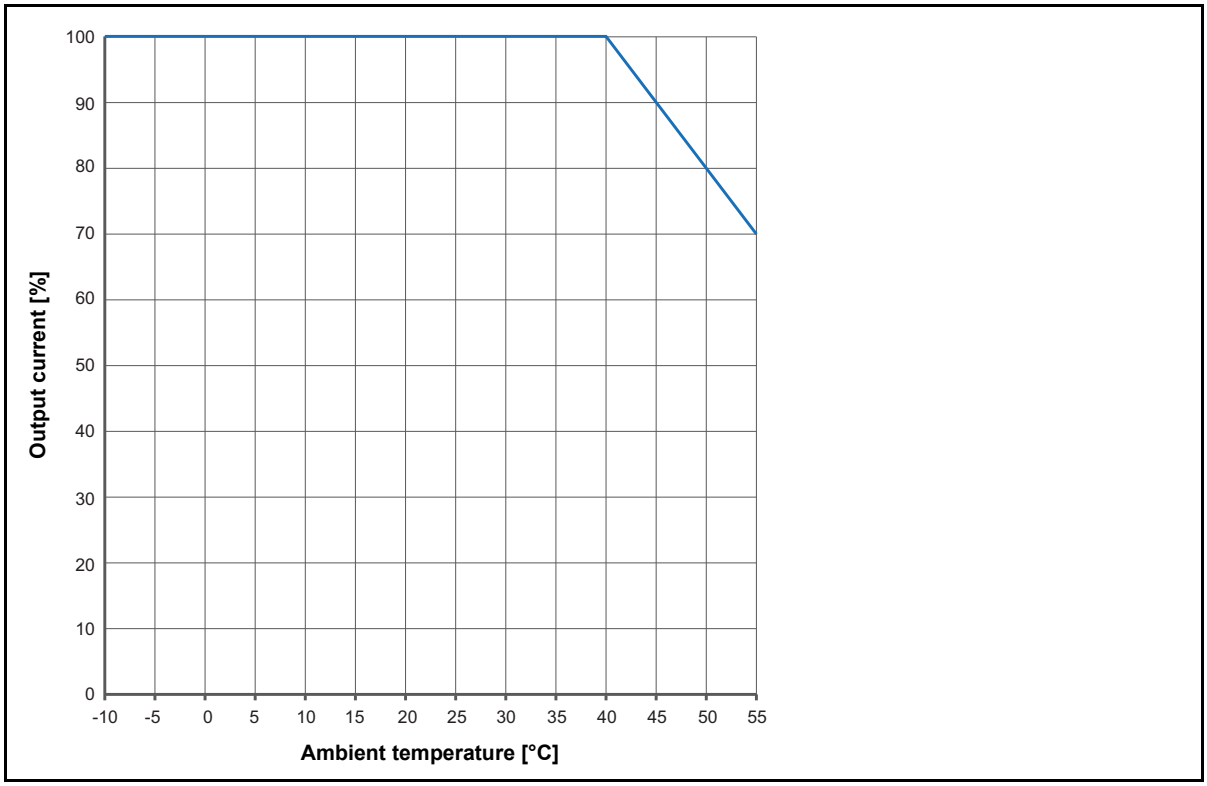


Figure 1-6: Derating of continuous output current

1.1.2 Input specifications

Table 1-7: Voltage inputs (HV and LV) 3 phase

Range name	Range value	Accuracy[1]
AC		
300 mV_{RMS}	0 ... 300 mV_{RMS}	0.01 % rd + 0.003 % range
3 V_{RMS}	0 ... 3 V_{RMS}	0.01 % rd + 0.003 % range
30 V_{RMS}	0 ... 30 V_{RMS}	0.01 % rd + 0.003 % range
300 V_{RMS}	0 ... 300 V_{RMS}	0.012 % rd + 0.003 % range
DC		
42.4 mV_{DC}	0 ... 42.4 mV_{DC}	0.022 % rd + 0.032 % range
424 mV_{DC}	0 ... 424 mV_{DC}	0.01 % rd + 0.017 % range
4.24 V_{DC}	0 ... 4.24 V_{DC}	0.007 % rd + 0.012 % range
42.4 V_{DC}	0 ... 42.4 V_{DC}	0.01 % rd + 0.017 % range
424 V_{DC}	0 ... 424 V_{DC}	0.007 % rd + 0.012 % range

1. Typical accuracy at 23 °C ±5 K

Typical phase accuracy at 50/60 Hz, V>30 % of used range: 0.017°

Table 1-8: Voltage input (Booster)

Range name	Range value	Accuracy[1]
280 V_{RMS}	0 ... 280 V_{RMS}	0.012 % rd + 0.003 % range

1. Typical accuracy at 23 °C ±5 K

Typical phase accuracy at 50/60 Hz, V>30 % of used range: 0.017°

Table 1-9: Current inputs (internal)

Range name	Range value	Accuracy[1]
AC		
4 A_{RMS}	0 ... 4 A_{RMS}	0.036 % rd + 0.0033 % range
40 A_{RMS}	0 ... 40 A_{RMS}	0.023 % rd + 0.013 % range
DC		
0.56 A_{DC}	0 ... 0.56 A_{DC}	0.01 % rd + 0.023 % range
5.6 A_{DC}	0 ... 5.6 A_{DC}	0.037 % rd + 0.026 % range
56 A_{DC}	0 ... 56 A_{DC}	0.008 % rd + 0.01 % range

1. Typical accuracy at 23 °C ±5 K

Typical phase accuracy at 50/60 Hz, I>30 % of used range: 0.017°

Table 1-10: On-load tap changer measurement (tap changer connector)

Characteristic	Rating
Voltage	300 V_{RMS}
Accuracy[1] AC (50/60 Hz)/DC	0.07 % rd + 0.07 % range
Current clamp input	3 V_{RMS}
Tap up/down switch current	300 mA continuous, 9 A for 0.7 s (AC permitted only)
Tap up/down switch voltage	300 V_{RMS} (AC permitted only)

1. Typical accuracy at 23 °C ±5 K

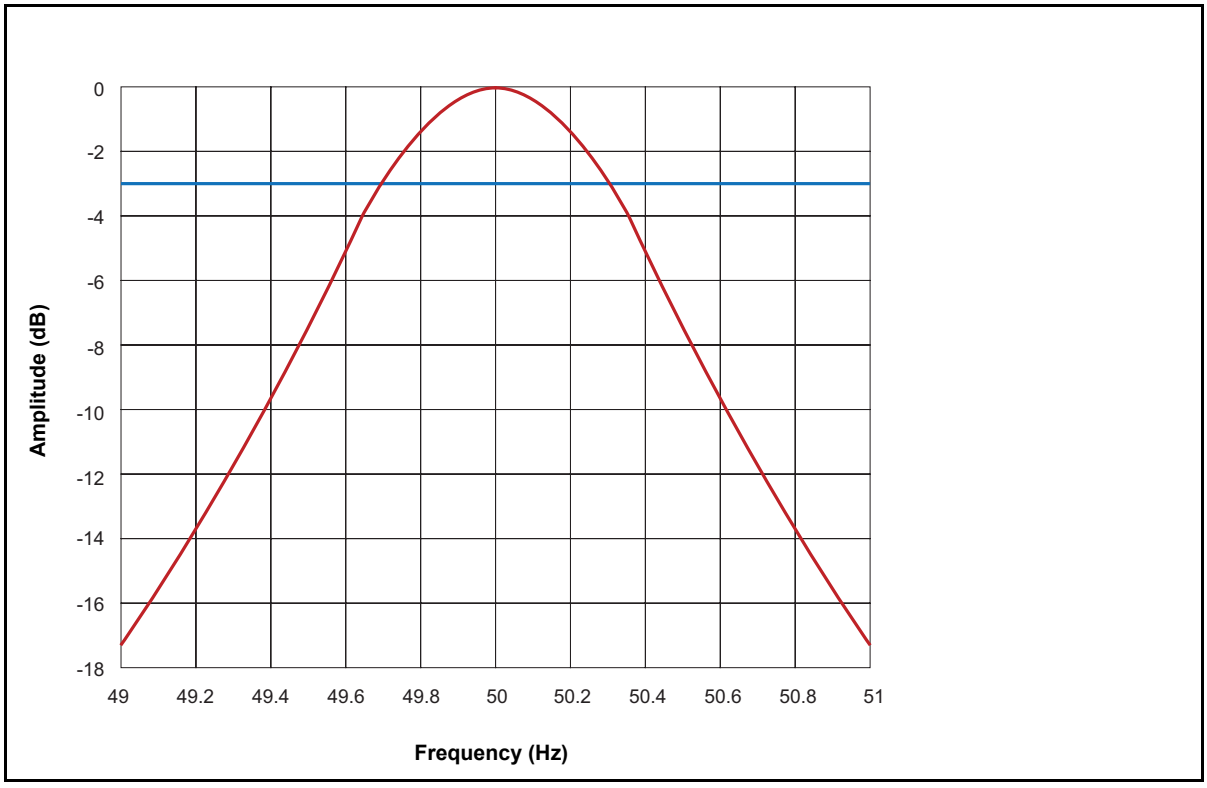


Figure 1-7: Filter characteristic of frequency-selective measurements (example at 50 Hz)

1.1.3 Interfaces

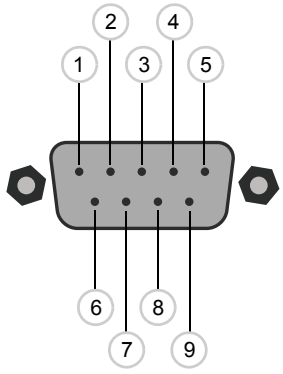
Table 1-11: Connector overview

Interface	Rating
Digital	1 × EtherCAT®[1] 1 × Ethernet 1 × Serial 2 × Safety
Analog	6 × Configurable outputs: – (HV) 3 × analog output – (LV) 3 × analog output
	6 × Configurable inputs: – (HV) 3 × analog input – (LV) 3 × analog input
	On-load tap changer interface: – 2 × internal switch – 1 × voltage measurement – 1 × current clamp measurement
	1 × Booster interface

1. EtherCAT® is registered trademark and patented technology, licensed by Beckhoff automation GmbH, Germany.

SAFETY connectors

Table 1-12: SAFETY 1 and SAFETY 2 pin assignment

	Pin no.	SAFETY 1	SAFETY 2
	**1***	Warning light green	Warning light green
	2*	Warning light red	Warning light red
	3	Start button IN (n/o)	Start button OUT (n/o)
	4	Common start n/o + emergency stop	Common start n/o + emergency stop
	5	Emergency stop	Emergency stop
	6	Ground	Ground
	7	Ground	Ground
	8	Start button IN (n/c)	Start button OUT (n/c)
	9	Ground	Ground

*) **Typical output pin 1 and pin 2**:

- 10 ... 14 V per connector (**SAFETY 1** or **SAFETY 2**)
- 400 mA combined (**SAFETY 1** and **SAFETY 2**)

Display

Table 1-13: Display

Characteristic	Rating
Size	10.6 in 26.9 cm
Resolution	1280 x 768 WXGA
Type	Color touch TFT LCD
Contrast ratio	1000:1
Luminance	800 cd/m^2
Viewing angle (CR ≥ 10)	85° (H), 85° (V)

1.2 Combined values

Table 1-14: Resistance measurement AC

Range name	Current	Range	Accuracy[1]
40 A_{RMS}	30 A_{RMS}	1 Ω ... 10 Ω	0.053 % rd + 0.033 % range
		0.1 Ω ... 1 Ω	0.053 % rd + 0.033 % range
		10 mΩ ... 100 mΩ	0.053 % rd + 0.033 % range
		1 mΩ ... 10 mΩ	0.053 % rd + 0.033 % range
		100 µΩ ... 1000 µΩ	0.063 % rd + 0.033 % range
4 A_{RMS}	3 A_{RMS}	10 Ω ... 100 Ω	0.053 % rd + 0.037 % range
		1 Ω ... 10 Ω	0.053 % rd + 0.037 % range
		0.1 Ω ... 1 Ω	0.053 % rd + 0.037 % range
		10 mΩ ... 100 mΩ	0.053 % rd + 0.037 % range
		1 mΩ ... 10 mΩ	0.067 % rd + 0.037 % range

1. Typical accuracy at 23 °C ±5 K

Table 1-15: Resistance measurement DC

Range name	Current	Range	Accuracy[1]
4 A_{RMS}	3 A_{DC}	10 Ω ... 100 Ω	0.1 % rd + 0.18 % range
		1 Ω ... 10 Ω	0.1 % rd + 0.267 % range
		0.1 Ω ... 1 Ω	0.1 % rd + 0.18 % range
		10 mΩ ... 100 mΩ	0.1 % rd + 0.267 % range
		1 mΩ ... 10 mΩ	0.113 % rd + 0.433 % range
40 A_{RMS}	30 A_{DC}	1 Ω ... 10 Ω	0.037 % rd + 0.017 % range
		0.1 Ω ... 1 Ω	0.04 % rd + 0.027 % range
		10 mΩ ... 100 mΩ	0.033 % rd + 0.017 % range
		1 mΩ ... 10 mΩ	0.037 % rd + 0.027 % range
		100 µΩ ... 1000 µΩ	0.05 % rd + 0.043 % range
120 A_{RMS}	100 A_{DC}	30 mΩ ... 300 mΩ	0.04 % rd + 0.027 % range
		3 mΩ ... 30 mΩ	0.033 % rd + 0.017 % range
		300 µΩ ... 3000 µΩ	0.037 % rd + 0.027 % range
		30 µΩ ... 300 µΩ	0.05 % rd + 0.043 % range
		3 µΩ ... 30 µΩ	0.07 % rd + 0.44 % range

1. Typical accuracy at 23 °C ±5 K

Table 1-16: Ratio measurement

Range name (LV voltage range)	Voltage at HV	Range[1]	Accuracy[2]
300 V_{RMS}	230 V_{RMS} HV (LN)	$\frac{1}{1 \ldots 10}$	0.03 % rd + 0.043 % range
30 V_{RMS}		$\frac{1}{10 \ldots 100}$	0.027 % rd + 0.043 % range
3 V_{RMS}		$\frac{1}{100 \ldots 1000}$	0.027 % rd + 0.043 % range
300 mV_{RMS}		$\frac{1}{1000 \ldots 10000}$	0.027 % rd + 0.043 % range

1. Range = $\frac{LV}{HV}$

2. Typical accuracy at 23 °C ±5 K

1.3 Power supply specifications

Table 1-17: Power supply specifications

Characteristic		Rating
Voltage	Nominal	100 V … 240 V_{AC}
	Permitted	85 V … 264 V_{AC}
Current	Nominal	16 A
Frequency	Nominal	50 Hz/60 Hz
	Permitted	45 Hz … 65 Hz
Power fuse		Automatic circuit breaker with magnetic overcurrent tripping at I >16 A
Power consumption	Continuous	<3.6 kW
	Peak	<5.0 kW
Current consumption, continuous		<16 A_{AC}
Connector type		IEC320/C20, 1 phase

1.4 Environmental conditions

Table 1-18: Climate

Characteristic		Rating
Temperature	Operating	-10 ºC … +55 ºC/+14 ºF…+131 ºF
	Storage	-30 ºC … +70 ºC/-22 ºF…+158 ºF
Max. altitude	Operating	2000 m/6550 ft, up to 5000 m/16400 ft with limited specifications[1]
	Storage	12 000 m/40 000 ft

1. Output **TAP CHANGER (CAT III / 300 V)**: from 2000 m/6550 ft to 5000 m/16400 ft altitude only CAT II compliance or CAT III compliance with half voltage

1.5 Mechanical data

Table 1-19: Mechanical data

Characteristic		Rating
Dimensions (w × h× d)	With cover, without handles	464 × 386 × 229 mm 18.3 × 15.2 × 9 in
	With cover, with handles	580 × 386 × 229 mm 22.8 × 15.2 × 9 in
Weight	Device with display	20.6 kg/45.5 lb
	Device without display	19.5 kg/43 lb

1.6 Standards

Table 1-20: Standards conformity

EMC, safety	
EMC	IEC/EN 61326-1 (industrial electromagnetic environment) FCC subpart B of part 15, class A
Safety	IEC/EN/UL 61010-1, IEC/EN/UL 61010-2-30
Other	
Shock	IEC/EN 60068-2-27 (15 g/11 ms, half-sinusoid, 3 shocks in each axis)
Vibration	IEC/EN 60068-2-6 (frequency range 10 Hz…150 Hz, acceleration 2 g continuous (20 m/s^2/65 ft/s^2), 20 cycles per axis)
Humidity	IEC/EN 60068-2-78 (5 % … 95 % relative humidity, no condensation), tested at 40 ºC/104 ºF for 48 hours