TEST AT ITS BEST

SCHLEICH
Advanced Test Technologies

TECHNICAL DATA SHEET

Safety and function tester
GLP2-BASIC

Revision 10-14, valid from March 2026

Standard model GLP2-BASIC

ELECTRICAL SPECIFICATIONS	
Supply voltage	110 to 250 V AC
Mains frequency	47 to 63 Hz
No load current consumption	0.5 A, fuse T10A
GENERAL SPECIFICATIONS	
Display	7“ color graphic display, resolution 800 x 480 pixels, display behind scratch-proof glass
Data input	PCAP capacitive touch display behind scratch-proof glass
Time & Date	Clock with integrated calendar
Test plan storage	10.000 test plans
Test result storage	250.000 test results
Test connections	Test probe connection on the rear side of the tester Industrial plug connection on the rear side of the tester High-voltage sockets on the rear side of the tester
Safety	Key lock[1)] Access to the test parameters protected by password CAT IV safety relay with 2 contacts (emergency stop, test cover) Input for release CE-conform, corresponding to VDE 0104 / EN 50191 / EN 61010
Interface (display)	HDMI port to operate an additional, large monitor screen / HDMI 1.0 | 800 x 480 and/or 800 x 600
Interfaces (communication)	2 x USB on the front side of the tester 4 x USB on the rear side of the tester LAN on the rear side of the tester RS232 on the rear side of the tester
Interfaces (standard)	Outputs: result light, warning light Inputs: foot-switch on the rear side of the tester, control plug, optional: two-hand start
Interface (PLC-I/O remote control)	Outputs: GO / NO GO, test is running, ready, HV on, contact control I<min (Check whether current falls below minimum), disruptive discharge 16 x freely configurable outputs (max. current load: 200 mA per output, 1.5 A for all outputs in total. *See connection No. 5 on rear of device*) Inputs: start, foot-switch, 4 x freely configurable inputs, e.g., for digital test plan selection between 15 test plans (*see connection No. 5 on rear of device*)
Calibration	Adjustment via software without having to open the test device, remotely via SmartCalibration.
Software operator convenience	All inputs are checked by plausibility check. Therefore, wrong inputs should be avoided. The operator can display a detailed help text for any input option.
Front panel languages	DE, EN
Software languages	DE, EN, CS, ES, FR, IT, NL, PL
Design and production	Made in Germany – True German Quality

1) Key lock only for testers with dangerous test voltages and/or dangerous test currents

MECHANICAL SPECIFICATIONS

Options	▪ Desktop device in 19“-design incl. solid pedestals to put the tester into an inclined position ▪ Rack-mount device: optional mounting kit for installation in a 19“-cabinet
Operating environment	Operating temperature 0 °C to 50 °C / 32 °F to 104 °F, designed for a relative humidity of 0 to 80 %rF without condensation!
Storage	Storage temperature -10 °C to 60 °C / 14 °F to 140 °F, designed for a relative humidity of 0 to 90 %rF without condensation!
Dimensions & Color	Desktop device 19“: 448 x 430 x 178 mm (W x D x H), RAL 7035
Weights	BASIC 320 – 13.4 kg / 29.5 lbs. BASIC 330 – 18.6 kg / 41.0 lbs. BASIC 360 – 13 kg + 20 kg[*1)] / 28.7 lbs. + 44.1 lbs.[*1)] BASIC 370 – 13 kg + 25 kg[*2)] / 28.7 lbs. + 55.1 lbs.[*2)] BASIC 380 – 13 kg + 45 kg[*3)] / 28.7 lbs. + 99.2 lbs.[*3)] BASIC 440 – 18.6 kg / 41.0 lbs. BASIC 530 – 18.6 kg / 41.0 lbs. BASIC 820 – 11.2 kg / 24.7 lbs. BASIC 920 – 14.2 kg / 31.3 lbs. BASIC 930 – 19.4 kg / 42.8 lbs. BASIC 940 – 18.6 kg / 41.0 lbs. BASIC 1030 – 19.8 kg / 43.7 lbs. BASIC 1040 – 27.7 kg / 61.1 lbs. BASIC 1041 – 25.0 kg / 55.1 lbs. BASIC 1130 – 17.6 kg / 38.8 lbs. BASIC 1131 – 17.6 kg / 38.8 lbs. BASIC 1220 – 20.6 kg / 45.4 lbs. BASIC 1230 – 25.8 kg / 56.9 lbs. BASIC 1231 – 25.8 kg / 56.9 lbs. BASIC 1232 – 25.8 kg / 56.9 lbs. BASIC 1240 – 25.0 kg / 55.1 lbs. BASIC 1320 – 17.5 kg / 38.6 lbs. BASIC 1322 – 17.5 kg / 38.6 lbs. BASIC 1330 – 16.8 kg / 37.0 lbs. BASIC 1420 – 17.5 kg / 38.6 lbs. BASIC 1430 – 17.5 kg / 38.6 lbs. BASIC 1520 – 20.5 kg / 45.2 lbs. BASIC 1530 – 25.7 kg / 56.7 lbs. BASIC 1540 – 19.8 kg / 43.7 lbs. BASIC 1550 – 25.0 kg / 55.1 lbs. BASIC 1620 – 20.5 kg / 45.2 lbs. BASIC 1630 – 25.7 kg / 56.7 lbs. BASIC 1640 – 20.5 kg / 45.2 lbs. BASIC 1650 – 25.7 kg / 56.7 lbs. BASIC 1720 – 18.3 kg / 40.3 lbs. BASIC 1740 – 17.6 kg / 38.8 lbs. BASIC 1820 – 18.3 kg / 40.3 lbs. BASIC 1840 – 18.3 kg / 40.3 lbs. BASIC 1920 – 21.3 kg / 47.0 lbs. BASIC 1930 – 26.5 kg / 58.4 lbs. BASIC 1931 – 26.4 kg / 58.2 lbs. BASIC 1940 – 21.3 kg / 47.0 lbs. BASIC 1950 – 26.5 kg / 58.4 lbs. BASIC 2010 – ca. 16.0 kg / 35.3 lbs. BASIC 2011 – ca. 16.0 kg / 35.3 lbs. BASIC 2030 – ca. 16.0 kg / 35.3 lbs. BASIC 2031 – ca. 16.0 kg / 35.3 lbs. BASIC 2110 – ca. 16.0 kg / 35.3 lbs. BASIC 2130 – ca. 16.0 kg / 35.3 lbs. BASIC 2210 – 23.3 kg / 51.4 lbs. BASIC 2230 – 22.5 kg / 51.4 lbs. BASIC 2310 – 23.3 kg / 51.4 lbs. BASIC 2330 – 23.3 kg / 51.4 lbs. BASIC 2410 – 23.3 kg / 51.4 lbs. BASIC 2430 – 23.3 kg / 51.4 lbs.

[*1)] Additional high-voltage transformer: ca. 20 kg, 225 x 265 x 198 mm (W x D x H) + tube: 150 mm (H)
[*2)] Additional high-voltage transformer: ca. 25 kg, 250 x 300 x 250 mm (W x D x H) + tube: 195 mm (H)
[*3)] Additional high-voltage transformer: ca. 45 kg, 300 x 300 x 400 mm (W x D x H) + tube: 400 mm (H)

Earth / Ground-bond resistance test AC GLP2-BASIC

TEST CURRENT AC	
Test current max.	30 A AC, beginning 1 A, adjustable in steps of 1 A
Output Frequency	47 to 63 Hz, depending on mains supply
Current control	Automatic electronic constant-current control with minimum-current control and sense-interruption detector
Setting	Default value + 0.5 A
VOLTAGE	
Test voltage max.	6 / 12 V AC – selectable in the test plan operator, with automatic maximum voltage limitation
RESISTANCE	
Accuracy	High-precision 4-wire resistance measurement
Measuring range total	0 to 1200 mΩ, depending on the flowing test current and the permitted maximum voltage
Resolution	1 mΩ or 10 mV AC
Resistance measurement	0 to 1200 mΩ at 12 V and 10 A 0 to 600 mΩ at 6 V and 10 A 0 to 400 mΩ at 12 V and 30 A 0 to 200 mΩ at 6 V and 30 A
Milliohm offset range	0 to 300 mΩ | This value is subtracted from the measured value. It is used to compensate fixed and unchanging contact resistances.
Measuring accuracy	± 1.25 % of the measured value ± 1 digit
EVALUATION	
Evaluation related to	Resistance or voltage drop
Upper resistance limit PE_{Rmax} or upper voltage limit PE_{Umax}	10 to 1200 mΩ freely definable, measured values equal to or under this limit are GO or alternately 0 to 12 V freely definable, measured values equal to or under this limit are GO
Lower resistance limit PE_{Rmin} or lower voltage limit	Freely definable, measured values under this limit are NO GO This function serves for contact control. This function can be deactivated. The lower resistance limit is always smaller than the upper limit.
Undercurrent	If the test current is smaller than the default value during test process, the test result is NO GO.
GENERAL	
Test timer	0 to 180 s in steps of 0.1 s
Measurement technique of U & I	High-precision true r.m.s measurement
Test points	Usual: PE/GB in the test socket ↔ test probe Special tester variant: test probe ↔ ground connection

Insulation resistance test (IR) GLP2-BASIC

TEST VOLTAGE	
Test voltage	30 to 1000 V DC, adjustable in steps of 10 V
Voltage control	Automatic electronic constant voltage control with undervoltage control
Setting	Default value + 5 V
CURRENT	
Test current max.	Max. 6 mA DC, safety current limiting
POWER	
Power max.	Max. 0.5 W
RESISTANCE	
Measuring range 1	100 kΩ to 99.9 MΩ
Resolution	100 kΩ
Measuring accuracy	± 1 % of the measure value, at a test voltage of min. 500 V
Resistance-/voltage table	Resistance max. voltage / limited by maximum power --- 100 kΩ 220 V 250 kΩ 250 V 500 kΩ 500 V 1 MΩ 700 V 2 MΩ 1000 V
Measuring range 2	100 to 499.9 MΩ
Resolution	1 MΩ
Measuring accuracy	± 1.5 % of the measured value, at a test voltage of min. 500 V
Measuring range 3	500 to 999.9 MΩ
Resolution	1 MΩ
Measuring accuracy	± 2.5 % of the measured value, at a test voltage of min. 500 V
Measuring range 4	1 to 10 GΩ
Resolution	10 MΩ
Measuring accuracy	± 5 % of the measured value, at a test voltage of min. 500 V
EVALUATION	
Lower resistance limit IR_{Rmin}	100 kΩ to 10 GΩ freely definable, measured values equal to or above this limit are GO
Upper resistance limit IR_{Rmax}	500 kΩ to 10 GΩ freely definable, measured values above this limit are NO GO This function serves for contact control. This function can be deactivated. The upper resistance limit is always greater than the lower limit.
Undervoltage	If the test voltage is smaller than the default value during test process, the test result is NO GO.
GENERAL	
Test timer manual measurement	0 to 600 s in steps of 0.1 s (0 = continuous operation without time limit)
Ramp timer	0 s, 0.1 s, 0.2 s to 60 s in steps of 0.1 s
Delay time	Delay of the evaluation, e.g., to prevent the effect of switch-on effects on measurements
Measurement technique of U & I	Lowest measured value is used for evaluation
Discharge	≤ 200 ms – for test objects with only ohmic load provided that: after testing, the test connections still must be connected with the test object during discharge process
Discharge resistor	2 x 100 kΩ (IR^+/IR^-) at IR with max. 1000 V test voltage
Residual voltage test	The test (test step) is only finished when output voltage decreased under 60 V.
Internal resistance	330 kΩ at IR with max. 1000 V test voltage Charge time of test object depends on internal resistance. Min. charge time = internal resistance x capacity of test object [s]
Test points	L&N ↔ PE, L ↔ PE, N ↔ PE, L ↔ N, L ↔ test probe, N ↔ test probe, L&N ↔ test probe, L&N ↔ PE& test probe, PE ↔ PE
IR warm	When combined with functional test 5 A, also possible during operation of the test object.

High-Voltage test AC GLP2-BASIC

TEST VOLTAGE	
Test voltage and resolution	50 to 6000 V AC, not potential-free @ 3 mA safety current limiting, DUT must be set up IRlated 50 to 6000 V AC, potential-free @ 100 mA GLP2-BASIC 360: 125 to 15000 V AC, not potential-free @ 50 mA, resolution: 10 V GLP2-BASIC 370: 250 to 30000 V AC, not potential-free @ 30 mA, resolution: 50 V GLP2-BASIC 380: 400 to 50000 V AC, not potential-free @ 25 mA, resolution: 50 V
Resolution	1 V
Voltage adjustment	Adjustable in steps of 10 V
Voltage control	Automatic electronic constant-voltage control with undervoltage monitoring
Tolerance of setting	Approx. 5 V higher than the default value, from no load to full load
Voltage measurement	True r.m.s. value or peak value, selectable by operator
Measuring accuracy	Devices up to 6 kV: ± 0.25 % of measured value
Output frequency	47 to 63 Hz, depending on mains supply, optionally adjustable: 50/60 Hz
POWER	
Output power	▪ Max. 25 VA at device with 3 mA safety current limiting ▪ Max. 500 VA at device with 100 mA according to VDE-, EN- and IEC standards
CURRENT	
Test current, tester variant 1	3 mA Safety current limiting with redundant overcurrent evaluation!
Resolution	1 µA
Measuring accuracy	± 2 % of the measured value ± 5 µA
Test current, tester variant 2	100 mA I_k ≥ 100 mA from ≥ 500 V, ≥ 500 VA according to VDE-, EN- and IEC-standards I_k ≥ 200 mA from ≥ 1000 V, according to VDE-, EN- and IEC-standards
Resolution	10 µA
Measuring accuracy	± 2 % of the measured value ± 0.1 mA
Test current and resolution, tester variant 3	GLP2-BASIC 360: 50 mA, resolution 10 µA GLP2-BASIC 370: 30 mA, resolution 10 µA GLP2-BASIC 380: 25 mA, resolution 10 µA
Current measuring and evaluation	True r.m.s value (TRMS) Total current, active current or reactive current – selectable by operator
EVALUATION	
Upper current limit / Imax	0 to max. test current (depending on tester variant), measured values equal to or under this limit are GO
Lower current limit / Imin	0 to max. test current (depending on tester variant), measured values under this limit are NO GO This function serves for contact control. This function can be deactivated. The lower current limit is always smaller than the upper limit.
Undervoltage	If the test voltage is smaller than the default value during test process, the test result is NO GO.
Error detector	Optical and acoustic
GENERAL	
Test timer	0 s to 200 h in steps of 0.1 s (0 = continuous operation without time limit)
Ramp up timer	0 s to 24 h in steps of 0.1 s (0 = without ramp up)
Ramp down timer	0 s to 4 h in steps of 0.1 s (0 = without ramp down)
Operation modes	4
Manual	Test is performed without timer. Shutdown at overcurrent.
Automatic	The voltage is automatically adjusted. Test is performed with timer. Shutdown at overcurrent or current outside the minimum / maximum limits.
Burning	Test is performed without timer, manual measurement only.
only at 100mA	No shutdown at overcurrent. Test current is electronically limited to max. 100 mA.
Pulsing	Test is performed without timer, manual measurement only.
not at 6 kV @ 3 mA	Shutdown for 0.5 s at overcurrent. Test current is electronically limited to max. 100 mA.
Discharge	0 to 100 ms provided that: after testing, the test connections still have to be connected with the test object during discharge process
Discharge resistor	1.45 kΩ, active without voltage
Residual voltage test	The test (test step) is only finished when output voltage decreased under 60 V.

High-voltage test DC GLP2-BASIC

TEST VOLTAGE

Test voltage and resolution	50 to 6000 V DC, not potential-free, negative pole at PE (Earth - Ground)
Resolution	1 V
Ripple tester variant 1, 4 mA	< 1 % (6 kV @ 4 mA)
Ripple tester variant 2, 100 mA	Up to 100 %, rectifier bridge with 10 nF filter capacity
Voltage adjustment	Adjustable in steps of 10 V
Voltage control	Automatic electronic constant voltage control with undervoltage control
Tolerance of setting	Approx. 5 V higher than the default value, from no load to full load
Voltage measurement	Type 1: average value Type 2: peak value
Measuring accuracy	± 1.5 % of measurement value

CURRENT

Test current, tester variant 1: safety current limiting:

Resistance	Current	Power	Voltage
100 kΩ	3.0 mA	0.9 W	300 V
250 kΩ	3.0 mA	2.25 W	750 V
500 kΩ	3.0 mA	4.5 W	1500 V
1 MΩ	2.5 mA	6.25 W	2500 V
2 MΩ	1.65 mA	5.4 W	3300 V
5 MΩ	0.92 mA	4.23 W	4600 V
6 MΩ	0.785 mA	4.3 W	5500 V
10 MΩ	0.549 mA	3.2 W	6000 V

Resolution	1 µA
Measuring accuracy	± 1 % of measuring range's final value
Test current, tester variant 2	100 mA
Resolution	100 µA
Measuring accuracy	0 to 100 mA: ± 2 % of measuring range's final value
Current measurement and evaluation	Average value
Power	Type 1: See table "Test current, tester variant 1" Type 2: I_k ≥ 100 mA from ≥ 500 V, ≥ 500 VA according to VDE-, EN- and IEC-standards I_k ≥ 200 mA from ≥ 1000 V, according to VDE-, EN- and IEC-standards

INSULATION RESISTANCE ONLY AVAILABLE FOR DEVICE TYPE 1

Range	100 kΩ to 1 GΩ
Resolution	100 kΩ
Measuring accuracy	± 1 % of measuring range's final value at min. 500 V

EVALUATION resistance ONLY AVAILABLE FOR DEVICE TYPE 1

Lower resistance limit IR_{Rmin}	100 kΩ to 1 GΩ freely definable, measured values equal to or above this limit are GO.
Upper resistance limit IR_{Rmax}	500 kΩ to 1 GΩ freely definable, measured values below this limit are GO This function serves for contact control. This function can be deactivated. The upper resistance limit is always larger than the lower one.
Undervoltage	If the test voltage is below the default value, the test result is NO GO.

EVALUATION current

Upper current limit / Imax	0 to max. test current (depending on tester variant), measured values equal to or under this limit are GO
Lower current limit / Imin	0 to max. test current (depending on tester variant), measured values above this limit are GO This function serves for contact control. This function can be deactivated. The lower current limit is always smaller than the upper limit.
Undervoltage	If the test voltage is smaller than the default value during test process, the test result is NO GO.
Error detector	Optical and acoustic

GENERAL

Test timer	0 to 200 h in steps of 0.1 s (0 = continuous operation without time limit)
Ramp up timer	0 to 24 h in steps of 0.1 s (0 = ramp up off)
Ramp down timer	0 to 24 h in steps of 0.1 s (0 = ramp down off) at ohmic load only!
Discharge	≤ 200 ms provided that: after testing, the test connections still have to be connected with the test object during discharge process
Discharge resistor, tester variant 1	33 kΩ
Discharge resistor, tester variant 2	500 kΩ
Residual voltage test	The test (test step) is only finished when output voltage falls below 60 V.

Continuity test and short-circuit test GLP2-BASIC

TEST VOLTAGE	
Test voltage	Approx. 4.5 V DC
TEST CURRENT	
Test current	Max. 10 mA
RESISTANCE	
Measuring method	2-wire method
Measuring range 1	1 Ω to 99.9 Ω
Resolution	0.1 Ω
Measuring accuracy	± 1.5 % of the measured value ± 1.5 Ω
Measuring range 2	100 Ω to 999.9 Ω
Resolution	0.1 Ω
Measuring accuracy	± 1.5 % of the measured value ± 1.5 Ω
Measuring range 3	1 to 9.99 kΩ
Resolution	10 Ω
Measuring accuracy	± 1.5 % of the measured value ± 10 Ω
Measuring range 4	10 to 100 kΩ
Resolution	100 Ω
Measuring accuracy	± 2.5 % of the measured value ± 100 Ω
L ↔ N short-circuit test	▪
Test points	L ↔ N, L ↔ PE, N ↔ PE, test probe ↔ PE
EVALUATION	
Upper & lower Limit ±tolerance in % of default value	Resistances within the tolerance limits are GO
Upper limit	Resistances under this limit are GO
Lower limit	Resistances above this limit are GO

Function test 5 A GLP2-BASIC

TEST VOLTAGE	
Test voltage	12 to 260 V AC single-phase potential-free via an integrated IRlating transformer
Resolution	0.1 V
Voltage adjustment	Adjustable in steps of 1 V
Voltage control	Automatic electronic constant voltage control with undervoltage and overvoltage control
Tolerance of setting	0 to ± 1 % of the default value, from no load to full load
Voltage measurement	True r.m.s. value (TRMS)
Measuring accuracy	± 1.5 % of measuring range's final value
Output frequency	47 to 63 Hz, depending on mains supply, optionally adjustable: 50/60 Hz
CURRENT	
Test current	Max. 5 A AC continuous current at 230 V supply voltage with 12 to 230 V test voltage Max. 5, reduced to 4.4 A continuous current AC at 230 V supply voltage with a proportional reduction to the test voltage from 230 V to 260 V Max. 5 A AC continuous current at 110 V supply voltage and 110 V test voltage Max. 5, reduced to 2.1 A AC continuous current at 110 V supply voltage with a proportional reduction to the test voltage from 110 V to 260 V
Measuring range 1	0.5 A
Resolution	10 µA
Measuring accuracy	± 1.5 % of measuring range's final value
Measuring range 2	5 A
Resolution	1 mA
Measuring accuracy	± 1.5 % of measuring range's final value
Current measurement and evaluation	True r.m.s value (TRMS)
POWER in W, VA, cosφ	
Power	1150 VA maximum permanent power at 230 V @ 5 A 550 VA maximum permanent power at 110 V @ 5 A
Measuring range 1	130 VA at 260 V @ 0.5 A
Resolution	1 mVA
Measuring range 2	1300 VA at 260 V @ 5 A
Resolution	0.1 VA
Power measurement and evaluation	VA, W
EVALUATION	
Upper & lower Limit I ± tolerance in % of the default value	0 to 5 A, measured values within the tolerance limits are GO
Upper & lower Limit W ± tolerance in % of the default value	0 to 1300 W, measured values within the tolerance limits are GO
Upper & lower Limit VA ± tolerance in % of the default value	0 to 1300 VA, measured values within the tolerance limits are GO
Upper & lower Limit VAR ± tolerance in % of the default value	0 to 1300 VAR, measured values within the tolerance limits are GO
Upper & lower Limit cosφ ± tolerance in % of the default value	0 to 1, measured values within the tolerance limits are GO
Undervoltage / Overvoltage	If test voltage is smaller than -1.5 % of the default value, test result is NO GO. If test voltage is greater than +1.5 % of the default value, test result is NO GO.
Electronic short-circuit detection	Continuously short-circuit proof with automatic electronic current limiting
Error detector	Optical and acoustic
GENERAL	
Starting time	0 to 1 h in steps of 0.1 s (0 = off). Bridging of a start process, start-up, etc. No evaluation of measurements during the starting time.
Test timer	0 to 1 h in steps of 0.1 s
Residual voltage test	The test (test step) is only finished when output voltage decreased under 60 V.

Function test 16 A GLP2-BASIC

TEST VOLTAGE	
Test voltage	16 A tester: 0 to 260 V AC single-phase, externally supplied via separate connection
Resolution	0.1 V
Voltage adjustment	Voltage adjustment not possible
Voltage control	Externally controlled and supplied With undervoltage and overvoltage control
Tolerance of setting	No voltage setting
Voltage measurement	True r.m.s value (TRMS)
Measuring accuracy	±1.5 % of measuring range's final value
Output frequency	50 or 60 Hz, depending on mains supply
CURRENT	
Test current	16 A AC
Resolution up to 9.9 A	1 mA
Resolution 10 to 16 A	10 mA
Current measurement and evaluation	True r.m.s value (TRMS)
Measuring accuracy	16 A testers: ± 1.5 % measuring range's final value
POWER W, VA, cosφ	
Power	4200 W, 4200 VA maximum permanent power at 260 V @ 16 A
Resolution	1 VA, 1 W
Power measurement and evaluation	VA, W
EVALUATION	
Upper & lower limit I ± tolerance in % of the default value	0 to 16 A, measured values within the tolerance limits are GO
Upper & lower limit W ± tolerance in % of the default value	0 to 4200 W, measured values within the tolerance limits are GO
Upper & lower limit VA ± tolerance in % of the default value	0 to 4200 VA, measured values within the tolerance limits are GO
Upper & lower limit VAR ± tolerance in % of the default value	0 to 4200 VAR, measured values within the tolerance limits are GO
Upper & lower limit cosφ ± tolerance in % of the default value	0 to 1, measured values within the tolerance limits are GO
Undervoltage / Overvoltage	If test voltage is smaller than -1.5 % of the default value, test result is NO GO. If test voltage is greater than +1.5 % of the default value, test result is NO GO.
Electronic short-circuit detection	No electronic fuse, fuse protection via 2 x 16 A MCBs
Error detector	Optical and acoustic
GENERAL	
Starting delay timer	0 to 200 h in steps of 0.1 s (0 = off). Bridging of a start process, start-up, etc. No evaluation of measurements during the starting time.
Test timer	0 to 200 h in steps of 0.1 s
Residual voltage test	The test (test step) is only finished when output voltage decreased below 60 V.

Leakage current test for testers with 5 A GLP2-BASIC

TEST VOLTAGE	
Test voltage	12 to 260 V AC single-phase, potential-free via an integrated isolation transformer Voltage supplied by function test
CURRENT	
Supply current DUT	Max. 5 A AC continuous current at 230 V supply voltage with 12 to 230 V test voltage Max. 5, reduced to 4.4 A continuous current AC at 230 V supply voltage with a proportional reduction to the test voltage from 230 V to 260 V Max. 5 A AC continuous current at 110 V supply voltage and 110 V test voltage Max. 5, reduced to 2.1 A AC continuous current at 110 V supply voltage with a proportional reduction to the test voltage from 110 V to 260 V
LEAKAGE CURRENT	
Leakage current I_{eff}	Max. 30 mA
Measuring ranges	5 with automatic switchover of measuring ranges
Resolution	1 µA
Accuracy	± 1.5 % of the measured value + 1 µA
Current measurement	I_{TRMS}, I_{Peak}, $I_{dc\text{-}component}$, $I_{ac\text{-}component}$
Measuring method	ground leakage current, housing leakage current
Standards	EN60990, EN60601
Measuring circuits	3 x MD for EN60990, 1 x MD for EN60601
Fault conditions	1 (PE interrupted), 2 (N interrupted), with normal and reverse polarity
Max. measurement frequency	500 Hz
Test points	L+N ↔ PE, L+N ↔ test probe
EVALUATION	
Upper limit	0 to 30 mA

Substitute leakage current test for testers with 16 A GLP2-BASIC

TEST VOLTAGE	
Test voltage	Approx. 40 V AC single-phase
Calculated test voltage	25 to 300 V
LEAKAGE CURRENT	
Leakage current I_{eff}	0 to 30 mA (calculated)
Resolution	10 µA
Accuracy	1.5 % of the measured value + 10 µA
Calculated test current	10 µA to 30 mA
Measuring method	Ground leakage current, housing leakage current
Standards	EN 50678/50699 and VDE 0701/0702; touch current measurement – alternative method
Test points	L+N ↔ PE, L+N ↔ test probe
EVALUATION	
Upper limit	30 mA

Resistance test with voltage adjustment max. 3 A GLP2-BASIC

GENERAL	
Measuring ranges	4 ranges
4-wire measurement	Yes
Measuring time	Min. 0.3 s (The measuring time can be decreased for an additional charge if required)
Test current	Max. 3 A
Open circuit voltage	Ca. 4.5 V
Test voltage	≤ 4.5 V, this is equivalent to ≤ open-circuit voltage
MEASURING RANGES	
Measuring range 1	0 to 100 kΩ (1 MΩ) – Maximum current < 50 µA – Test voltage ≤ 4.5 V
100 Ω – 1 kΩ	Measuring accuracy: 1.0 % | Resolution: 0.1 Ω
1K Ω – 10 kΩ	Measuring accuracy: 1.5 % | Resolution: 1 Ω
10 kΩ – 100 kΩ	Measuring accuracy: 1.5 % | Resolution: 10 Ω
100 kΩ – 1 MΩ	Measuring accuracy: 2.5 % | Resolution: 100 Ω
Measuring range 2	0 to 10 kΩ – Maximum current < 5 mA – Test voltage ≤ 4.5 V
10 Ω – 100 Ω	Measuring accuracy: 0.5 % | Resolution: 0.01 Ω
100 Ω – 1 kΩ	Measuring accuracy: 0.5 % | Resolution: 0.1 Ω
1 kΩ – 10 kΩ	Measuring accuracy: 0.5 % | Resolution: 1 Ω
Measuring range 3	0 to 100 Ω – Maximum current < 500 mA – Test voltage ≤ 4.5 V
0.1 Ω – 1 Ω	Measuring accuracy: 0.3 % | Resolution: 0.001 Ω
1 Ω – 10 Ω	Measuring accuracy: 0.3 % | Resolution: 0.001 Ω
10 Ω – 100 Ω	Measuring accuracy: 0.3 % | Resolution: 0.01 Ω
Measuring range 4	0 to 10 Ω – Maximum current < 3 A – Test voltage ≤ 4.5 V
0.000 Ω – 0.001 Ω	Measuring accuracy: 12.5 % | Resolution: 0.00001 Ω (only if test device has no other test methods)
0.001 Ω – 0.01 Ω	Measuring accuracy: 1.5 % | Resolution: 0.00001 Ω
0.01 Ω – 0.1 Ω	Measuring accuracy: 0.3 % | Resolution: 0.0001 Ω
0.1 Ω – 1 Ω	Measuring accuracy: 0.3 % | Resolution: 0.001 Ω
1 Ω – 10 Ω	Measuring accuracy: 0.3 % | Resolution: 0.001 Ω

Resistance test with current adjustment max. 1 A GLP2-BASIC

GENERAL	
Measuring ranges	3 ranges (0 to 10 Ω, 0 to 100 Ω, 0 to 10 kΩ)
4-wire measurement	Yes
Measuring time	Min. 0.3 s
Test current	Max. 1 A
Current adjustment active	Up to 2.2 Ω @ 1 A; ab 2.2 Ω @ < 1 A
Open circuit voltage	ca. 8 V
Test voltage	≤ 8 V, *which corresponds to ≤ open-circuit voltage*
Voltage regulation	No
MEASURING RANGES	
Measuring range 1	0 to 10 kΩ – Maximum current < 5 mA – Test voltage ≤ 8 V
10 Ω – 100 Ω	Measuring accuracy: 1.5 % | Resolution: 0.01 Ω
100 Ω – 1 kΩ	Measuring accuracy: 1.5 % | Resolution: 0.1 Ω
1 kΩ – 10 kΩ	Measuring accuracy: 1.5 % | Resolution: 1 Ω
Measuring range 2	0 to 100 Ω – Maximum current < 500 mA – Test voltage ≤ 8 V
0.1 Ω – 1 Ω	Measuring accuracy: 0.5 % | Resolution: 0.001 Ω
1 Ω – 10 Ω	Measuring accuracy: 0.5 % | Resolution: 0.001 Ω
10 Ω – 100 Ω	Measuring accuracy: 0.5 % | Resolution: 0.01 Ω
Measuring range 3	0 to 10 Ω – Maximum current < 1 A – Test voltage ≤ 8 V
0.000 Ω – 0.001 Ω	Measuring accuracy: 15 % | Resolution: 0.00001 Ω (only if test device has no other test methods)
0.001 Ω – 0.01 Ω	Measuring accuracy: 3 % | Resolution: 0.00001 Ω
0.01 Ω – 0.1 Ω	Measuring accuracy: 0.5 % | Resolution: 0.0001 Ω
0.1 Ω – 1 Ω	Measuring accuracy: 0.5 % | Resolution: 0.001 Ω
1 Ω – 10 Ω	Measuring accuracy: 0.5 % | Resolution: 0.001 Ω

Electrical connections for testing and control

ELECTRICAL CONNECTIONS ***Testing according to concept: Manual testing***

Variants												Fig.
Test methods					HV	IR HV	PE IR HV CONT	Technical Data	Measurement paths			
					320			HVAC 6 kV / 3 mA – safety	Test pistol 1	↔	Test pistol 2	6
					330			HVAC 6 kV / 100 mA	Test pistol 1	↔	Test pistol 2	6
						920		IR 1 kV	Test pistol 1	↔	Test pistol 2	3
								HVDC 6 kV / 4 mA – safety	Test pistol 1	↔	Test pistol 2	3
								HVAC 6 kV / 3 mA – safety	Test pistol 1	↔	Test pistol 2	3
						930		IR 1 kV	Test pistol 1	↔	Test pistol 2	3
								HVDC 6 kV / 4 mA – safety	Test pistol 1	↔	Test pistol 2	3
								HVAC 6 kV / 100 mA	Test pistol 1	↔	Test pistol 2	3
							1041	PE 30 A AC	PE GND	↔	Test tip	1
								IR 1 kV	PE GND	↔	Test tip	2
								HVAC 6 kV / 3 mA – safety	Test pistol 1	↔	Test pistol 2	3
								CONT	PE GND	↔	Test tip	4
							1131	PE 30 A AC	PE GND	↔	Test tip	1
								IR 1 kV	PE GND	↔	Test tip	2
								HVDC 6 kV / 4 mA – safety	Test pistol 1	↔	Test pistol	3
								CONT	PE GND	↔	Test tip	4
							1231	PE 30 A AC	PE GND	↔	Test tip	1
								IR 1 kV	PE GND	↔	Test tip	2
								HVAC 6 kV / 100 mA	Test pistol 1	↔	Test pistol 2	3
								HVDC 6 kV / 4 mA – safety	Test pistol 1	↔	Test pistol 2	3
								CONT	PE GND	↔	Test tip	4
							1232	PE 30 A AC	PE GND	↔	Test tip	1
								IR 1 kV	PE GND	↔	Test tip	2
								HVAC 6 kV / 100 mA	Test pistol 1	↔	Test pistol 2	5
								HVDC 6 kV / 4 mA – safety	Test pistol 1	↔	Test pistol 2	5
								CONT	PE GND	↔	Test tip	4

Test pistol 1, 2 = Single-pole test probes
PE GND = Ground/housing connection terminals to the DUT
Test tip = Test tip for contacting housing parts for both protective earth conductor and insulation resistance testing

PE = Protective earth resistance test
IR = Insulation resistance test
HVAC = High voltage test with alternating current (AC)
HVDC = High voltage test with direct current (DC)
CONT = Continuity test (two-wire measurement)

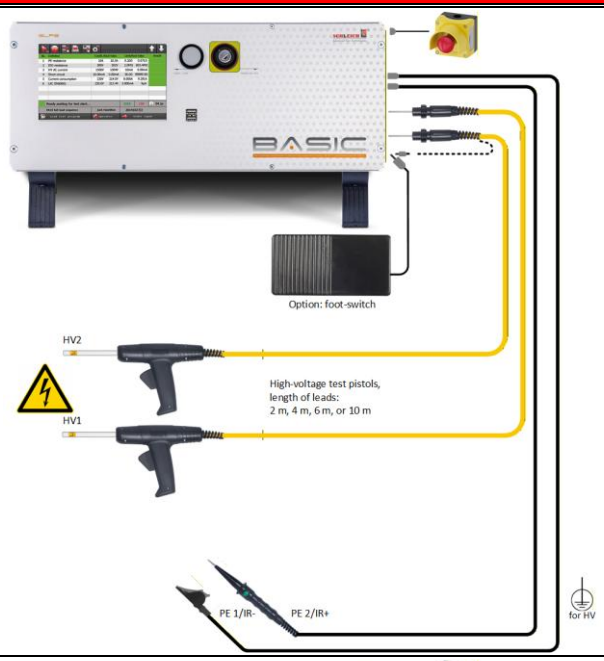
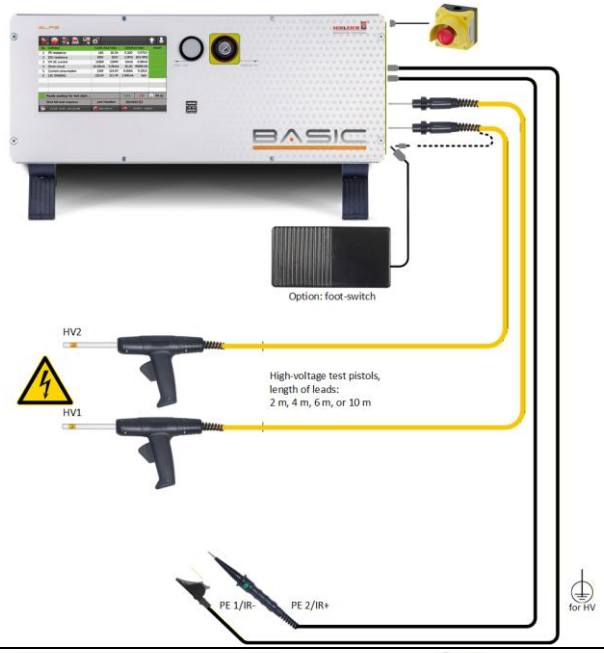
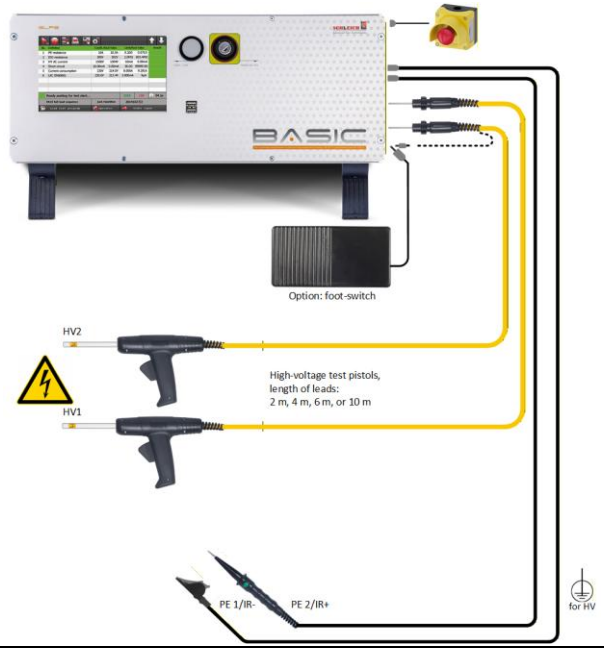
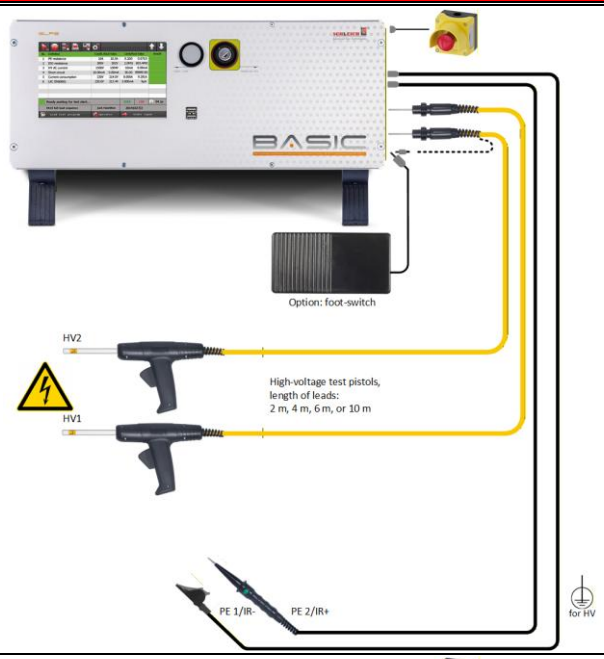
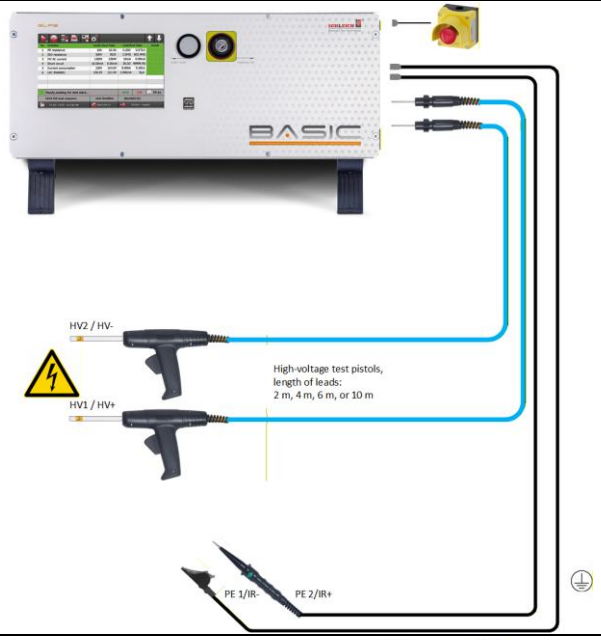
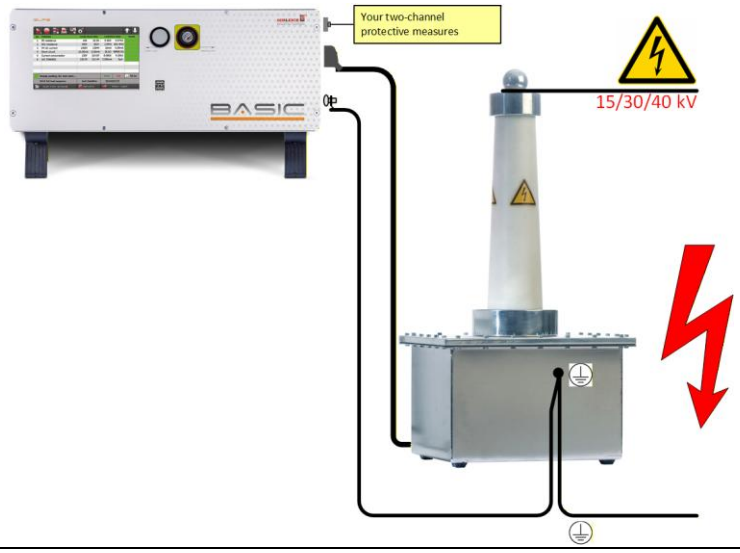
Fig.	Illustration	Annotations
1		Protective earth resistance test between measuring points **PE_1** and **PE_2**. The illustration is for visualization purposes only. Depending on the configuration, the test device may have a wider housing, but the principle remains the same. The start is initiated via the button on the front of the device or via a command sent through the communication interface.
2		Insulation resistance test between the measuring points **IR-** and **IR+**. The illustration is for visualization purposes only. Depending on the configuration, the test device may have a wider housing, but the principle remains the same. The start is initiated via the button on the front of the device or via a command sent through the communication interface.
3		High voltage test between measuring points **$HVAC_1$** and **$HVAC_2$**. The test is started using a button on the front of the device or a foot-switch. The illustration is for visualization purposes only. Depending on the configuration, the test device may have a wider housing, but the principle remains the same.

Fig.	Illustration	Annotations
4		Continuity test to determine resistance between different connections via **PE_1** and **PE_2**. The start is initiated via the button on the front of the device or via a command sent through the communication interface.
5		High voltage test between measuring points **$HVAC_1$** and **$HVAC_2$**. The test is started using a button on the front of the device or via the test pistol. For this purpose, the test pistol has a built-in push button which moves a few millimeters into the test pistol when pressed, thereby triggering the start.  The illustration is for visualization purposes only. Depending on the configuration, the test device may have a wider housing, but the principle remains the same.
6		High voltage test between measuring points **$HVAC_1$** and **$HVAC_2$**. The test is started using a button on the front of the device or a foot-switch. The illustration is for visualization purposes only. Depending on the configuration, the test device may have a wider housing, but the principle remains the same.

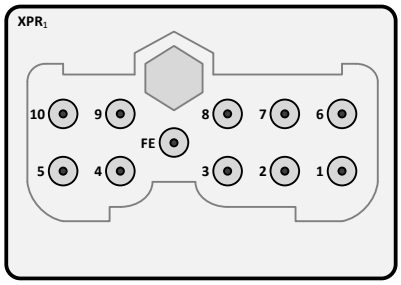
Variants										
Test methods								**Technical Data**	**Measurement paths**	
							HV			
							360	HVAC 15 kV / 50 mA	GND connection ↔	Tube ball[*1]
							370	HVAC 30 kV / 30 mA	GND connection ↔	Tube ball[*2]
							380	HVAC 50 kV / 25 mA	GND connection ↔	Tube ball[*3]

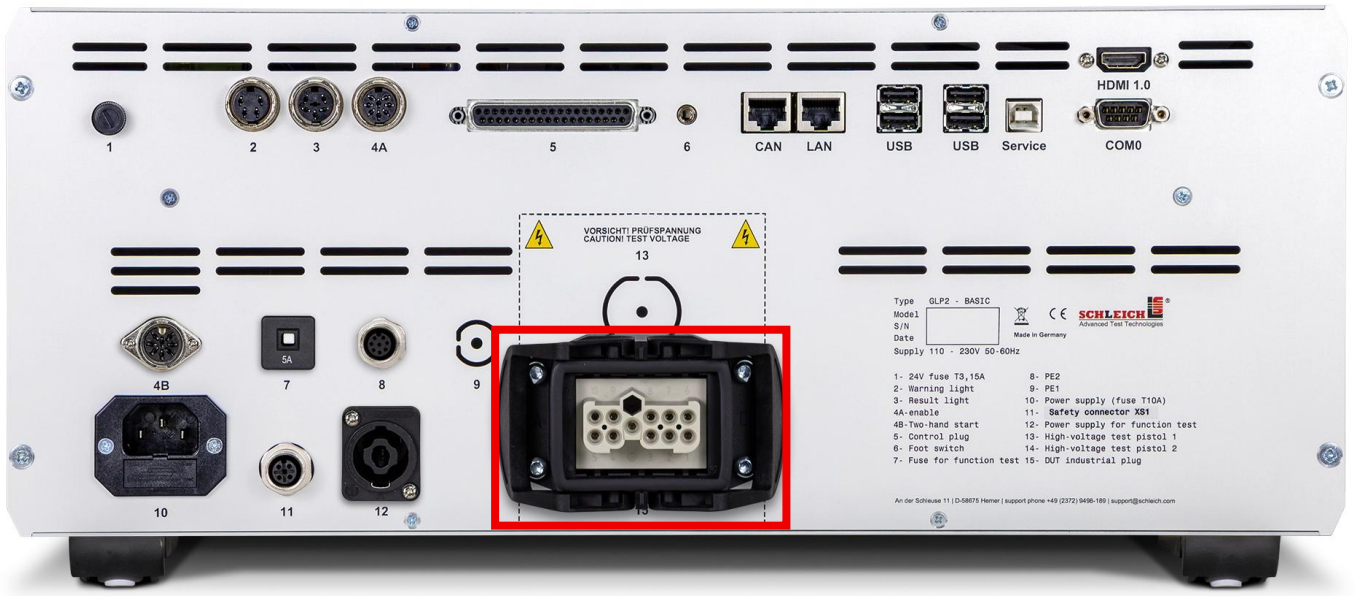
HVAC = High voltage test with alternating current (AC)

[*1]) Additional high-voltage transformer: ca. 20 kg, 225 x 265 x 198 mm (W x D x H) + tube: 150 mm (H)
[*2]) Additional high-voltage transformer: ca. 25 kg, 250 x 300 x 250 mm (W x D x H) + tube: 195 mm (H)
[*3]) Additional high-voltage transformer: ca. 45 kg, 300 x 300 x 400 mm (W x D x H) + tube: 400 mm (H)

Fig.	Illustration	Annotations
HV transformer with connection tube		High voltage test via external high-voltage transformer with connection tube

Test concepts:
- Connection box
- Automation
- Test cover





Test device variants	Tests	#15 | Industrial connector - Connection pins											Fig.
		1	2	3	4	5	6	7	8	9	10	FE	
320, 330	HVAC	$HVAC_1$	$Interlock_1$*	-	$HVAC_2$	-	$HVAC_1$	$Interlock_2$*	-	-	-	nc	8
440	HVDC	HVDC+	$Interlock_1$*	-	HVDC-	-	-	$Interlock_2$*	-	-	-	nc	9
530	HVAC	$HVAC_1$	$Interlock_1$*	-	$HVAC_2$	-	-	$Interlock_2$*	-	-	-	nc	9
	HVDC	HVDC+	"	-	HVDC-	-	-	"	-	-	-	"	10
820	IR	IR+	$Interlock_1$*	-	IR-	-	-	$Interlock_2$*	-	-	-	nc	2b
	HVDC	HVDC+	"		HVDC-	-	-	"	-	-	-	"	10
920, 930, 940	IR	IR+	$Interlock_1$*	-	IR-	-	-	$Interlock_2$*	-	-	-	nc	2b
	HVAC	$HVAC_1$	"	-	$HVAC_2$	-	-	"	-	-	-	"	8
	HVDC	HVDC+	"	-	HVDC-	-	-	"	-	-	-	"	10
1030, 1040	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	PE_1 sense	PE_2 sense	nc	1
	IR L/N – PE1/PE2	IR+	"	$Start_1$	IR-	IR-	IR+	"	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	"	$Start_1$	IR-	-	IR+	"	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	"	$Start_1$	-	IR-	IR+	"	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	"	$Start_1$	IR-	IR+	-	"	$Start_2$	-	-	"	2d
	IR L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	2e
	HVAC	$HVAC_1$	"	-	$HVAC_2$	-	-	"	-	-	-	"	8
	CONT L/N – PE1/PE2	CONT+	"	$Start_1$	CONT-	CONT-	CONT+	"	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	"	$Start_1$	CONT-	-	CONT+	"	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	"	$Start_1$	-	CONT-	CONT+	"	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	"	$Start_1$	CONT-	CONT+	-	"	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	"	$Start_1$	-	-	CONT-	"	$Start_2$	-	-	"	3e

1130	PE	-	Interlock$_1$*	Start$_1$	PE$_1$	PE$_2$	-	Interlock$_2$*	Start$_2$	PE$_{1\ sense}$	PE$_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	“	Start$_1$	IR-	IR-	IR+	“	Start$_2$	-	-	“	2a
	IR L/N – PE1	IR+	“	Start$_1$	IR-	-	IR+	“	Start$_2$	-	-	“	2b
	IR L/N – PE2(Tip)	IR+	“	Start$_1$	-	IR-	IR+	“	Start$_2$	-	-	“	2c
	IR PE1 – PE2(Tip)	-	“	Start$_1$	IR-	IR+	-	“	Start$_2$	-	-	“	2d
	IR L – N	IR+	“	Start$_1$	-	-	IR-	“	Start$_2$	-	-	“	2e
	HVDC	HVDC$_1$	“	-	HVDC-	-	-	“	-	-	-	“	10
	CONT L/N – PE1/PE2	CNT+	“	Start$_1$	CONT-	CONT-	CONT+	“	Start$_2$	-	-	“	3a
	CONT L/N – PE1	CONT+	“	Start$_1$	CONT-	-	CONT+	“	Start$_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+	“	Start$_1$	-	CONT-	CONT+	“	Start$_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-	“	Start$_1$	CONT-	CONT+	-	“	Start$_2$	-	-	“	3d
	CONT L – N	CONT+	“	Start$_1$	-	-	CONT-	“	Start$_2$	-	-	“	3e
1220, 1230, 1240	PE	-	Interlock$_1$*	Start$_1$	PE$_1$	PE$_2$	-	Interlock$_2$*	Start$_2$	PE$_{1\ sense}$	PE$_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	“	Start$_1$	IR-	IR-	IR+	“	Start$_2$	-	-	“	2a
	IR L/N – PE1	IR+	“	Start$_1$	IR-	-	IR+	“	Start$_2$	-	-	“	2b
	IR L/N – PE2(Tip)	IR+	“	Start$_1$	-	IR-	IR+	“	Start$_2$	-	-	“	2c
	IR PE1 – PE2(Tip)	-	“	Start$_1$	IR-	IR+	-	“	Start$_2$	-	-	“	2d
	IR L – N	IR+	“	Start$_1$	-	-	IR-	“	Start$_2$	-	-	“	2e
	HVAC	HVAC$_1$	“	-	HVAC$_2$	-	-	“	-	-	-	“	8
	HVDC	HVDC+	“	-	HVDC-	-	-	“	-	-	-	“	10
	CONT L/N – PE1/PE2	CONT+	“	Start$_1$	CONT-	CONT-	CONT+	“	Start$_2$	-	-	“	3a
	CONT L/N – PE1	CONT+	“	Start$_1$	CONT-	-	CONT+	“	Start$_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+	“	Start$_1$	-	CONT-	CONT	“	Start$_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-	“	Start$_1$	CONT-	CONT+	-	“	Start$_2$	-	-	“	3d
	CONT L – N	CONT+	“	Start$_1$	-	-	CONT-	“	Start$_2$	-	-	“	3e
1320	PE	-	-	Start$_1$	PE$_1$	PE$_2$	-	-	Start$_2$	PE$_{1\ sense}$	PE$_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	-	Start$_1$	IR-	IR-	IR+	-	Start$_2$	-	-	“	2a
	IR L/N – PE1	IR+	-	Start$_1$	IR-	-	IR+	-	Start$_2$	-	-	“	2b
	IR L/N – PE2(Tip)	IR+	-	Start$_1$	-	IR-	IR+	-	Start$_2$	-	-	“	2c
	IR PE1 – PE2(Tip)	-	-	Start$_1$	IR-	IR+	-	-	Start$_2$	-	-	“	2d
	IR L – N	IR+	-	Start$_1$	-	-	IR-	-	Start$_2$	-	-	“	2e
	IR warm L – PE1	L IR+	-	-	IR-	-	N	-	-	-	-	“	11a
	IR warm N – PE1	L	-	-	IR-	-	N IR+	-	-	-	-	“	11b
	CONT L/N – PE1/PE2	CONT+	-	Start$_1$	CONT-	CONT-	CONT+	-	Start$_2$	-	-	“	3a
	CONT L/N – PE1	CONT+	-	Start$_1$	CONT-	-	CONT+	-	Start$_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+	-	Start$_1$	-	CONT-	CONT+	-	Start$_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-	-	Start$_1$	CONT-	CONT+	-	-	Start$_2$	-	-	“	3d
	CONT L – N	CONT+	-	Start$_1$	-	-	CONT-	-	Start$_2$	-	-	“	3e
	Fct(5 A)	L	-	-	-	-	N	-	-	-	-	“	6
1322	PE	-		Start$_1$	PE$_1$	PE$_2$	-	-	Start$_2$	PE$_{1\ sense}$	PE$_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+		Start$_1$	IR-	IR-	IR+	-	Start$_2$	-	-	“	2a
	IR L/N – PE1	IR+		Start$_1$	IR-	-	IR+	-	Start$_2$	-	-	“	2b
	IR L/N – PE2(Tip)	IR+		Start$_1$	-	IR-	IR+	-	Start$_2$	-	-	“	2c
	IR PE1 – PE2(Tip)	-		Start$_1$	IR-	IR+	-	-	Start$_2$	-	-	“	2d
	IR L – N	IR+		Start$_1$	-	-	IR-	-	Start$_2$	-	-	“	2e
	IR warm L – PE1	L IR+		-	IR-	-	N	-	-	-	-	“	11a
	IR warm N – PE1	L		-	IR-	-	N IR+	-	-	-	-	“	11b
	CONT L/N – PE1/PE2	CONT+		Start$_1$	CONT-	CONT-	CONT+	-	Start$_2$	-	-	“	3a
	CONT L/N – PE1	CONT+		Start$_1$	CONT-	-	CONT+	-	Start$_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+		Start$_1$	-	CONT-	CONT+	-	Start$_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-		Start$_1$	CONT-	CONT+	-	-	Start$_2$	-	-	“	3d
	CONT L – N	CONT+		Start$_1$	-	-	CONT-	-	Start$_2$	-	-	“	3e
	Fct(5 A)	L		-	-	-	N	-	-	-	-	“	6
	Fkt DC	DC+	DC+	-	-	-	DC-	DC-	-	-	-	“	7
1330	PE	-	-	Start$_1$	PE$_1$	PE$_2$	-	-	Start$_2$	PE$_{1\ sense}$	PE$_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	-	Start$_1$	IR-	IR-	IR+	-	Start$_2$	-	-	“	2a
	IR L/N – PE1	IR+	-	Start$_1$	IR-	-	IR+	-	Start$_2$	-	-	“	2b
	IR L/N – PE2(Tip)	IR+	-	Start$_1$	-	IR-	IR+	-	Start$_2$	-	-	“	2c
	IR PE1 – PE2(Tip)	-	-	Start$_1$	IR-	IR+	-	-	Start$_2$	-	-	“	2d
	IR L – N	IR+	-	Start$_1$	-	-	IR-	-	Start$_2$	-	-	“	2e
	CONT L/N – PE1/PE2	CONT+	-	Start$_1$	CONT-	CONT-	CONT+	-	Start$_2$	-	-	“	3a
	CONT L/N – PE1	CONT+	-	Start$_1$	CONT-	-	CONT+	-	Start$_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+	-	Start$_1$	-	CONT-	CONT+	-	Start$_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-	-	Start$_1$	CONT-	CONT+	-	-	Start$_2$	-	-	“	3d
	CONT L – N	CONT+	-	Start$_1$	-	-	CONT-	-	Start$_2$	-	-	“	3e
	Fct(16 A)	L	-	-	-	-	N	-	-	-	-	“	6

1420	PE	-	-	$Start_1$	PE_1	PE_2	-	-	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	-	$Start_1$	IR-	IR-	IR+	-	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	-	$Start_1$	IR-	-	IR+	-	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	-	$Start_1$	-	IR-	IR+	-	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	-	$Start_1$	IR-	IR+	-	-	$Start_2$	-	-	"	2d
	IR L – N	IR+	-	$Start_1$	-	-	IR-	-	$Start_2$	-	-	"	2e
	IR warm L – PE1	L IR+	-	-	IR-	-	N	-	-	-	-	"	11a
	IR warm N – PE1	L	-	-	IR-	-	N IR+	-	-	-	-	"	11b
	CONT L/N – PE1/PE2	CONT+	-	$Start_1$	CONT-	CONT-	CONT+	-	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	-	$Start_1$	CONT-	-	CONT+	-	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	-	$Start_1$	-	CONT-	CONT+	-	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	-	$Start_1$	CONT-	CONT+	-	-	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	-	$Start_1$	-	-	CONT-	-	$Start_2$	-	-	"	3e
	Fct(5 A)	L	-	-	-	-	N	-	-	-	-	"	6
	LC fixed connection	L	-	-	PE_1	-	N	-	-	-	-	"	5a
	LC tip	L	-	-	-	PE_2	N	-	-	-	-	"	5b
1430	PE	-	-	$Start_1$	PE_1	PE_2	-	-	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	-	$Start_1$	IR-	IR-	IR+	-	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	-	$Start_1$	IR-	-	IR+	-	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	-	$Start_1$	-	IR-	IR+	-	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	-	$Start_1$	IR-	IR+	-	-	$Start_2$	-	-	"	2d
	IR L – N	IR+	-	$Start_1$	-	-	IR-	-	$Start_2$	-	-	"	2e
	CONT L/N – PE1/PE2	CONT+	-	$Start_1$	CONT-	CONT-	CONT+	-	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	-	$Start_1$	CONT-	-	CONT+	-	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	-	$Start_1$	-	CONT-	CONT+	-	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	-	$Start_1$	CONT-	CONT+	-	-	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	-	$Start_1$	-	-	CONT-	-	$Start_2$	-	-	"	3e
	Fct(16 A)	L	-	-	-	-	N	-	-	-	-	"	6
	Sub L/N – PE1/PE2	Sub_1	-	$Start_1$	Sub_2	Sub_2	Sub_1	-	$Start_2$	-	-	"	4a
	Sub L/N – PE1	Sub_1	-	$Start_1$	Sub_2	-	Sub_1	-	$Start_2$	-	-	"	4b
	Sub L/N – PE2(Tip)	Sub_1	-	$Start_1$	-	Sub_2	Sub_1	-	$Start_2$	-	-	"	4c
	Sub PE1 – PE2(Tip)	-	-	$Start_1$	Sub_2	Sub_1	-	-	$Start_2$	-	-	"	4d
	Sub L – N	IR+	-	$Start_1$	-	-	IR-	-	$Start_2$	-	-	"	4e
1520, 1530	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	"	$Start_1$	IR-	IR-	IR+	"	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	"	$Start_1$	IR-	-	IR+	"	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	"	$Start_1$	-	IR-	IR+	"	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	"	$Start_1$	IR-	IR+	-	"	$Start_2$	-	-	"	2d
	IR L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	2e
	IR warm L – PE1	L IR+	"	-	IR-	-	N	"	-	-	-	"	11a
	IR warm N – PE1	L	"	-	IR-	-	N IR+	"	-	-	-	"	11b
	HVAC	$HVAC_1$	"	-	$HVAC_2$	-	-	"	-	-	-	"	8
	CONT L/N – PE1/PE2	CONT+	"	$Start_1$	CONT-	CONT-	CONT+	"	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	"	$Start_1$	CONT-	-	CONT+	"	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	"	$Start_1$	-	CONT-	CONT	"	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	"	$Start_1$	CONT-	CONT+	-	"	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	"	$Start_1$	-	-	CONT-	"	$Start_2$	-	-	"	3e
	Fct(5 A)	L	"	-	-	-	N	"	-	-	-	"	6
1540, 1550	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	"	$Start_1$	IR-	IR-	IR+	"	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	"	$Start_1$	IR-	-	IR+	"	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	"	$Start_1$	-	IR-	IR+	"	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	"	$Start_1$	IR-	IR+	-	"	$Start_2$	-	-	"	2d
	IR L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	2e
	HVAC	$HVAC_1$	"	-	$HVAC_2$	-	-	"	-	-	-	"	8
	CONT L/N – PE1/PE2	CONT+	"	$Start_1$	CONT-	CONT-	CONT+	"	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	"	$Start_1$	CONT-	-	CONT+	"	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	"	$Start_1$	-	CONT-	CONT+	"	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	"	$Start_1$	CONT-	CONT+	-	"	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	"	$Start_1$	-	-	CONT-	"	$Start_2$	-	-	"	3e
	Fct(16 A)	L	"	-	-	-	N	"	-	-	-	"	6
1620, 1630	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	"	$Start_1$	IR-	IR-	IR+	"	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	"	$Start_1$	IR-	-	IR+	"	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	"	$Start_1$	-	IR-	IR+	"	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	"	$Start_1$	IR-	IR+	-	"	$Start_2$	-	-	"	2d
	IR L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	2e

	IR warm L – PE1	L IR+	"	-	IR-	-	N	"	-	-	-	"	11a
	IR warm N – PE1	L	"	-	IR-	-	N IR+	"	-	-	-	"	11b
	HVAC	$HVAC_1$	"	-	$HVAC_2$	-	-	"	-	-	-	"	8
	CONT L/N – PE1/PE2	CONT+	"	$Start_1$	CONT-	CONT-	CONT+	"	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	"	$Start_1$	CONT-	-	CONT+	"	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	"	$Start_1$	-	CONT-	CONT+	"	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	"	$Start_1$	CONT-	CONT+	-	"	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	"	$Start_1$	-	-	CONT-	"	$Start_2$	-	-	"	3e
	Fct(5 A)	L	"	-	-	-	N	"	-	-	-	"	6
	LC fixed connection	L	"	-	PE_1	-	N	"	-	-	-	"	5a
	LC tip	L	"	-	-	PE_2	N	"	-	-	-	"	5b
1640	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
1650	IR L/N – PE1/PE2	IR+	"	$Start_1$	IR-	IR-	IR+	"	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	"	$Start_1$	IR-	-	IR+	"	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	"	$Start_1$	-	IR-	IR+	"	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	"	$Start_1$	IR-	IR+	-	"	$Start_2$	-	-	"	2d
	IR L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	2e
	HVAC	$HVAC_1$	"	-	$HVAC_2$	-	-	"	-	-	-	"	8
	CONT L/N – PE1/PE2	CONT+	"	$Start_1$	CONT-	CONT-	CONT+	"	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	"	$Start_1$	CONT-	-	CONT+	"	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	"	$Start_1$	-	CONT-	CONT+	"	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	"	$Start_1$	CONT-	CONT+	-	"	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	"	$Start_1$	-	-	CONT-	"	$Start_2$	-	-	"	3e
	Fct(16 A)	L	"	-	-	-	N	"	-	-	-	"	6
	Sub L/N – PE1/PE2	Sub_1	"	$Start_1$	Sub_2	Sub_2	Sub_1	"	$Start_2$	-	-	"	4a
	Sub L/N – PE1	Sub_1	"	$Start_1$	Sub_2	-	Sub_1	"	$Start_2$	-	-	"	4b
	Sub L/N – PE2(Tip)	Sub_1	"	$Start_1$	-	Sub_2	Sub_1	"	$Start_2$	-	-	"	4c
	Sub PE1 – PE2(Tip)	-	"	$Start_1$	Sub_2	Sub_1	-	"	$Start_2$	-	-	"	4d
	Sub L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	4e
1720	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	"	$Start_1$	IR-	IR-	IR+	"	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	"	$Start_1$	IR-	-	IR+	"	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	"	$Start_1$	-	IR-	IR+	"	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	"	$Start_1$	IR-	IR+	-	"	$Start_2$	-	-	"	2d
	IR L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	2e
	IR warm L – PE1	L IR+	"	-	IR-	-	N	"	-	-	-	"	11a
	IR warm N – PE1	L	"	-	IR-	-	N IR+	"	-	-	-	"	11b
	HVDC	HVDC+	"	-	HVDC-	-	$HVAC_1$	"	-	-	-	"	10
	CONT L/N – PE1/PE2	CONT+	"	$Start_1$	CONT-	CONT-	CONT+	"	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	"	$Start_1$	CONT-	-	CONT+	"	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	"	$Start_1$	-	CONT-	CONT	"	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	"	$Start_1$	CONT-	CONT+	-	"	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	"	$Start_1$	-	-	CONT-	"	$Start_2$	-	-	"	3e
	Fct(5 A)	L	"	-	-	-	N	"	-	-	-	"	6
1740	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	"	$Start_1$	IR-	IR-	IR+	"	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	"	$Start_1$	IR-	-	IR+	"	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	"	$Start_1$	-	IR-	IR+	"	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	"	$Start_1$	IR-	IR+	-	"	$Start_2$	-	-	"	2d
	IR L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	2e
	HVDC	HVDC+	"	-	HVDC-	-	$HVAC_1$	"	-	-	-	"	10
	CONT L/N – PE1/PE2	CONT+	"	$Start_1$	CONT-	CONT-	CONT+	"	$Start_2$	-	-	"	3a
	CONT L/N – PE1	CONT+	"	$Start_1$	CONT-	-	CONT+	"	$Start_2$	-	-	"	3b
	CONT L/N – PE2(Tip)	CONT+	"	$Start_1$	-	CONT-	CONT+	"	$Start_2$	-	-	"	3c
	CONT PE1 - PE2(Tip)	-	"	$Start_1$	CONT-	CONT+	-	"	$Start_2$	-	-	"	3d
	CONT L – N	CONT+	"	$Start_1$	-	-	CONT-	"	$Start_2$	-	-	"	3e
	Fct(16 A)	L	"	-	-	-	N	"	-	-	-	"	6
1820	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	"	$Start_1$	IR-	IR-	IR+	"	$Start_2$	-	-	"	2a
	IR L/N – PE1	IR+	"	$Start_1$	IR-	-	IR+	"	$Start_2$	-	-	"	2b
	IR L/N – PE2(Tip)	IR+	"	$Start_1$	-	IR-	IR+	"	$Start_2$	-	-	"	2c
	IR PE1 – PE2(Tip)	-	"	$Start_1$	IR-	IR+	-	"	$Start_2$	-	-	"	2d
	IR L – N	IR+	"	$Start_1$	-	-	IR-	"	$Start_2$	-	-	"	2e
	IR warm L – PE1	L IR+	"	-	IR-	-	N	"	-	-	-	"	11a
	IR warm N – PE1	L	"	-	IR-	-	N IR+	"	-	-	-	"	11b
	HVDC	HVDC+	"	-	HVDC-	-	$HVAC_1$	"	-	-	-	"	10
	CONT L/N – PE1/PE2	CONT+	"	$Start_1$	CONT-	CONT-	CONT+	"	$Start_2$	-	-	"	3a

	CONT L/N – PE1	CONT+	“	$Start_1$	CONT-	-	CONT+	“	$Start_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+	“	$Start_1$	-	CONT-	CONT+	“	$Start_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-	“	$Start_1$	CONT-	CONT+	-	“	$Start_2$	-	-	“	3d
	CONT L – N	CONT+	“	$Start_1$	-	-	CONT-	“	$Start_2$	-	-	“	3e
	Fct(5 A)	L	“	-	-	-	N	“	-	-	-	“	6
	LC fixed connection	L	“	-	PE_1	-	N	“	-	-	-	“	5a
	LC tip	L	“	-	-	PE_2	N	“	-	-	-	“	5b
1840	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	“	$Start_1$	IR-	IR-	IR+	“	$Start_2$	-	-	“	2a
	IR L/N – PE1	IR+	“	$Start_1$	IR-	-	IR+	“	$Start_2$	-	-	“	2b
	IR L/N – PE2(Tip)	IR+	“	$Start_1$	-	IR-	IR+	“	$Start_2$	-	-	“	2c
	IR PE1 – PE2(Tip)	-	“	$Start_1$	IR-	IR+	-	“	$Start_2$	-	-	“	2d
	IR L – N	IR+	“	$Start_1$	-	-	IR-	“	$Start_2$	-	-	“	2e
	CONT L/N – PE1/PE2	CONT+	“	$Start_1$	CONT-	CONT-	CONT+	“	$Start_2$	-	-	“	3a
	CONT L/N – PE1	CONT+	“	$Start_1$	CONT-	-	CONT+	“	$Start_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+	“	$Start_1$	-	CONT-	CONT+	“	$Start_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-	“	$Start_1$	CONT-	CONT+	-	“	$Start_2$	-	-	“	3d
	CONT L – N	CONT+	“	$Start_1$	-	-	CONT-	“	$Start_2$	-	-	“	3e
	HVDC	HVDC+	“	$Start_1$	HVDC-	-	$HVAC_1$	“	$Start_2$	-	-	“	10
	Fct(16 A)	L	“	-	-	-	N	“	-	-	-	“	6
	Sub L/N – PE1/PE2	Sub_1	“	$Start_1$	Sub_2	Sub_2	Sub_1	“	$Start_2$	-	-	“	4a
	Sub L/N – PE1	Sub_1	“	$Start_1$	Sub_2	-	Sub_1	“	$Start_2$	-	-	“	4b
	Sub L/N – PE2(Tip)	Sub_1	“	$Start_1$	-	Sub_2	Sub_1	“	$Start_2$	-	-	“	4c
	Sub PE1 – PE2(Tip)	-	“	$Start_1$	Sub_2	Sub_1	-	“	$Start_2$	-	-	“	4d
	Sub L – N	IR+	“	$Start_1$	-	-	IR-	“	$Start_2$	-	-	“	4e
1930	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	“	$Start_1$	IR-	IR-	IR+	“	$Start_2$	-	-	“	2a
	IR L/N – PE1	IR+	“	$Start_1$	IR-	-	IR+	“	$Start_2$	-	-	“	2b
	IR L/N – PE2(Tip)	IR+	“	$Start_1$	-	IR-	IR+	“	$Start_2$	-	-	“	2c
	IR PE1 – PE2(Tip)	-	“	$Start_1$	IR-	IR+	-	“	$Start_2$	-	-	“	2d
	IR L – N	IR+	“	$Start_1$	-	-	IR-	“	$Start_2$	-	-	“	2e
	IR warm L – PE1	L IR+	“	-	IR-	-	N	“	-	-	-	“	11a
	IR warm N – PE1	L	“	-	IR-	-	N IR+	“	-	-	-	“	11b
	HVAC	$HVAC_1$	“	-	$VHAC_2$	-	-	“	-	-	-	“	8
	HVDC	HVDC+	“	-	HVDC-	-	$HVAC_1$	“	-	-	-	“	10
	CONT L/N – PE1/PE2	CONT+	“	$Start_1$	CONT-	CONT-	CONT+	“	$Start_2$	-	-	“	3a
	CONT L/N – PE1	CONT+	“	$Start_1$	CONT-	-	CONT+	“	$Start_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+	“	$Start_1$	-	CONT-	CONT+	“	$Start_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-	“	$Start_1$	CONT-	CONT+	-	“	$Start_2$	-	-	“	3d
	CONT L – N	CONT+	“	$Start_1$	-	-	CONT-	“	$Start_2$	-	-	“	3e
	Fct(5 A)	L	“	-	-	-	N	“	-	-	-	“	6
	LC fixed connection	L	“	-	PE_1	-	N	“	-	-	-	“	5a
	LC tip	L	“	-	-	PE_2	N	“	-	-	-	“	5b
1940, 1950	PE	-	$Interlock_1$*	$Start_1$	PE_1	PE_2	-	$Interlock_2$*	$Start_2$	$PE_{1\ sense}$	$PE_{2\ sense}$	nc	1
	IR L/N – PE1/PE2	IR+	“	$Start_1$	IR-	IR-	IR+	“	$Start_2$	-	-	“	2a
	IR L/N – PE1	IR+	“	$Start_1$	IR-	-	IR+	“	$Start_2$	-	-	“	2b
	IR L/N – PE2(Tip)	IR+	“	$Start_1$	-	IR-	IR+	“	$Start_2$	-	-	“	2c
	IR PE1 – PE2(Tip)	-	“	$Start_1$	IR-	IR+	-	“	$Start_2$	-	-	“	2d
	IR L – N	IR+	“	$Start_1$	-	-	IR-	“	$Start_2$	-	-	“	2e
	CONT L/N – PE1/PE2	CONT+	“	$Start_1$	CONT-	CONT-	CONT+	“	$Start_2$	-	-	“	3a
	CONT L/N – PE1	CONT+	“	$Start_1$	CONT-	-	CONT+	“	$Start_2$	-	-	“	3b
	CONT L/N – PE2(Tip)	CONT+	“	$Start_1$	-	CONT-	CONT+	“	$Start_2$	-	-	“	3c
	CONT PE1 - PE2(Tip)	-	“	$Start_1$	CONT-	CONT+	-	“	$Start_2$	-	-	“	3d
	CONT L – N	CONT+	“	$Start_1$	-	-	CONT-	“	$Start_2$	-	-	“	3e
	HVAC	$HVAC_1$	“	-	$HVAC_2$	-	-	“	$Start_2$	-	-	“	8
	HVDC	HVDC+	“	-	HVDC-	-	$HVAC_1$	“	$Start_2$	-	-	“	10
	Fct(16 A)	L	“	-	-	-	N	“	-	-	-	“	6
	Sub L/N – PE1/PE2	Sub_1	“	$Start_1$	Sub_2	Sub_2	Sub_1	“	$Start_2$	-	-	“	4a
	Sub L/N – PE1	Sub_1	“	$Start_1$	Sub_2	-	Sub_1	“	$Start_2$	-	-	“	4b
	Sub L/N – PE2(Tip)	Sub_1	“	$Start_1$	-	Sub_2	Sub_1	“	$Start_2$	-	-	“	4c
	Sub PE1 – PE2(Tip)	-	“	$Start_1$	Sub_2	Sub_1	-	“	$Start_2$	-	-	“	4d
	Sub L – N	IR+	“	$Start_1$	-	-	IR-	“	$Start_2$	-	-	“	4e

* = $Interlock_1$ and $Interlock_2$. Bridge in industrial connector so that testing is only possible when the connector is plugged in. Every test device with HVAC or HVDC is equipped with an interlock. For these devices, Figure 0 must also be observed!

XPR = 10-pin industrial connector on the rear of the device

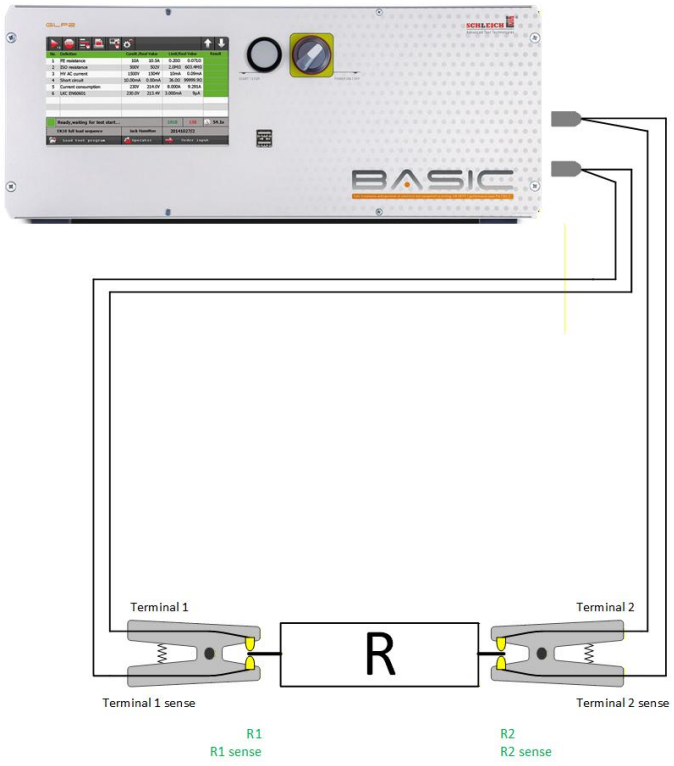
PE	= Protective earth resistance test
IR	= Insulation resistance test
IR warm	= Insulation resistance test during operation (for Fct with AC)
HVAC	= High-voltage test with alternating current (AC)
HVDC	= High-voltage test with direct current (DC)
CONT	= Continuity test (two-wire measurement)
Fct	= Function test (current consumption or power measurement)
Fct DC	= Function test DC (current consumption or power measurement)
LC	= Leakage current test EN 60990 and EN 60601
Sub	= Substitute leakage current test (alternative method)
$Start_1$	= Start button in a test tip for starting a PE or IR test
$Start_2$	= Start button in a test tip for starting a PE or IR test
nc	= not connected
FE	= Functional Earth (not used)

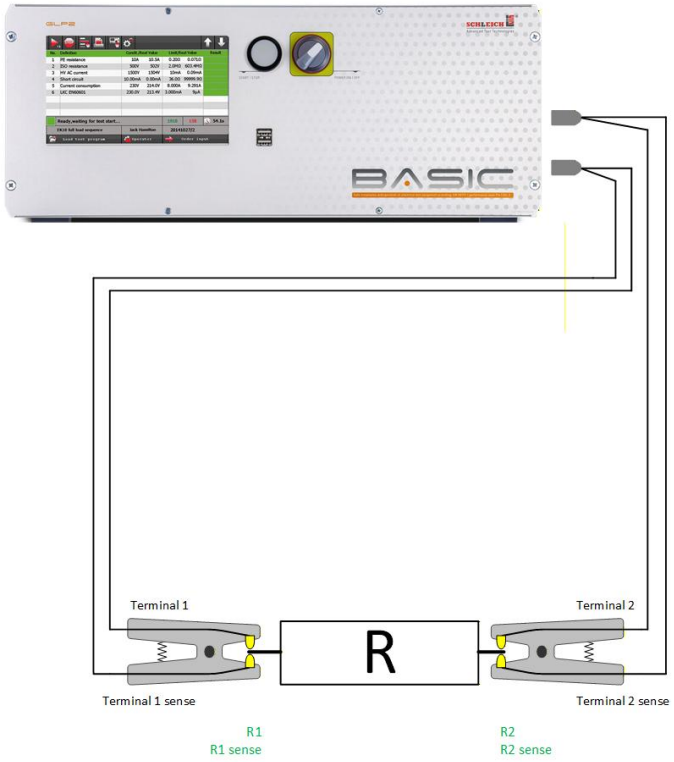
- Typical application: Manual test

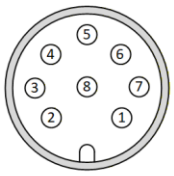
Variants											Fig.
Test methods						**R**	**R IR**	**Technical Data**	**Measurement paths**		
						2011			Test tip 1	↔ Test tip 2	12
							2031		Test tip 1	↔ Test tip 2	12 13

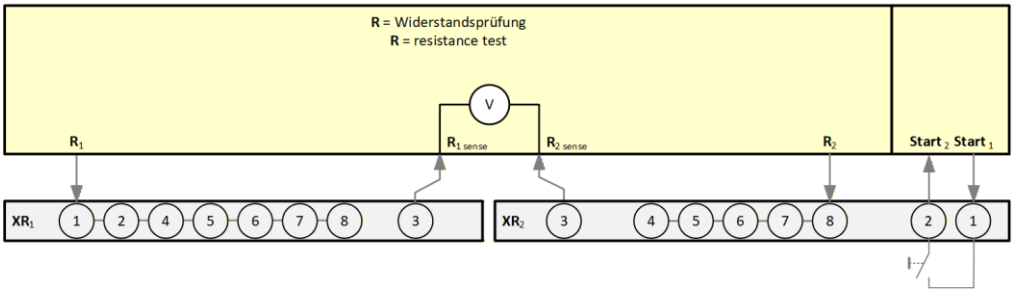
Test tip = Test tip for contacting housing parts for both protective earth conductor and insulation resistance testing

R = Resistance test (four-wire measurement)
IR = Insulation resistance test

Device	Illustration	Annotations
2011 2031		Resistance measurement between **R1** and **R2**. <u>Applies only to **R2**</u>: The start is initiated via the button on the front of the device or via a command sent through the communication interface.

Device	Illustration	Annotations
2031		Insulation resistance test between the measuring points **IR-** and **IR+**. The illustration is for visualization purposes only. Depending on the configuration, the test device may have a wider housing, but the principle remains the same. <u>Applies only to **R2**</u>: The start is initiated via the button on the front of the device or via a command sent through the communication interface.





R1				
Pin	I/O	Signal name	Logic	Function
1	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
2	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
3	In	R1-Sense	-	Sense line for measuring the voltage at the device under test. (Four-wire measurement)
4	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
5	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
6	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
7	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
8	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.

Plug type: M12, 8-pole

R2				
Pin	I/O	Signal name	Logic	Function
1	Out	Power_+24 V	+24 V	+ 24 V zur Spannungsversorgung des Starttasters.
2	In	Start	Impulse min. 50 ms	The test or test sequence is started by pressing the button.
3	In	R1-Sense	-	Sense line for measuring the voltage at the device under test. (4-wire measurement)
4	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
5	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
6	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
7	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.
8	Out	R1	-	Current output for connection to the device under test. All current connections must be connected in parallel.

Plug type: M12, 8-pole

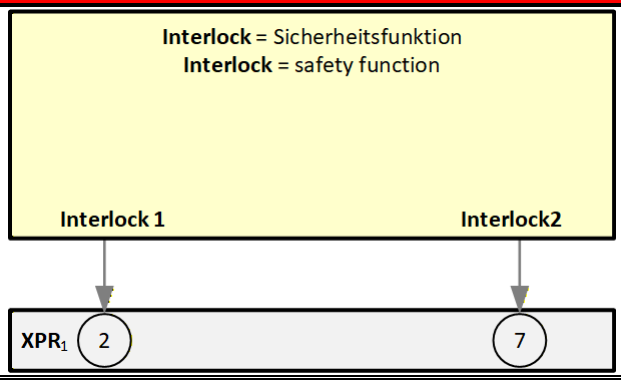
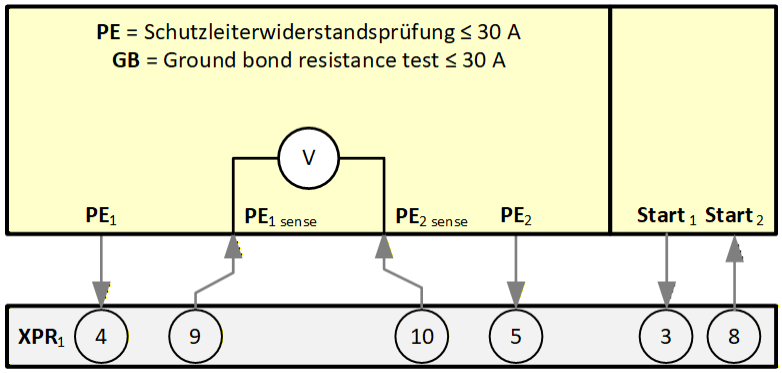
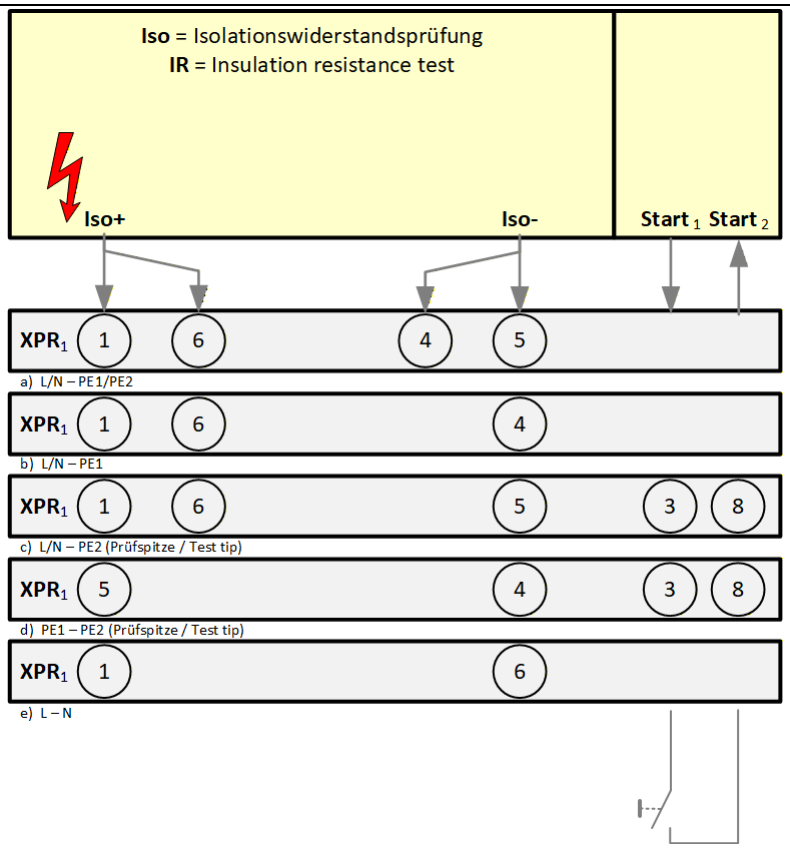
Fig.	Measurement paths	Annotations
0		Applies to all HVDC and HVAC test devices. Safety function for monitoring whether the XPR connector (#15) is plugged in. **No testing is possible without an interlock bridge**.
1		Protective earth resistance test between measuring points **PE₁** and **PE₂**. A start input for starting the test is also available at terminals 3 and 8. Alternatively, the device can be started using the button on the front of the device or via a command sent through the communication interface. As protective conductor resistances are very low (typically < 100 mΩ), the measurement must be carried out using four-wire technology. If you have any questions about the four-wire technology, please refer to the SCHLEICH test method handbook included in the scope of delivery.
2		Insulation resistance test between the measurement points **IR-** and **IR+**. A start input for starting the test is also available at terminals 3 and 8. Alternatively, the device can be started using the button on the front of the device or via a command sent through the communication interface.

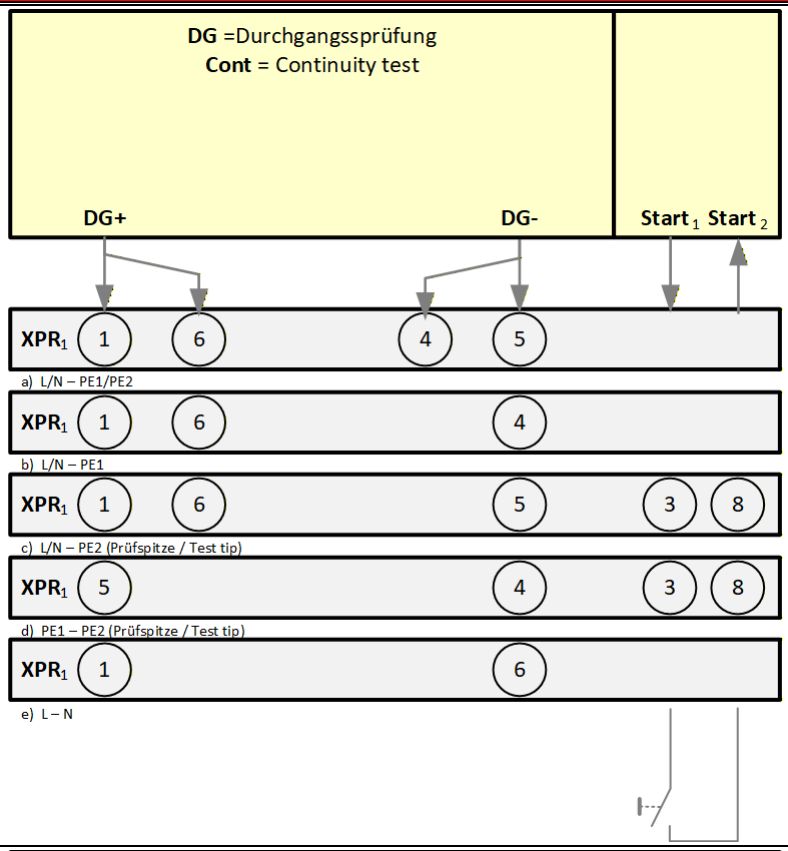
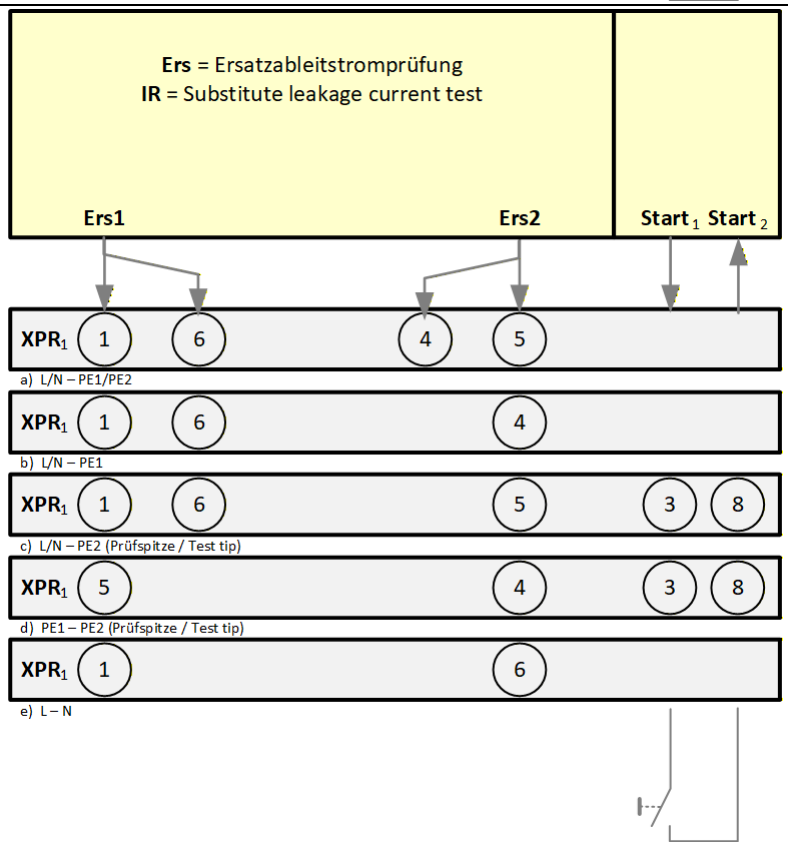
Fig.	Measurement paths	Annotations
3		Continuity test for determining the resistance between different connections. A start input for starting the test is also available at terminals 3 and 8. Alternatively, the device can be started using the button on the front of the device or via a command sent through the communication interface.
4		Substitute leakage current test between different test points with fixed connection or test tip. A start input for starting the test is also available at terminals 3 and 8. Alternatively, the device can be started using the button on the front of the device or via a command sent through the communication interface.

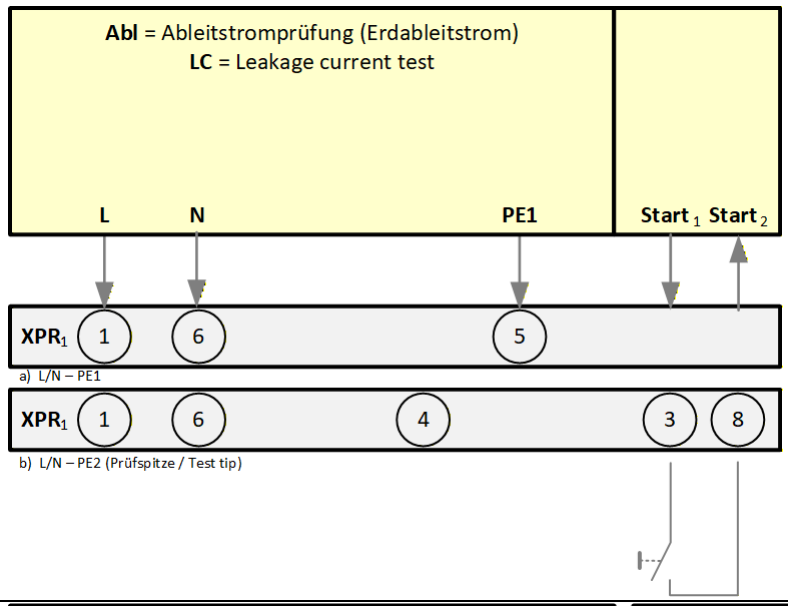
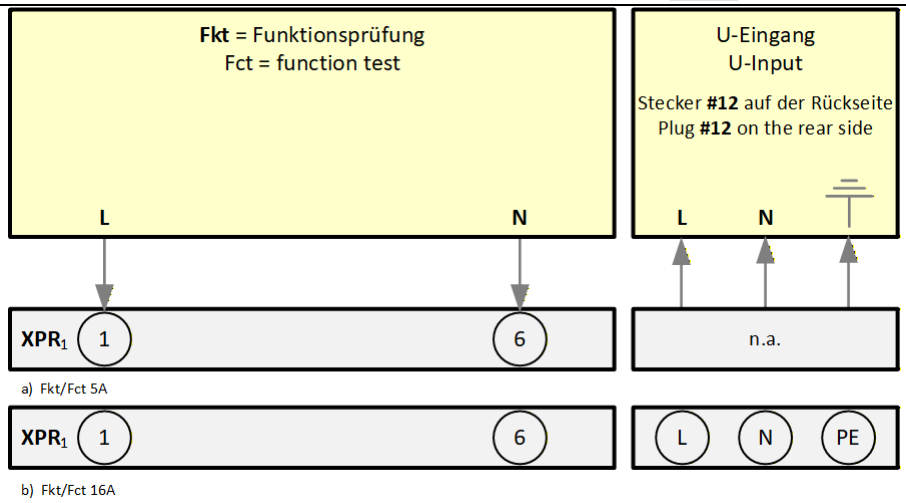
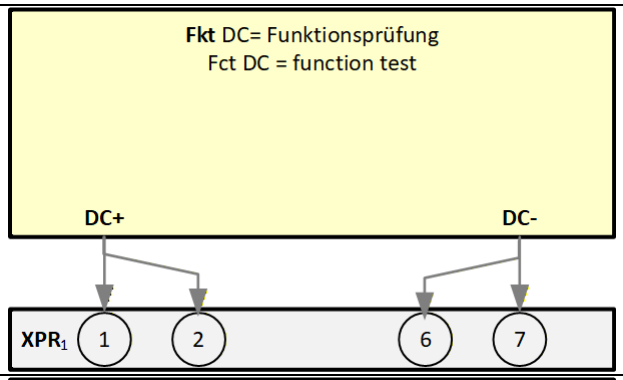
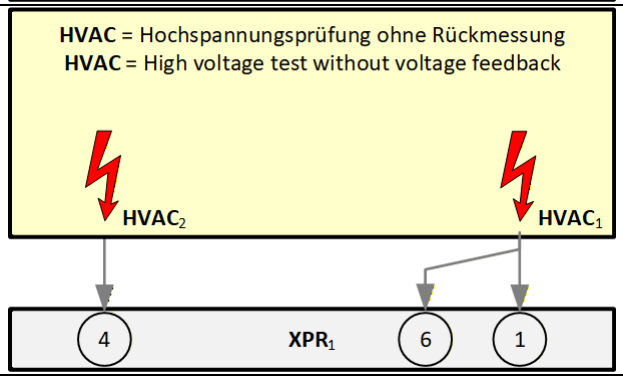
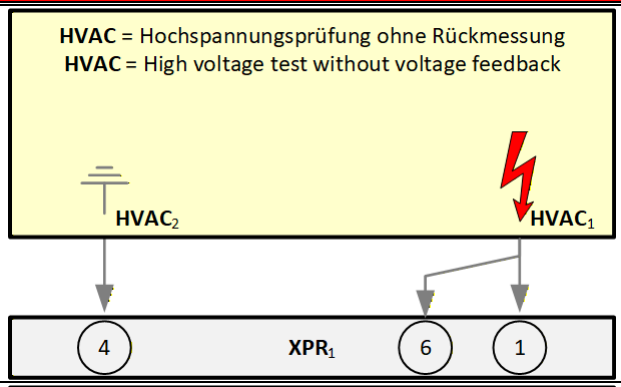
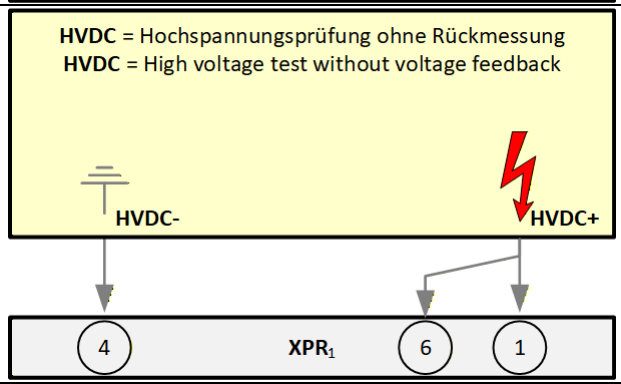
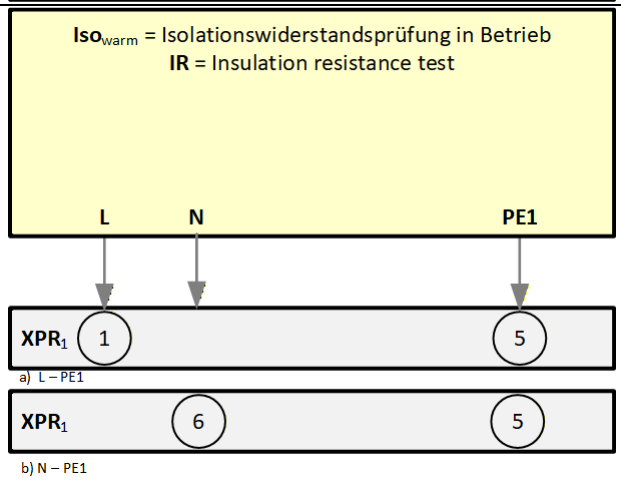
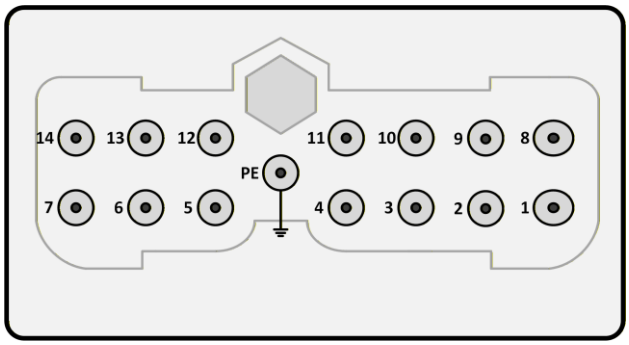
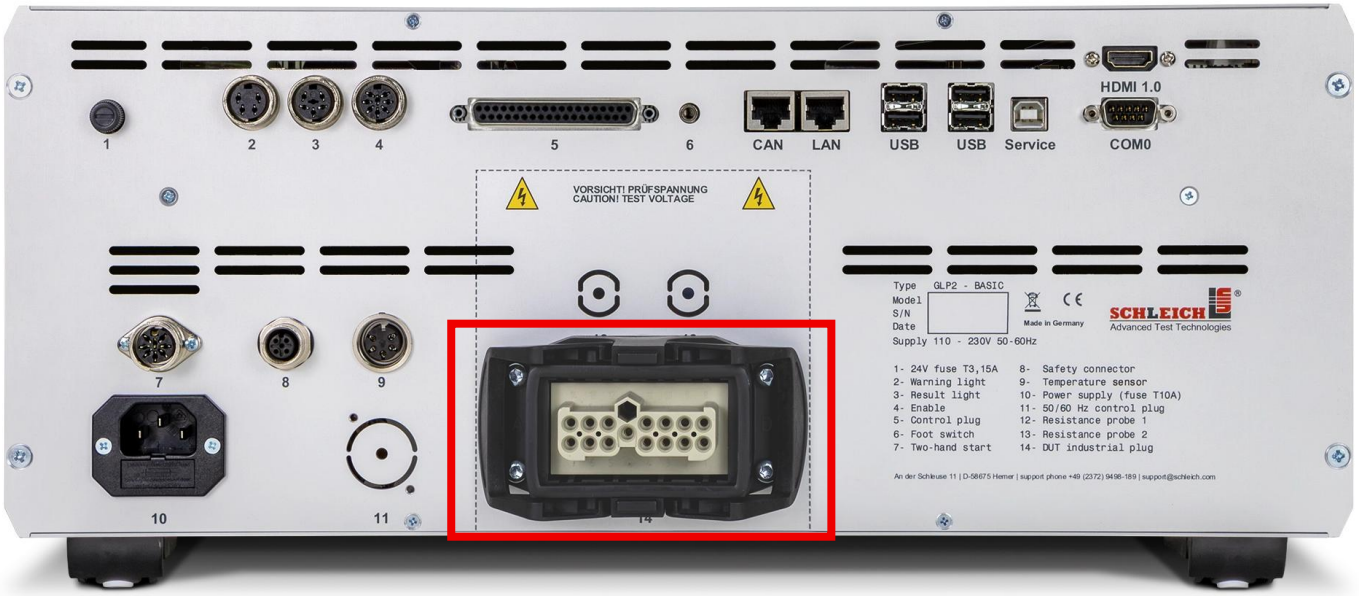
Fig.	Measurement paths	Annotations
5		Leakage current test between measuring points **L** or **N** against **PE1** (fixed connection) or **PE2** (test tip). A start input for starting the test is also available at terminals 3 and 8. Alternatively, the device can be started using the button on the front of the device or via a command sent through the communication interface.
6		Function test between measuring points **L** and **N**.
7		Function test between measuring points **DC+** and **DC-**.
8		High voltage test between measuring points **HVAC1** and **HVAC2**.

Fig.	Measurement paths	Annotations
9		High voltage test between measuring points **HVAC$_1$** and **HVAC$_2$**. Notice: Measuring point **HV2** is connected to earth.
10		High voltage test between measuring points **HVDC+** and **HVDC-**. Notice: Measuring point **HVDC-** is connected to earth.
11		Insulation resistance test between measuring points **IR-** and **IR+**. IR+ and IR- are connected as follows: **L → IR+** **N → IR+** **PE1 → IR-** Notice: The process runs in parallel with the function test.

Test concepts:
- Automation
- Test cover





Device variants		XPR1 | Industrial connector - Connection pins															Fig.
Tests		1	2	3	4	5	6	7	8	9	10	11	12	13	14	FE	
2010, 2030	R	-	-	$Start_1$		R_1	-	R_2		$R_{2\ sense}$	$Start_2$		$R_{1\ sense}$	-	-	nc	12
2110, 2130	R IR	- IR-	- -	$Start_1$ $Start_1$	$Interlock_1$* “	R_1 IR+	- -	R_2 IR+	IR-$_{sense}$	$R_{2\ sense}$ IR+$_{sense}$	$Start_2$ $Start_2$	$Interlock_2$* “	$R_{1\ sense}$ IR+$_{sense}$	- -	- -	nc “	12 13
2210, 2230	R IR HVAC	- IR- $HVAC_2$	- - -	$Start_1$ $Start_1$ -	$Interlock_1$* “ “	R_1 IR+ $HVAC_1$	- - -	R_2 IR+ $HVAC_1$	IR-$_{sense}$ $HVAC_{2\ sense}$	$R_{2\ sense}$ IR+$_{sense}$ $HVAC_{1\ sense}$	$Start_2$ $Start_2$ -	$Interlock_2$* “ “	$R_{1\ sense}$ IR+$_{sense}$ $HVAC_{1\ sense}$	- - -	- - -	nc “ “	12 13 14
2310, 2330	R IR HVDC	- IR- HVDC-	- - -	$Start_1$ $Start_1$ -	$Interlock_1$* “ “	R_1 IR+ HVDC+	- - -	R_2 IR+ HVDC+	IR-$_{sense}$ HVDC-$_{sense}$	$R_{2\ sense}$ IR+$_{sense}$ HVDC+ $_{sense}$	$Start_2$ $Start_2$ -	$Interlock_2$* “ “	$R_{1\ sense}$ IR+$_{sense}$ HVDC+$_{sense}$	- - -	- - -	nc “ “	12 13 15
2410, 2430	R IR HVDC HVAC	- IR- HVDC- $HVAC_2$	- - - -	$Start_1$ $Start_1$ - -	$Interlock_1$* “ “ “	R_1 IR+ HVDC+ $HVAC_1$	- - - -	R_2 IR+ HVDC+ $HVAC_1$	IR-$_{sense}$ HVDC-$_{sense}$ $HVAC_{2\ sense}$	$R_{2\ sense}$ IR+$_{sense}$ HVDC+ $_{sense}$ $HVAC_{1\ sense}$	$Start_2$ $Start_2$ - -	$Interlock_2$* “ “ “	$R_{1\ sense}$ IR+$_{sense}$ HVDC+$_{sense}$ $HVAC_{1\ sense}$	- - - -	- - - -	nc “ “ “	12 13 14 15

* = Interlock1 and Interlock2. Bridge in industrial connector so that testing is only possible when the connector is plugged in. Every test device with HVAC or HVDC is equipped with an interlock. For these devices, Figure 16 must also be observed!

XPR = 14-pole industrial connection on the rear of the device

R = Resistance test (four-wire measurement)

IR = Insulation resistance test

HVAC = High-voltage test with alternating current (AC)

HVDC = High-voltage test with direct current (DC)

$Start_1$ = Start button in a test tip for starting a PE or IR test

$Start_2$ = Start button in a test tip for starting a PE or IR test

nc = not connected

FE = Functional Earth (not used)

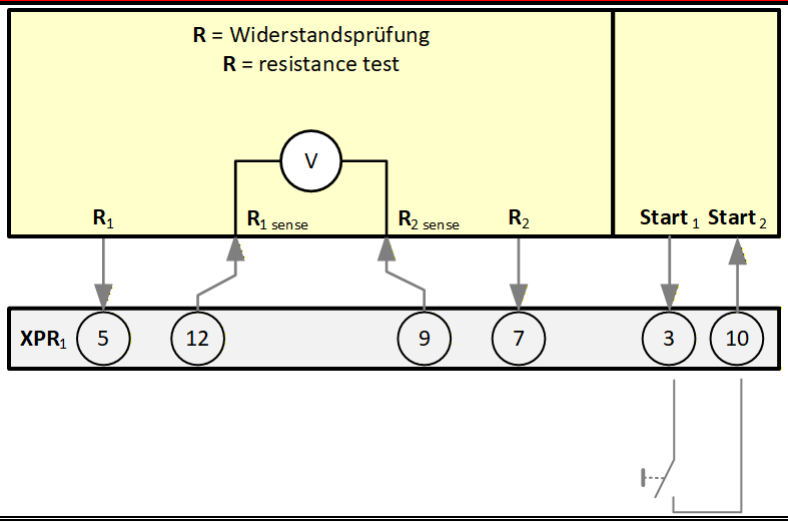
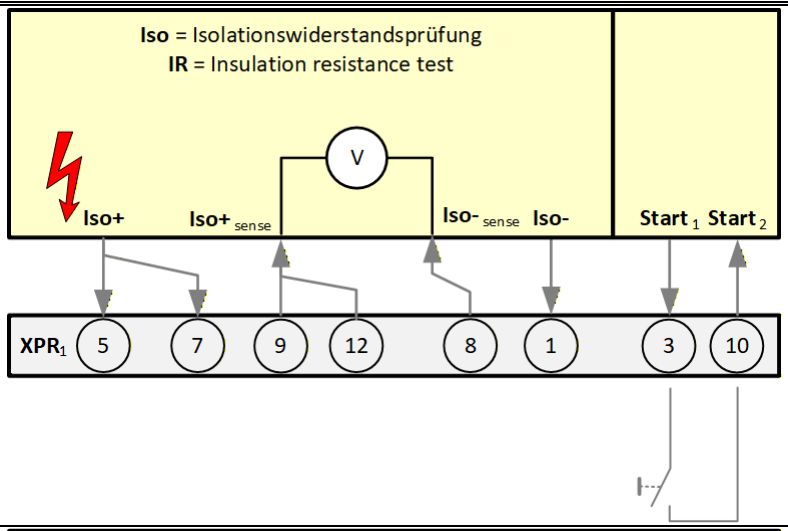
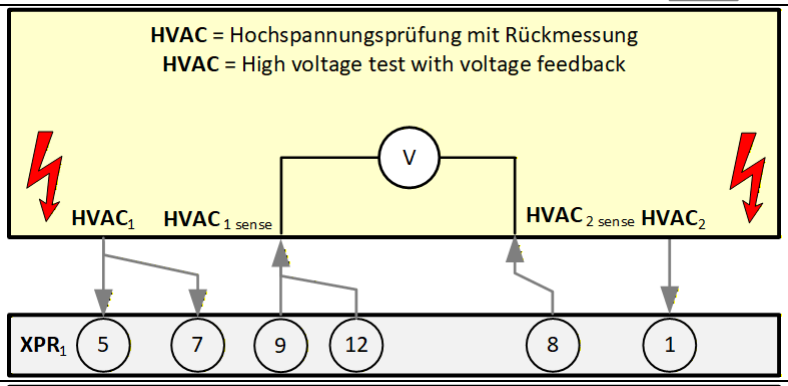
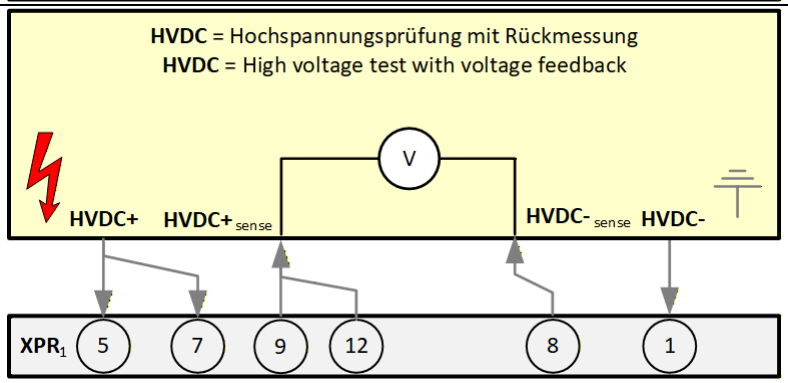
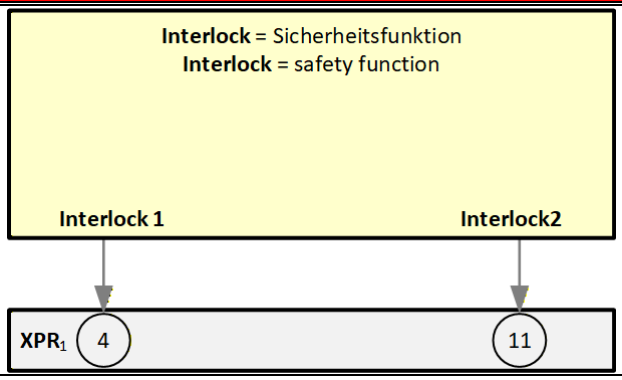
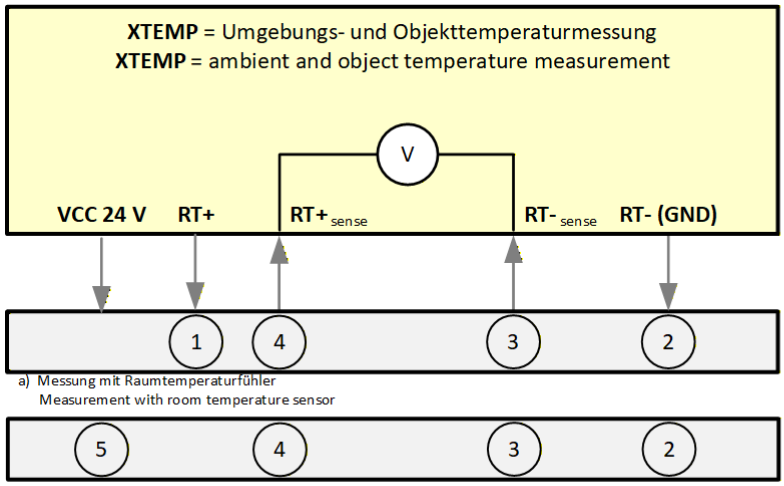
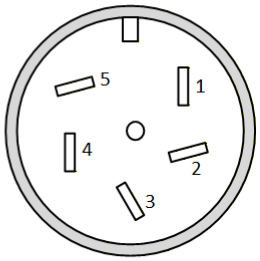
Fig.	Measurement paths	Illustration	Annotations
12			Resistance measurement between **points 5** and **Sense 12** against **points 7** and **Sense 9**. A start input for starting the test is also available at terminals 3 and 10. Alternatively, the device can be started using the button on the front of the device or via a command sent through the communication interface.
13			Insulation resistance test between measurement points **IR-** and **IR+**. The additional test voltage feedback lines can be used for measurement to determine whether the test voltage is actually applied correctly to the DUT. A start input for starting the test is also available at terminals 3 and 10. Alternatively, the device can be started using the button on the front of the device or via a command sent through the communication interface.
14			High voltage test between measuring points **HVAC$_1$** and **HVAC$_2$**. The additional test voltage feedback lines can be used for measurement to determine whether the test voltage is actually applied correctly to the DUT.
15			High-voltage test between measuring points **HVAC-** and **HVAC+**. The additional test voltage feedback lines can be used for measurement to determine whether the test voltage is actually applied correctly to the DUT. Notice: Measuring point **HVDC-** is connected to earth.

Fig.	Measurement paths	Illustration	Annotations
16			Applies to all HVDC and HVAC test devices. Safety function for monitoring whether the XPR connector (#15) is plugged in. **No testing is possible without an interlock bridge**.

Ambient temperature measurement:

 		Measurement of ambient temperature using room temperature sensor. Alternative measurement of object temperature using a pyrometer. Measured resistance values can be calculated using the measured temperature.

Plug type: Amphenol T 336-0000

XTEMP				
Pin	I/O	Signal name	Logic	Function
1	Out	RT+	-	Power output for connection to the room temperature sensor.
2	Out	RT-	-	Power output for connection to the room temperature sensor.
3	In	RT- Sense and 24 V GND	-	Sense line for measuring the voltage at the temperature sensor (four-wire measurement). When making a connection with a pyrometer: GND 24 V.
4	In	RT+ Sense and measurement input	-	Sense line for measuring the voltage at the temperature sensor (four-wire measurement). Measurement input at the connection of the pyrometer.
5	Out	Power +24 V	+24 V	+ 24 V for power supply to the pyrometer.

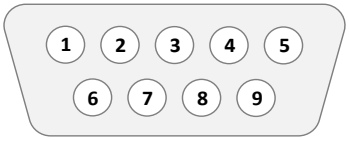
IMPORTANT NOTICE:

The following pages show all electrical connections that are installed in different versions of the GLP2-BASIC.

The following table defines which connections are available for the corresponding device version:

Connection	Labelling rear side	Device type
RS232	COM0	all
Warning light	2	all
Result light	3	all
Control plug	5	all
Enable plug	4a	320, 330, 440, 530, 820, 920, 930, 940, 1030, 1040, 1041, 1130, 1131, 1220, 1230, 1231, 1232, 1240, 1320, 1322, 1330, 1420, 1430, 1520, 1530, 1540, 1550, 1620, 1630, 1640, 1650, 1720, 1740, 1820, 1840, 1920, 1930, 1931, 1940, 1950
Enable plug	4	2010, 2011, 2030, 2031, 2110, 2130, 2210, 2230, 2310, 2330, 2410, 2430
Two-hand operation	4b	320, 330, 440, 530, 820, 920, 930, 940, 1030, 1040, 1041, 1130, 1131, 1220, 1230, 1231, 1232, 1240, 1320, 1322, 1330, 1420, 1430, 1520, 1530, 1540, 1550, 1620, 1630, 1640, 1650, 1720, 1740, 1820, 1840, 1920, 1930, 1931, 1940, 1950
Two-hand operation	7	2010, 2011, 2030, 2031, 2110, 2130, 2210, 2230, 2310, 2330, 2410, 2430
Safety connector	11	320, 330, 440, 530, 820, 920, 930, 940, 1030, 1040, 1041, 1130, 1131, 1220, 1230, 1231, 1232, 1240, 1320, 1322, 1330, 1420, 1430, 1520, 1530, 1540, 1550, 1620, 1630, 1640, 1650, 1720, 1740, 1820, 1840, 1920, 1930, 1931, 1940, 1950
Safety connector	8	2010, 2011, 2030, 2031, 2110, 2130, 2210, 2230, 2310, 2330, 2410, 2430
Room temperature sensor	9	2010, 2011, 2030, 2031, 2110, 2130, 2210, 2230, 2310, 2330, 2410, 2430
Ext. voltage supply Fct 16A	12	1330, 1430, 1540, 1550, 1640, 1650, 1740, 1840, 1940, 1950

ELECTRICAL CONNECTIONS RS232 connector on the rear panel – interface specification

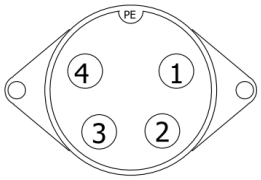


Communication port (male pin header) on the rear of the test device (view of the test device from behind)

Pin	I/O	Signal name	Description	Function
1	In	DCD	Data Carrier Detect	Not used
2	In	RxD	Receive Data	Receive data from …
3	Out	TxD	Transmit Data	Send data to …
4	Out	DTR	Data Terminal Ready	Not used
5	-	GND	System Ground	Ground for both signals TxD and RxD
6	In	DSR	Data Set Ready	Not used
7	Out	RTS	Request To Send	Not used
8	In	CTS	Clear To Send	Not used
9	In	RI	Ring indicator	Not used

Plug type: Sub-D, 9-pole

ELECTRICAL CONNECTIONS Warning light connector on the rear – pin assignment

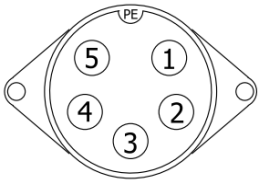


Warning light connector on the rear of the test device (view of the test device from behind)

Pin	I/O	Signal name	Logic	Function
1	Out	DUT voltage-free	+24 V DC	The test is complete as soon as the device under test is de-energized after the tests have been completed. The residual voltage is then below the extra-low voltage*.
2	Out	DUT not voltage-free	+24 V DC	The test is running and test voltage is applied to the device under test, or test current is flowing.
3		-	-	Not used
4		GND	GND	Mass connection for the green and red signal lights in the warning light.

* NOTE - This can only be ensured if the device under test remains connected to the test device until the end of the discharge after the test has been completed!
The plug is designed for the connection of the warning light from SCHLEICH.
Plug type: PREH, 4-pole

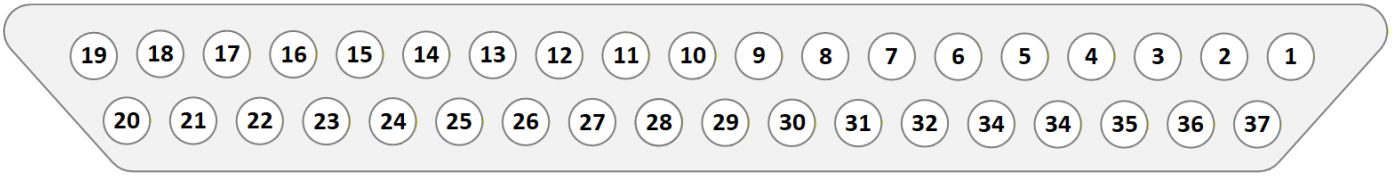
ELECTRICAL CONNECTIONS Result light connector on the rear – pin assignment



Result light connector on the rear of the test device (view of the test device from behind)

Pin	I/O	Signal name	Logic	Function
1	Out	Test GO	+24 V DC	The test result is OK (GO).
2	Out	HV on	+24 V DC	The high voltage test is active. High voltage is applied to the test connections.
3	Out	Test NOGO	+24 V DC	The test result is not OK (NOGO).
4		GND	GND	Mass connection for the green and red signal lights in the result light.
5		-	-	Not used.

The plug is designed for the connection of the SCHLEICH result light.
Plug type: PREH, 5-pole



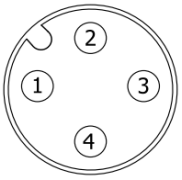
Control connector (female connector strip) on the rear of the test device (view of the test device from behind)

Plug type: Sub-D, 37-pole socket

Pin	I/O	Signal name	Logic	Function
1	Out	Power_+24 V	+24 V	+ 24 V, 200 mA to supply power to the digital inputs used.
2	-	-	-	Not used.
3	In	Start_Footswitch	Impulse min. 50 ms	The test or test sequence is started by a signal from the foot-switch.
4	-	-	-	Not used
5	In	IN_AUX_1	Level	Return of output status OUT_AUX_1 to the external PLC.
6	In	IN_AUX_3	Level	Return of output status OUT_AUX_3 to the external PLC.
7	Out	Power_GND	GND	GND reference point for the digital outputs.
8	Out	HV_<Imin	+24 V	During the high voltage test, the minimum current is not reached or is undershot. This signal can be used by an external PLC as a high voltage application check.
9	Out	HV_on	+24 V	The high voltage test is active. High voltage is applied to the test connections.
10	Out	niO	+24 V	The overall test result of the completed test plan is NOT OK (NOGO).
11	Out	Fault	+24 V	Feedback of the status “Fault in test sequence” to the external PLC.
12	Out	OUT_AUX_2	+24 V	Return of input status IN_AUX_2 to the external PLC.
13	Out	OUT_AUX_4	+24 V	Return of input status IN_AUX_4 to the external PLC.
14	Out	OUT_AUX_6	+24 V	Return of input status IN_AUX_6 to the external PLC.
15	Out	OUT_AUX_8	+24 V	Return of input status IN_AUX_8 to the external PLC.
16	Out	OUT_AUX_10	+24 V	Return of input status IN_AUX_10 to the external PLC.
17	Out	OUT_AUX_12	+24 V	Return of input status IN_AUX_12 to the external PLC.
18	Out	OUT_AUX_14	+24 V	Return of input status IN_AUX_14 to the external PLC.
19	Out	OUT_AUX_16	+24 V	Return of input status IN_AUX_16 to the external PLC.
20	-	-	-	Not used.
21	In	Enable	Level	A connecting bridge from 1 ↔ 21 is required to activate the test device. For this purpose, the control plug is supplied with two prepared connections that you can connect to each other or to your safety equipment.
22	In	Start_external	Impulse min. 50 ms	The test or test sequence is started by an external signal.
23	-	-	-	Not used.
24	In	IN_AUX_2	Level	Return of output status OUT_AUX_2 to the external PLC.
25	In	IN_AUX_4	Level	Return of output status OUT_AUX_4 to the external PLC.
26	Out	HV_Breakdown	+24 V	A breakdown occurred during the high voltage test. The maximum test current was exceeded. This signal can be used by an external PLC for evaluation.
27	Out	Ready for operation	+24 V	The test device is ready for operation. There are no faults.
28	Out	GO	+24 V	The overall test result of the completed test plan is OK (GO).
29	Out	Test running	+24 V	The started test plan runs one test step after another.
30	Out	OUT_AUX_1	+24 V	Return of input status IN_AUX_1 to the external PLC.
31	Out	OUT_AUX_3	+24 V	Return of input status IN_AUX_3 to the external PLC.
32	Out	OUT_AUX_5	+24 V	Return of input status IN_AUX_ 5to the external PLC.
33	Out	OUT_AUX_7	+24 V	Return of input status IN_AUX_7 to the external PLC.
34	Out	OUT_AUX_9	+24 V	Return of input status IN_AUX_9 to the external PLC.
35	Out	OUT_AUX_11	+24 V	Return of input status IN_AUX_11 to the external PLC.
36	Out	OUT_AUX_13	+24 V	Return of input status IN_AUX_13 to the external PLC.
37	Out	OUT_AUX_15	+24 V	Return of input status IN_AUX_15 to the external PLC.

Level = 24 Volt

ELECTRICAL CONNECTIONS Dual-channel safety switch device connector on the rear – pin assignment



Safety channel connector on the back of the test device (view of the test device from the rear)

Pin	I/O	Signal name	Logic	Function
1	In	T1	-	NC – Normally Closed contact 1 – pin 1
2	In	T2	-	NC – Normally Closed contact 2 – pin 1
3	In	R2	-	NC – Normally Closed contact 2 – pin 2
4	In	R1	-	NC – Normally Closed contact 1 – pin 2

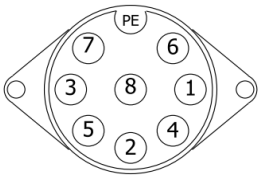
The plug is designed for the connection of the two-channel safety switch device from SCHLEICH.
Devices with built-in safety circuit/safety switching device meet requirements according to PL e, SIL 3, Cat. 4, and two-hand controls, including Type III C.
It is used to monitor emergency stops, safety doors, and light curtains and uses safe outputs in the test device.

Notice:
This connector may be installed twice (XS2) with identical pin assignments and different safety functions.

Normally closed (NC) means that the safety contact is closed in the safe state. If interrupted by an emergency stop or opening of the test cover, etc., the contact is opened. The signal path is thus interrupted. On this basis, a cable break in the supply line to the safety contact is also detected.
Even if a short circuit (connection to other lines) occurs, this is reliably detected by the safety switching device and the test is switched off or no longer switched on.

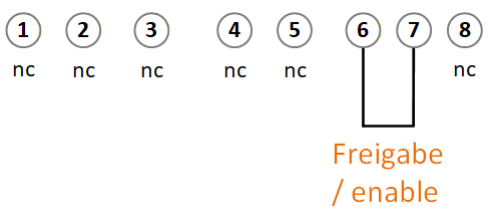
Plug type: M12, 4-pole

ELECTRICAL CONNECTIONS Enable plug on the rear – pin assignment



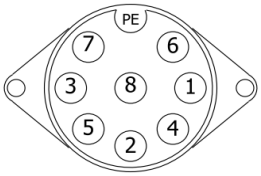
Safety channel connector on the rear of the test device (view of the test device from behind)

Pin	I/O	Signal name	Logic	Function
1			nc	Not used.
2			nc	Not used.
3			nc	Not used.
4			nc	Not used.
5			nc	Not used.
6	Out	Power_+24 V	+24 V	+ 24 V for power supply to the digital inputs used.
7	In	Enable	Level	A connecting bridge from 1 ↔ 21 is required to activate the test device. For this purpose, the control plug is supplied with two prepared connections that you can connect to each other or to your safety equipment.
8		-	nc	Not used.



Plug type: PREH, 8-pole

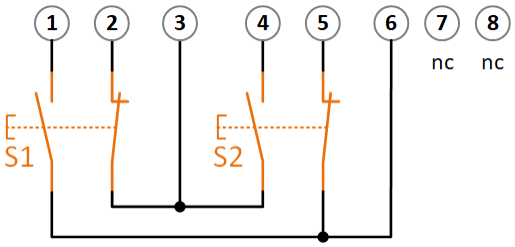
ELECTRICAL CONNECTIONS Dual-channel two-hand control connector on the rear – pin assignment



Safety channel connector on the rear of the test device (view of the test device from behind)

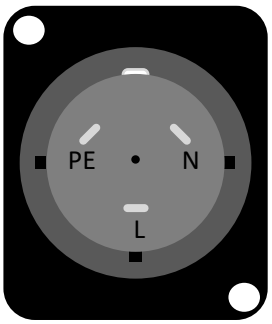
Pin	I/O	Signal name	Logic	Function
1	In	Button 1 / CH1	-	First two-hand button: Normally open contact (NO)
2	In	Button 1 / CH2	-	First two-hand button: Normally closed contact (NC)
3	Out	Cycle 1	-	Cycle for first two-hand switch (NC) and second two-hand switch (NO)
4	In	Button 2 / CH1	-	Second two-hand button: Normally open contact (NO)
5	In	Button 2 / CH2	-	Second two-hand button: Normally closed contact (NC)
6	Out	Cycle 2	-	Cycle for first two-hand switch (NO) and second two-hand switch (NC)
7		-	-	Not used
8		-	-	Not used

D The plug is designed for the connection of the two-channel safety switch device from SCHLEICH.
Devices with built-in safety circuit/safety switching device meet requirements according to PL e, SIL 3, Cat. 4, and two-hand controls, including Type III C.
It is used to monitor emergency stops, safety doors, and light curtains and uses safe outputs in the test device.



Plug type: PREH, 8-pole

ELECTRICAL CONNECTIONS Plug feed external voltage for Fct. 16 A – pin assignment



Pin	I/O	Signal name	Logic	Function
1	In	L	-	Feed for Fct. 16 A
2	In	N	-	Feed for Fct. 16 A
3	In	PE	-	Feed for Fct. 16 A

Plug type: Neutrik NAC3F-W

More information

For further information please visit our homepage www.schleich.com

RoHS conformity

We declare the conformity of our products with the **RoHS2 directive 2011/65/EU** of the European Parliament and of the Council of June 8, 2011 on the restriction of the use of hazardous substances in electrical and electronic equipment, as well as conformity with the **extended delegated directive 2015/863/EU** from March 31, 2015, effective July 22, 2019.

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