CHAPTER SUMMARY

Transformers, 1 kW

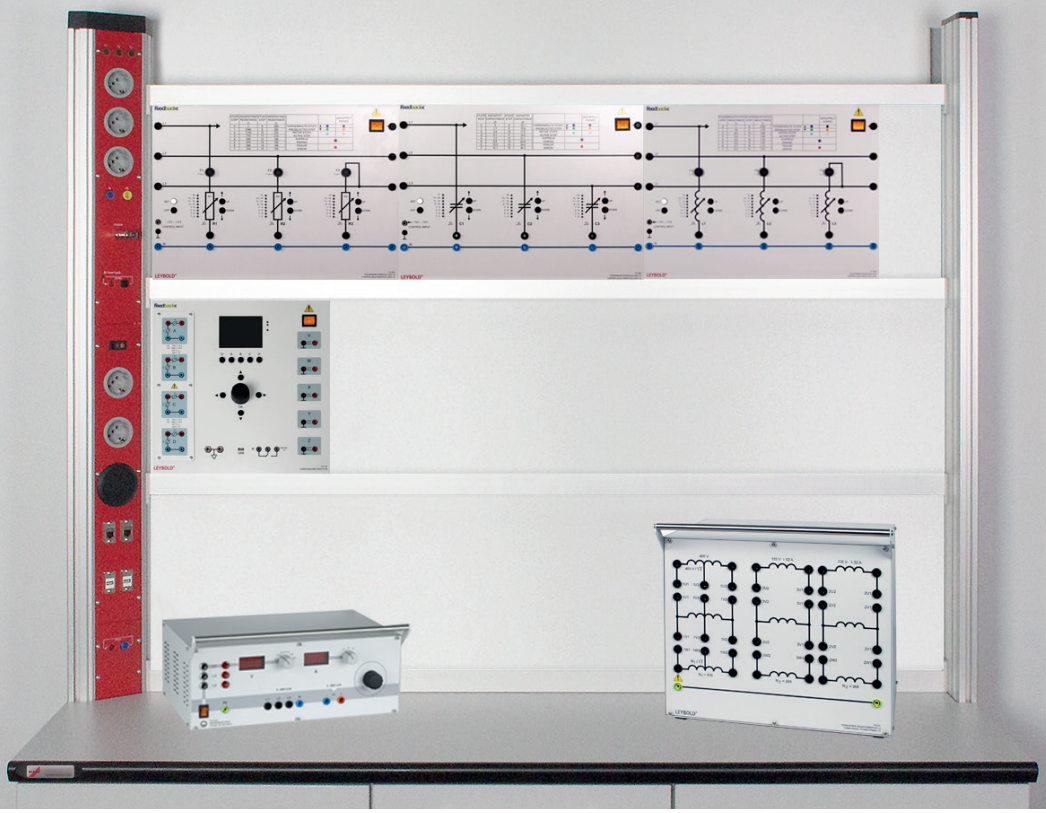
E2.3.1.1
Three-phase transformer, 1.0

E2.3.1.2
Scott transformer, 0.3

E2.3.1.3
AC transformer, 0.3

E2.3.1.4
AC Toroidal Core Transformer, 0.3

E2.3.1.5
AC auto-transformer, 0.3



Three-phase transformer, 1.0 (E2.3.1.1)

Cat. No.	Description	E2.3.1.1	E2.3.1.2	E2.3.1.3	E2.3.1.4	E2.3.1.5
733 91	3-phase transformer, 1.0	1				
773 361	Controllable resistive load, 1.0	1	1	1	1	1
775 220EN	LIT-print: Transformers 1.0	1*	1*	1*	1*	1*
727 110	Power Analyser CASSY Plus	1	1	1	1	1
524 222	CASSY Lab 2 for Drives and Power Systems	1	1	1*		1*
725 442DG	Three-phase voltage 400 V/2.5 A	1	1			
726 09	Panel frame T130, two-level	1	1	1	1	1
500 59	Safety bridging plugs, black, set of 10	2	2	2	2	2
500 591	Safety bridging plugs, yellow/green, set of 10	1	1	1	1	1
500 855	Safety experiment cables, 32 A, set of 34	1	1	1	1	1
500 856	Safety experiment cables, 32 A, yellow/green, set of 5	1	1	1	1	1
733 93	Scott transformer		1			
733 97	1-phase transformer, 0.3			1		
726 85	Adjustable transformer 0...260 V			1	1	1
733 98	AC toroidal core transformer, 0.3				1	
773 363	Controllable capacitive load, 1.0				1	
773 364	Controllable inductive load				1	
733 99	AC auto-transformer, 0.3					1

* additionally recommended

The pictured experiment stand is not included in this equipment. It can be added on request for an extra charge.

In this practical course, only power engineering transformers are examined.

E2.3.1.1 Three-phase transformer, 1.0

Transformers are magnetically coupled systems used for transforming AC voltages or matching impedance. Transformers can therefore be used primarily for measurement or generation of electric power. These practical exercises study exclusively transformers used in energy generation. Transformer power ratings can range from a few mVA up to several MVA. The size and design also have an important effect on the transformer ratings. Transformers are regarded as electrical machines even though they contain no moving parts. The windings of three-phase transformers can be connected in a variety of circuit configurations.

E2.3.1.2 Scott Transformer 0.3

Scott transformers are made by connecting together two different transformers with special windings. They are designed for transformation to and from a two-phase network with a 90° phase-shift to a three-phase network with 120° phase-shift. Its main field of application is measurement and protection technology.

E2.3.1.3 AC transformer, 0.3

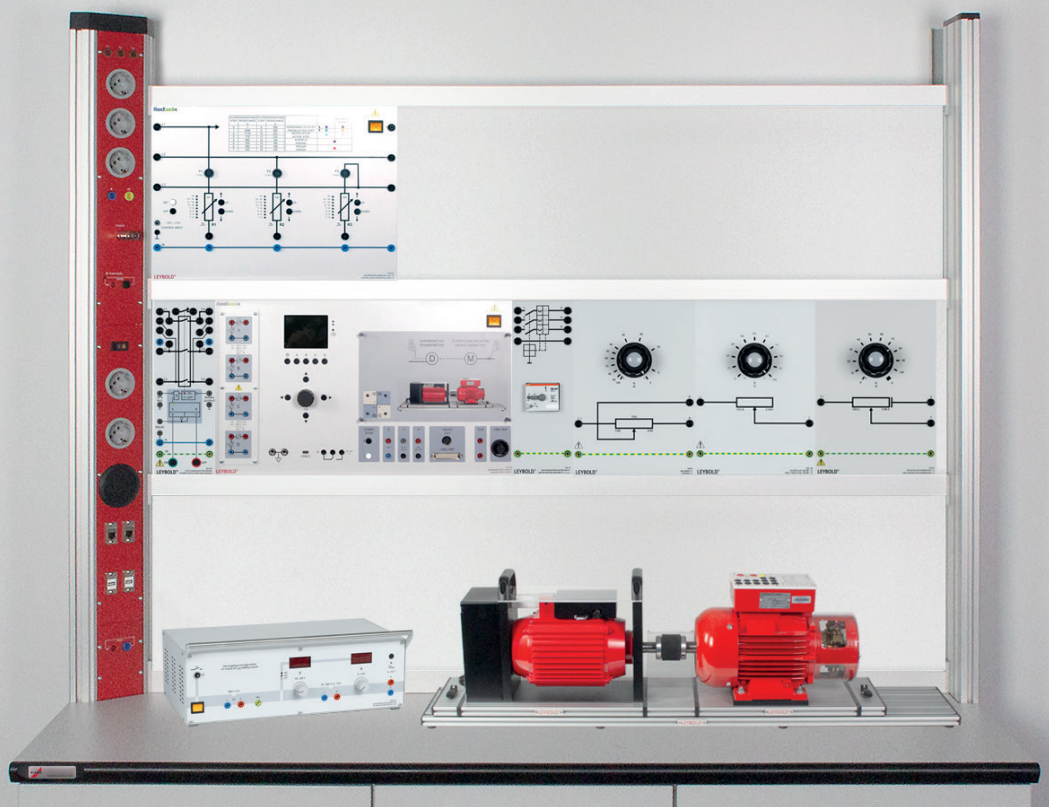
The AC transformer (single-phase transformer) is a standard module which can be used for many applications across the whole of electrical engineering. This transformer is suitable for the investigations of the equivalent circuit diagram with short-circuit, open-circuit and load test.

E2.3.1.4 AC Toroidal Core Transformer, 0.3

A toroidal transformer is ring-shaped. The material used for the core can be soft iron or ferrite material. The shape means that there is very little magnetic scattering. However, the manufacturing process of the windings is more complex than in conventional transformer types. The switch-on current for toroidal transformers can be very high and in practice needs to be limited by suitable means.

E2.3.1.5 AC Autotransformer 0.3 kW

Auto-transformers are designed to save on materials. They are distinct from conventional transformers in that they have a common winding for the primary and secondary circuits which is tapped part way along. Auto-transformers therefore do not have any galvanic isolation between the primary and secondary. The auto-transformer has a complex equivalent circuit and can only be described to a limited extent by short-circuit, no-load and load tests.



DC machines, 1 kW

E2.3.2.1
Compound machine, 1.0

E2.3.2.2
Universal motor, DC, 1.0

Compound machine, 1.0 (E2.3.2.1)

Cat. No.	Description	E2.3.2.1	E2.3.2.2
773 260	Compound machine, 1.0	1	
733 53	Motor protection switch, 4-6	1	1
745 561	Power circuit breaker module	1	1
773 2900	Machine Test CASSY, 1.0	1	1
524 222	CASSY Lab 2 for Drives and Power Systems	1	1
773 2990	Electrical dynamometer, 1.0	1	1
773 258	Coupling / shaft end guard, 1.0, transparent	1	1
315 40	Weight, 2 kg	1	1
773 115	Machine base bench, 120 cm	1	1
732 56	Coupling, 1.0	1	1
732 64	Starter, 1.0	1	1
732 65	Field rheostat, motor, 1.0	1	
732 66	Field rheostat, generator, 1.0	1	
773 361	Controllable resistive load, 1.0	1	
775 225EN	LIT-print: DC Machines 1.0	1*	1*
725 862DG	DC machine supply, 1.0	1	1
726 09	Panel frame T130, two-level	1	1
500 59	Safety bridging plugs, black, set of 10	1	1
500 591	Safety bridging plugs, yellow/green, set of 10	1	1
500 855	Safety experiment cables, 32 A, set of 34	1	1
500 856	Safety experiment cables, 32 A, yellow/green, set of 5	1	1
773 270	Universal motor, 1.0		1

* additionally recommended

The pictured experiment stand is not included in this equipment. It can be added on request for an extra charge.

When starting up under heavy load, in the rock breaking or cement industries or in iron smelting plants, DC motors are considered essential. Their ability to cope with high peaks of torque and their linear speed response over a large range constitute their distinctive features. DC machines are also widely used in small sizes, e.g. in motor vehicles, when a purely DC supply is all that is available.

E2.3.2.1 Compound machine, 1.0

Compound machines feature two separate field windings and can therefore be operated as series-wound, shunt-wound or compound-wound machines. The series-wound winding can also be tapped in order to investigate various types of compound winding.

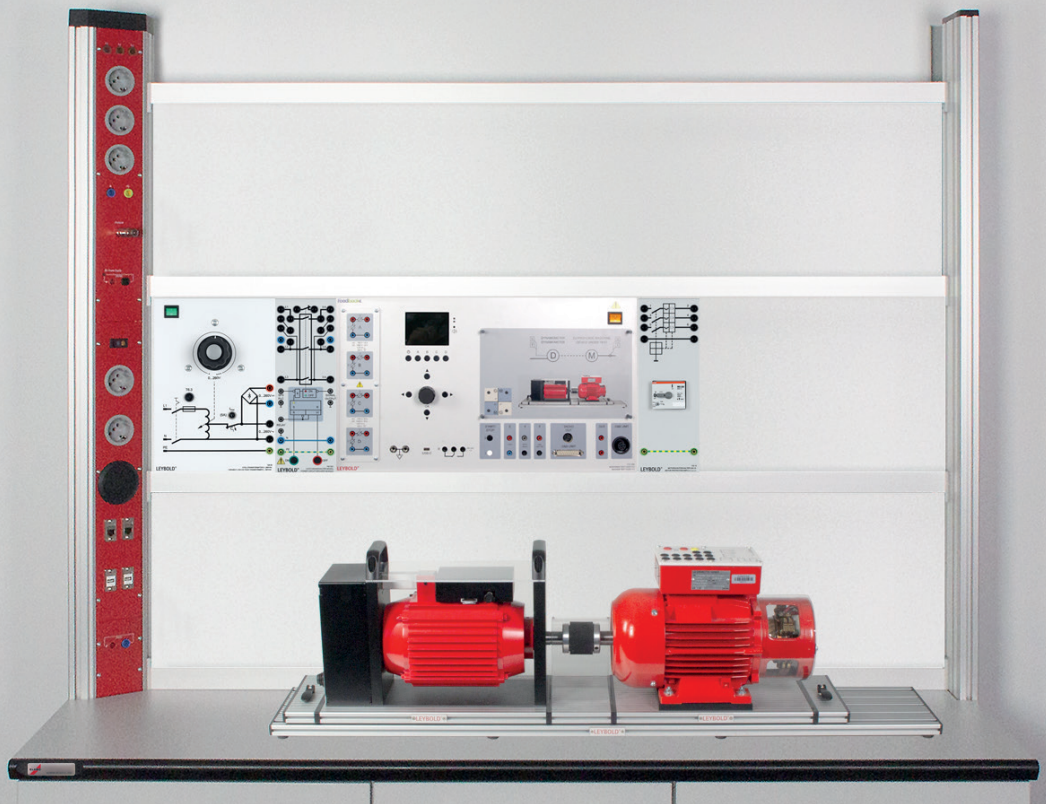
E2.3.2.2 Universal motor, DC, 1.0

Universal motors are a kind of commutator machine for both DC and AC operation. This is achieved by additional lamination of the iron in the stator. Universal motors can also be called single-phase series-wound motors. They are in widespread use, for example, in household appliances and machine tools.

AC machines, 1 kW

E2.3.3.1
Universal motor,
AC, 1.0

E2.3.3.2
Capacitor motor, 1.0



Universal motor, AC, 1.0 (E2.3.3.1)

Cat. No.	Description	E2.3.3.1	E2.3.3.2
773 270	Universal motor, 1.0	1	
733 53	Motor protection switch, 4-6	1	1
745 561	Power circuit breaker module	1	1
773 2900	Machine Test CASSY, 1.0	1	1
524 222	CASSY Lab 2 for Drives and Power Systems	1	1
773 2990	Electrical dynamometer, 1.0	1	1
773 258	Coupling / shaft end guard, 1.0, transparent	1	1
315 40	Weight, 2 kg	1	1
773 115	Machine base bench, 120 cm	1	1
732 56	Coupling, 1.0	1	1
775 230EN	LIT-print: AC Machines 1.0	1*	1*
726 85	Adjustable transformer 0...260 V	1	
726 090	Panel frame KH 160, two level	1	
500 59	Safety bridging plugs, black, set of 10	1	2
500 591	Safety bridging plugs, yellow/green, set of 10	1	1
500 855	Safety experiment cables, 32 A, set of 34	1	1
500 856	Safety experiment cables, 32 A, yellow/green, set of 5	1	2
773 2741	Capacitor Motor 1.0		1
727 115	4 Relays 230 V / 5 A		1
726 71	Single-phase terminal unit		1
726 09	Panel frame T130, two-level		1

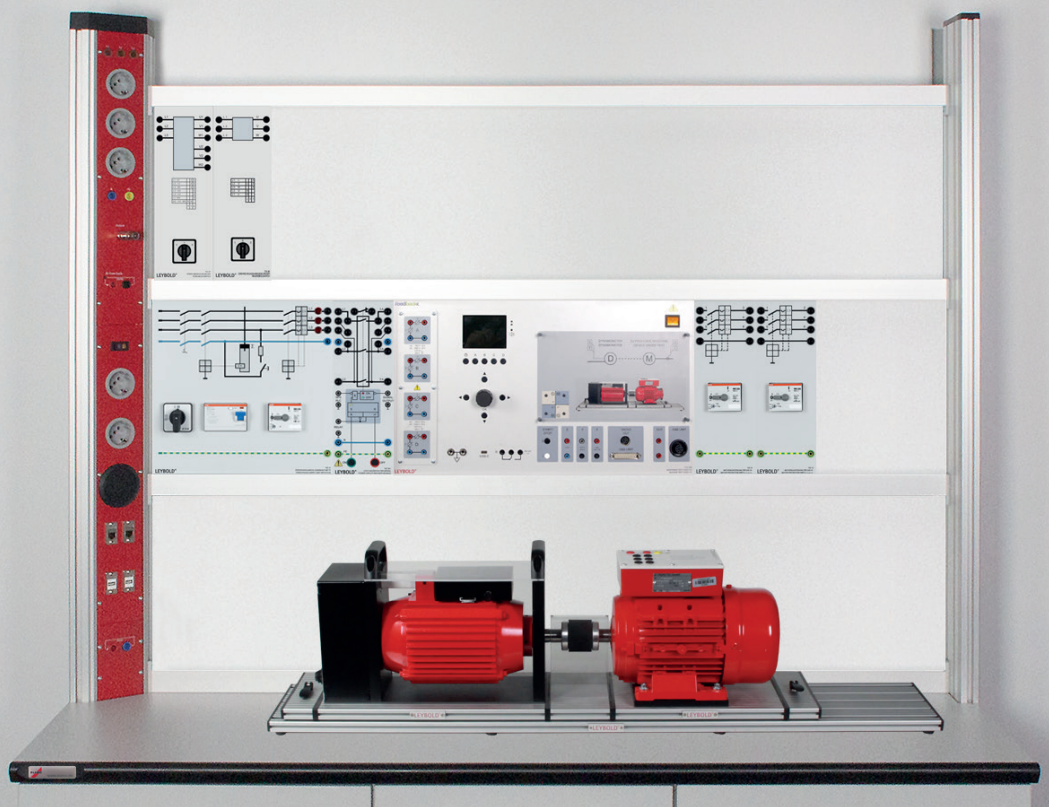
* additionally recommended

The pictured experiment stand is not included in this equipment. It can be added on request for an extra charge.

LD DIDACTIC offers a versatile range of products for AC motors, whereby their design, connection to an AC power supply network, as well as their starting and operating behaviour, are described in detailed experiments.

E2.3.3.1 Universal motor, AC, 1.0
Universal motors are a kind of commutator machine for both DC and AC operation. This is achieved by additional lamination of the iron in the stator. Universal motors can also be called single-phase series-wound motors. They are in widespread use, for example, in household appliances and machine tools.

E2.3.3.2 Capacitor motor, 1.0
Capacitor motors are rotating field machines with squirrel cage rotors which operate on single-phase AC. The rotating field is elliptical and is generated by a 2-core stator winding. The main winding of the stator is connected directly to the power supply, while the auxiliary winding, which is displaced with respect to the main winding, is supplied via a capacitor connected in series. In order to increase the starting torque, a starting capacitor is connected in parallel with the operational capacitor via a relay.



Three-phase asynchronous machines, 1 kW

E2.3.4.1
Squirrel cage rotor, 400/690, 1.0

E2.3.4.2
Squirrel cage rotor, 230/400, 1.0

E2.3.4.3
Slip-ring rotor, 1.0

E2.3.4.4
Squirrel cage rotor D, 1.0

E2.3.4.5
Multi-function machine, 1.0

Squirrel cage rotor, 400/690, 1.0 (E2.3.4.1)

Cat. No.	Description	E2.3.4.1	E2.3.4.2	E2.3.4.3	E2.3.4.4	E2.3.4.5
773 281	Squirrel cage motor 400/690, 1.0	1				
732 84	Motor protection switch, 2.4-4 A	1	1	1	1	
732 14	Motor protection switch, 1-1.6	1				
745 561	Power circuit breaker module	1	1	1	1	1
773 2900	Machine Test CASSY, 1.0	1	1	1	1	1
524 222	CASSY Lab 2 for Drives and Power Systems	1	1	1	1	1
773 2990	Electrical dynamometer, 1.0	1	1	1	1	1
773 258	Coupling / shaft end guard, 1.0, transparent	1	1	1	1	1
315 40	Weight, 2 kg	1	1	1	1	1
773 115	Machine base bench, 120 cm	1	1	1	1	1
732 56	Coupling, 1.0	1	1	1	1	1
731 49	Reversing switch	1	1			
731 47	Star-delta switch	1				
773 1391	Squirrel cage fault simulator	1*	1*			
727 293	Digital insulation tester	1*	1*			
739 836	Milliohm meter	1*	1*			
775 235EN	LIT-print: Induction Machines 1.0	1*	1*	1*		
726 75	Three-phase terminal unit with RCD	1	1	1	1	1
726 09	Panel frame T130, two-level	1	1	1	1	1
500 59	Safety bridging plugs, black, set of 10	1	1	1	1	1
500 591	Safety bridging plugs, yellow/green, set of 10	1	1	1	1	1
500 855	Safety experiment cables, 32 A, set of 34	1	1	1	1	1
500 856	Safety experiment cables, 32 A, yellow/green, set of 5	1	1	1	1	1
773 256	Assembly set el. machine base 1.0 short	1*	1*			
773 257	Assembly set el. machine base 1:0 long	1*	1*			
773 2804	Squirrel cage motor 230/400 IE3 1.0		1			
731 51	Soft starter, 0.3 /1.0		1*			
773 303	Slip-ring motor, 1.0			1		
732 99	Rotor starter, 1.0			1		1

Cat. No.	Description	E2.3.4.1	E2.3.4.2	E2.3.4.3	E2.3.4.4	E2.3.4.5
773 294	Squirrel cage motor D, 1.0				1	
732 83	Motor protection switch, 1.6-2.4 A				1	1
731 55	Pole reverser, Dahlander				1	
773 298	Multi-function machine, 1.0					1*

* additionally recommended

The pictured experiment stand is not included in this equipment. It can be added on request for an extra charge.

E2.3.4.1 Squirrel cage rotor, 400/690, 1.0

Asynchronous machines as squirrel cage rotors are widely used and are particularly low-maintenance motors. The asynchronous motor in this configuration has the suffix 400 / 690 V, which corresponds to the rated voltage specification of the motor.

E2.3.4.2 Squirrel cage rotor, 230/400, 1.0

This machine is particularly suitable for the industrial frequency inverter and the didactic frequency inverter.

E2.3.4.3 Slip-ring rotor, 1.0

The tests are carried out with industrially manufactured machines. With the CMachine Test CASSY all measured values of the AC machines are recorded. The measured values can be shown directly on the built-in display as a single value, table of a measurement series or diagram. The measurements can be made without additional software, and the measurement data can be stored locally on the unit.

E2.3.4.4 Squirrel cage rotor D, 1.0

Squirrel cage rotor D is a special design for asynchronous machines (Dahlander motors). In Dahlander circuits, the three-phase windings of the stator are equipped with a central tap. This allows the number of pole pairs and therefore the speed of the rotor to be switched in the ratio of 1:2

E2.3.4.5 Multi-function machine, 1.0

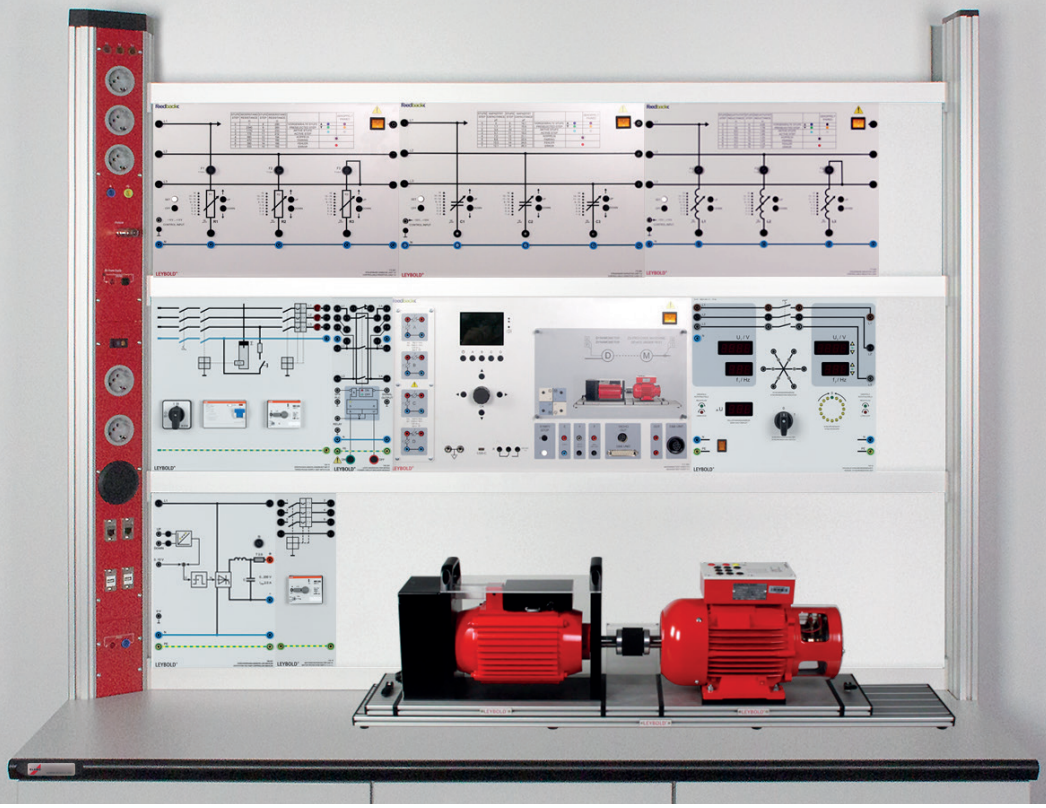
The multifunction machine is a slip-ring motor with the option of operating it as a synchronous machine with a suitable DC power source.

Three-phase synchronous machines with separate excitation, 1 kW

E2.3.5.1
Salient pole rotor, 1.0

E2.3.5.2
Smooth pole rotor, 1.0

E2.3.5.3
Multi-function machine, 1.0



Salient pole rotor, 1.0 (E2.3.5.1)

Cat. No.	Description	E2.3.5.1	E2.3.5.2	E2.3.5.3
773 306	Synchronous machine SP, 1.0	1		
732 14	Motor protection switch, 1-1.6	1	1	1
745 561	Power circuit breaker module	1	1	1
773 2900	Machine Test CASSY, 1.0	1	1	1
524 222	CASSY Lab 2 for Drives and Power Systems	1	1	1
773 2990	Electrical dynamometer, 1.0	1	1	1
773 258	Coupling / shaft end guard, 1.0, transparent	1	1	1
315 40	Weight, 2 kg	1	1	1
773 115	Machine base bench, 120 cm	1	1	1
732 56	Coupling, 1.0	1	1	1
745 05	Manual synchronisation unit	1	1	1
773 361	Controllable resistive load, 1.0	1	1	1
773 363	Controllable capacitive load, 1.0	1	1	1
773 364	Controllable inductive load	1	1	1
726 75	Three-phase terminal unit with RCD	1	1	1
745 021	Excitation voltage controller 200 V/2.5 A	1	1	
726 09	Panel frame T130, two-level	1	1	1
500 59	Safety bridging plugs, black, set of 10	2	2	2
500 591	Safety bridging plugs, yellow/green, set of 10	1	1	1
500 855	Safety experiment cables, 32 A, set of 34	1	1	1
500 856	Safety experiment cables, 32 A, yellow/green, set of 5	1	1	1
773 307	Synchronous machine VP, 1.0		1	
773 298	Multi-function machine, 1.0			1
726 890	DC power supply unit 1...32 V/0...20 A			1
500 990	Adapter sockets, set of 2			1

The pictured experiment stand is not included in this equipment. It can be added on request for an extra charge.

The main field of application of the synchronous machine is power generation. It is also used as commutated synchronous machines in drive control. In recent years, the commutated synchronous machine has been used in e-mobility, where field control is used in addition to speed control.

E2.3.5.1 Salient pole rotor, 1.0

The field of application for salient pole generators is hydroelectric power stations and diesel generators, which require a high number of pole pairs at low speed.

E2.3.5.2 Smooth pole rotor, 1.0

Full-pole generators are used in gas and steam power plants that require a low number of pole pairs at high speed. This rotor can better withstand the centrifugal forces that arise. The application area of the full-pole rotor generator is the choice for large thermodynamic power plants.

E2.3.5.3 Multi-function machine, 1.0

The multifunction machine is a full-pole rotor that is excited by an extra-low voltage source. The function of the full-pole rotor is also visible with this machine in the experiments.