

The figures in below tables apply for the operating temperature range as specified and a cable length of 300 meter between EM and MH. If system HITACC is delivered with multiple outputs, these outputs are independent. Independent means that overloading or short circuiting an output does not affect the other output(s). The outputs have a common reference so they are not isolated from each other. However, they are isolated with respect to the supply input and ground. Reference is made to IEC61869-14:2018-07.

### 1. Measurement characteristics for output 1 with 'FTZ'

Main output, representing the 0-2 pu primary current, DC and/or AC, with high bandwidth (HB)

A 'force-to-zero' function (FTZ) pulls the output to zero during non-valid conditions of the HITACC system. The non-valid conditions are indicated by the status contact 'Output valid' (see last page).

Nominal primary current $I_N$ (1 pu)	3000 A	(DC or AC)
Continuous thermal overload current $I_{CTH}$	1.25 pu	
Measuring range (overload duration $\leq 5$ s)	2 pu	(crest value for AC-current)
Short time overload current $I_{SOV}$ (1 s)	$< 12 \text{ kA}_{PK}$	(MH non-saturating)
Time to saturation of MH (for $I_p \geq 12 \text{ kA}_{PK}$ ) [1]	17.5 ms	( $\pm 10\%$ )
Dynamic peak current $I_{SC}$	50 kA	(max.)
Transfer ratio $K_R$	10 V @ 6000 A	
Output signal clipping level (with 1 k $\Omega$ load)	12.5 V	(max. 14 V unloaded)
Output load impedance	$\geq 1 \text{ k}\Omega$	
Output ripple and noise (peak-peak)	$\leq 0.05 \%$	(of range)
Accuracy (for whole measuring range) [2]	$\leq 0.09 \%$ of reading + 0.01 % of range	
Frequency dependent accuracy (indicative) [2]	$0.2 \cdot f^2 \%$	(of reading; f in kHz)
Bandwidth, -3 dB [3]	DC...30 kHz	
Step response time $T_{SR}$ (of output) [4]	$< 8 \mu\text{s}$	(10 to 90 % of steady state value)
Dead time $T_T$ (of output) [4]	$< 4 \mu\text{s}$	(also known as tracking delay time)
Output settling time $T_S$ [4]	$< 20 \mu\text{s}$	(for error within 10 %)
Output settling time $T_s$ [4]	$< 1 \text{ ms}$	(for error within $\pm 1 \%$ )
Output slew rate [4]	$> 1 \text{ V}/\mu\text{s}$	

[1] Time to saturation and the highest primary current: to be coordinated with customer/user. If the primary current ( $> I_{SOV}$ ) continues for longer, the occurring saturation will be indicated by opening of the contact 'Output valid'.

[2] Add both accuracy figures to find the total accuracy for the AC part. (Below to 200 Hz the freq. dependent part is negligible).

[3]  $I_p$  100 % amplitude for 0...500 Hz. De-rate  $I_p$  inversely proportional to 5 % for currents with a frequency of 10 kHz or more.

[4] The specified step response time, dead time, settling time and output slew rate are hard to demonstrate because an infinite steep primary current step is impossible to realize.

### 2. Measurement characteristics for output 2 (NB; Narrow Bandwidth) without 'FTZ'

'Slow Loupe' output for representing a small DC current that may be part of the primary current.

Measuring range (DC current, bipolar)	100 A	
DC transfer ratio $K_R$	10 V @ 100 A	
Output signal clipping level (with 1 k $\Omega$ load)	12.5 V	(max. 14 V unloaded)
Output load impedance	$\geq 1 \text{ k}\Omega$	
DC-accuracy (0 to 100 A)	0.2 %	(of range)
Bandwidth, -3 dB	DC...8 Hz	
Attenuation for primary current with f=50 Hz	80 dB	(90 dB for 60 Hz)

### 3. Operational characteristics

Return bar: distance to head surface	1 m	
Centre bar: minimum distance to the bend	1 m	
Centre bar: radial displacement sensitivity (influence on accuracy, related to main output)	< 0.01 %	(if 10 cm out of central axis)
Max. external magnetic DC-field	3 mT	(equals 2387 A/m)
Max. external magnetic AC-field (50/60 Hz)	1.25 mT	(equals 1000 A/m)
Minimum separation between heads	Nil	
Stabilization time after initial switch-on	< 2 s	( $I_P \leq 1$ pu)
Stabilization time after saturation	< 2 s	(after $I_P$ has returned to $\leq 1$ pu)
Cable length: head to electronics	$\leq 300$ m	(length specified by user)

### 4. Characteristics interconnect cable (instrumentation cable)

Twisted and screened pairs (each with drain wire)	7 x 2 x 1.5 mm <sup>2</sup>
Capacitance between pair cores	< 55 pF/m
Flame retardant, low smoke, zero halogen	Yes
Overall braided screen with coverage > 85 %	Yes
Test voltage braided screen $\leftrightarrow$ pair screen + cores	3 kV, 50 Hz, 1 min. (or 4.5 kV <sub>DC</sub> , 1 min.)
Diameter cable / min. bending radius	$\varnothing$ 26 mm / 185 mm
PM-SMS ordering code	ZF19016

### 5. Environmental characteristics

EMC	IEC61000-series
Operating temp. range: electronics	0 to +55 °C
Operating temp. range: measuring head + cable	-40 to +70 °C
Relative humidity (RH): electronics	Up to 95 % (non-condensing)
Storage temperature range	-20 to +55 °C
Temperature rise of measuring head (windings)	< 5 K (at 1 pu)

### 6. Measuring head physical characteristics

Marking: identification	Manufacturer, type, ser. number and nom. current
Marking: direction of primary current	P1 (output signal of electronics module is positive if $I_P$ enters at P1)
Dimensions, fixings and mass	See drawings
Shielding / screening	Magnetic shield and electrostatic foil screen
Connection method for interconnect cable	32-pole industrial connector
Earthing connection to local earth	M6 stud (situated at the connection box)

### 7. Measuring head electrical characteristics

Nominal primary current $I_N$ (1 pu)	3000 A	(equal to first row of table 1)
Number of turns of secondary windings N4//N5	2000	
Induced voltage into primary bar	< 5 mV <sub>PP</sub>	(caused by the HITACC system)
Test voltages primary to secondary	Dependent from primary insulator (see drawings)	
Protection for open sec. winding or broken cable?	Yes	(by means of built-in 'CTP5')
Test volt. sec.: winding-winding, windings-screens	3 kV <sub>RMS</sub> , 50 Hz, 1 min. (or 4.5 kV <sub>DC</sub> , 1 min.)	
Inter-turn over-voltage test for N4 and N5) [1]	4.5 kV <sub>PEAK</sub>	
Insulation sec.: winding-winding, windings-screens	> 100 MΩ @ 500 V <sub>DC</sub>	

[1] During this test the CTP5 is disconnected.

### 8. Electronics module physical characteristics

Marking: identification	Manufacturer, type, serial number and weight	
Marking: transfer ratio(s) and supply voltage	On rear panel	
Dimensions (W x H) and fixing [2]	3U x 19 inch rack mounting (see drawings)	
Mass (approx.)	8.5 kg	
Cooling	Natural (vent slots in bottom / top cover)	
Connection method Standard: 3 connectors (supply, MH and outputs)	Type Han10A, Han32E and Han16A (make Harting)	

[2] 1U equals 1¾ inch or 44.45 mm (1 inch = 25.4 mm)

### 9. Electronics module electrical characteristics

Supply voltage, nominal Supply voltage, range	+120 V <sub>DC</sub> (the built-in DC-DC converter +90...156 V <sub>DC</sub> provides galvanic isolation)	
Supply redundancy	Two inputs (OR-diodes) with common return that enable feeding from two battery systems.	
Power consumption (total)	15 · (I <sub>P</sub> + 1) W (I <sub>P</sub> in kA, max. 12 kA)	
P <sub>EXT</sub> (external dissipation in head + cable) (P <sub>TOTAL</sub> – P <sub>EXT</sub> = power dissipation for EM)	(0.4 + 1.5 · L <sub>C</sub> ) · I <sub>P</sub> <sup>2</sup> [W] L <sub>C</sub> cable length in km. I <sub>P</sub> in kA	
Status contacts: general description	Floating contacts. Closed when working properly Contact rating 100 V / 1 A / 10 VA All status contacts will indicate FALSE (open) when the electronics module is not powered	
Status contact: Supply OK	CLOSED when internal supply voltage of the DCCT is beyond ±21 V	
Status contact: Output valid	CLOSED if no fault conditions are detected, indicating that the analog output is valid	
Status signal: Fast valid	CONDUCTING if no fault conditions are detected, indicating proper internal operation	
Output type: open collector with 100 Ω in series	Rating: max. +30 V <sub>DC</sub> / 50 mA	
Test voltage: all electronics circuits ↔ chassis	3 kV <sub>RMS</sub> / 50 Hz / 1 min. (or 4.5 kV <sub>DC</sub> , 1 min.)	
Test voltage: supply input ↔ rest of electronics	3 kV <sub>RMS</sub> / 50 Hz / 1 min. (or 4.5 kV <sub>DC</sub> , 1 min.)	
Test voltage: status contacts to rest of electronics	3 kV <sub>RMS</sub> / 50 Hz / 1 min. (or 4.5 kV <sub>DC</sub> , 1 min.)	
Insulation test: all electronics circuits ↔ chassis	> 100 MΩ @ 500 V <sub>DC</sub>	

**Abbreviations**

- I<sub>N</sub> : Nominal current, also indicated with 1pu (pu means 'per unit')
- I<sub>P</sub> : Primary current, actual primary current flow
- MH : Measuring head EM : Electronics module
- N.A. : Not applicable