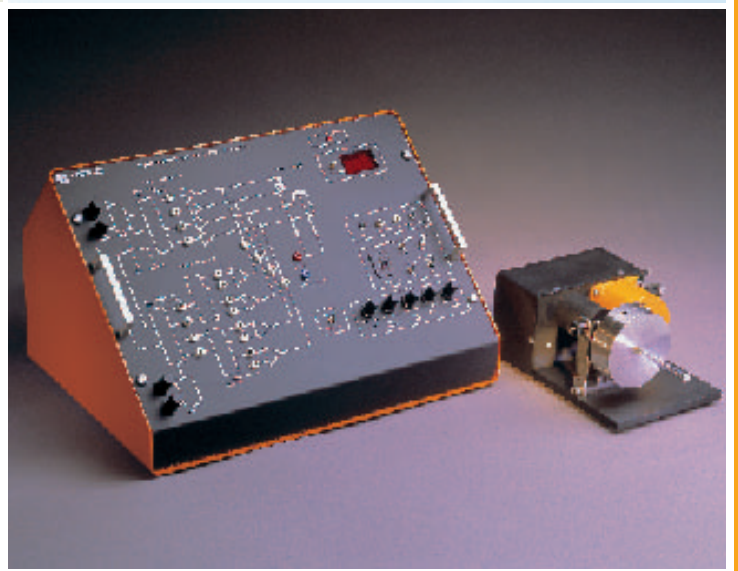
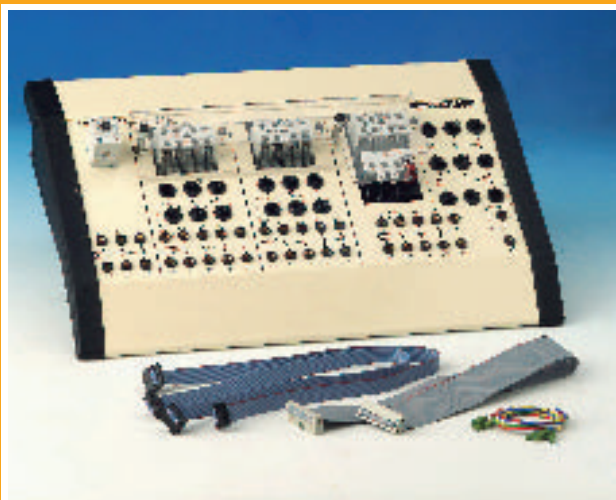


# Motor Control Systems



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## Guarantee & Terms

All overseas deliveries are dispatched in special, made to order wooden crates, extremely sturdy and damage resistant.

The guarantee is valid for 12 months from delivery and covers repair or exchange of parts, defective due to faulty design or workmanship at our factory. Detailed conditions of guarantee are specified in our Terms of Guarantee.

Spare parts for 2-5 years of normal operation can be offered on request.

Regular after-sales service is performed by the worldwide network of Terco representatives, along with the advice and support of our engineers.

Commissioning and training is normally offered separately. Special training can be arranged on request either in Sweden or on site.

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## Motor Control System

A Motor Control package including the DC-motor and the AC-motor, controlled in different, modern ways.

The AC- and DC-drives are the main subjects to be studied in this package.

Other types of drives can be studied in connection with motor control in industry.

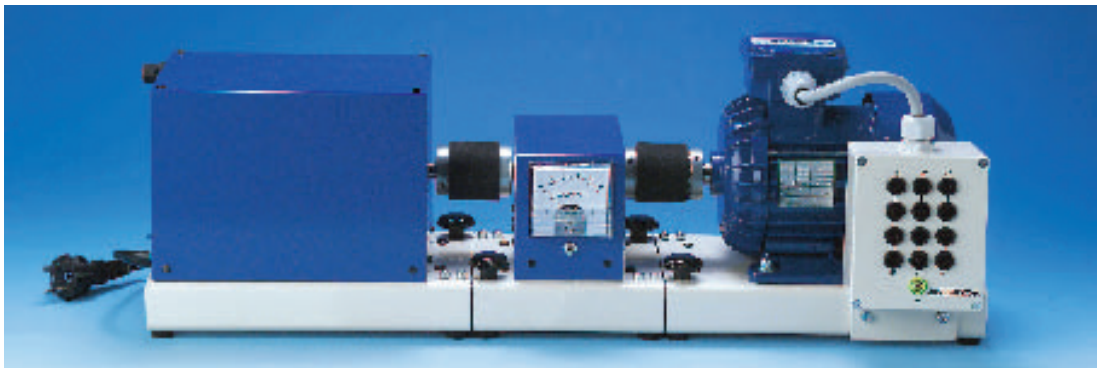
The package also covers combinations with control techniques and electricity.

The experiments are performed with AC- and DC-motors, which can easily be mechanically connected together. They can be loaded steplessly, with a magnetic powder brake.

Experiments are made with different control equipment used to drive and to control motors. Examples of control equipment are contactors, frequency converters, DC-drives and PLC. This equipment may be fixed in different units or on a module card to be connected to the Base Unit 2000.

Connection is done on terminals in an apparatus housing covering contactors, frequency converters, DC-drives, PLC and other applications.

The experiment book is mainly built on connections with laboratory leads of safety design with 4 mm terminals.



The picture above shows the AC-Motor together with the Brake Unit and rpm-Meter.



### AUT 302011 Control Module

The AC-motor is started and stopped by push button controlled electrical switches, located in the Control Module. They are specified with indication as normally closed (NC) or normally open (NO) contacts and there are two of each. In the Control Module you also find a number of indicating lamps. Two of them are red and two of them are green. To control the motor 24 V AC is used which is supplied from the Base Unit 2000, where the Control Module is to be connected. The Base Unit may be loaded up to 50 VA. The Control Module holds also 24 V DC for other experiments.

#### General data

The Control Module consists of

2 push buttons, NC

2 push buttons, NO

2 lamps

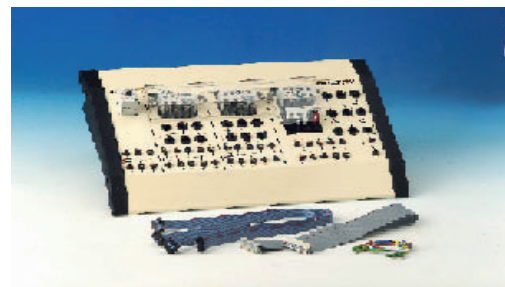
24 V DC

24 V AC

The Control Module has to be connected to the Base Unit 2000.

Dimensions: 240 x 140 x 55 mm

Weight: 0.7 kg



### AUT 302012 Contactor Unit

The Contactor Unit is used to control the motor. It connects the 3-phases from the 3-phase terminal to the AC-motor.

3 mini-contactors are placed in the Contactor Unit. If any of the contactors is in use, this is indicated by a LED. Two of the contactors have an auxiliary contact block and the third one has both, an auxiliary contact block and a thermal overload protection which is released at too high current output at any of the three phases meant for the motor drive. The time relay can be connected to one of the contactors.

The auxiliary contact blocks are used together with the contacts in the Control Module when controlling the AC-motor. Mains supply terminals of safety design.

#### General data

Operating voltage: 24 V AC

Main Voltage 400 V 3-ph, 50 - 60 Hz

Max current 10 A

Dimensions: 390 x 260 x 130 mm

Weight: 3.3 kg



### ELK 102250 DC-Motor

The motor is mounted on a steel base to be connected to a magnetic powder brake or to other electrical machines with a quick shaft coupling. The DC-Motor has open shunt windings to make it possible to connect it as shunt or separate excited DC - Motor.

#### General data

Shunt wound DC-motor.  
 Armature voltage 160 V  
 Field voltage 190 V  
 Armature current 2.1 A  
 Power 0.25 kW  
 Speed 1500 rpm.

Dimensions: 380 x 220 x 250 mm  
 Weight: 13 kg



### ELK 102240 Squirrel-cage 3-phase asynchronous motor

The motor is mounted on a steel base to be connected to a magnetic powder brake or to other electrical machines with a quick shaft coupling. The AC-motor can be switched between Y and D. The supply to the main current circuit of the AC-motor leads through a 3-phase terminal connected to a 3-phase net. The AC-motor can also be supplied via a frequency converter.

#### General data

Voltage: 230/400 V 3-ph, 50 - 60 Hz  
 Current: 1.55 / 0.9 A  
 Power: 0.25 kW, 1380 rpm, at 50 Hz  
 Power factor 0.68

Dimensions: 280 x 220 x 225 mm  
 Weight: 8 kg



### ELK 102244 Tachometer

To measure the rpm of a motor, the tachometer is connected to the motor shaft. The tachometer shows an analogue signal output in form of voltage which is in proportion to the rpm of the rotating shaft. It works like a DC generator. The measuring instrument has a scale of 0-2500 rpm. Voltage output DC 0-20 V, may be used for voltage feedback to the DC or AC - Drive.

#### General Data

Output: 20 V DC at 2500 rpm  
 Dimensions: 210 x 160 x 150 mm  
 Weight: 3 kg



### ELK 102242 Magnetic Powder Brake

To be used together with the AC-motor ELK102240 and DC-motor ELK102250. Brake 0-10 Nm adjustable with a 10-turns potentiometer.

#### General data

Power supply 230 V, 50 - 60 Hz.  
 Effect consumption max 25 W.

Dimensions: 300 x 160 x 200 mm  
 Weight: 7 kg



### ELK 102252 Rotary Index Table

The Rotary index table is to be connected to a motor via a coupling. The rotary index table includes a worm gear where the outgoing vertical shaft drives a fixture plate. The worm gear reduces the speed 30:1. The rotary index table shall be driven by an electrical motor by a ball bearing suspended shaft. The fixture plate with holders and sensors to recognize different materials.

Suitable to learn about different controls with frequency converters or current rectifiers.

Dimensions: 400 x 380 x 190 mm

Weight: 7.4 kg



### ELK 102248 DC - Drive

The DC-Drive is used to run the DC motor. Here the parameters are set, as rpm, current limits, acceleration, ramps and others.

#### General data

Current max 12 A

Armature voltage 0-180 V DC.

Field voltage 200 V DC.

Field current max 1 A

Acceleration period 0.2-5 s.

Feedback with armature current or tacho.

Supply voltage 230 V 1-ph, 50 - 60 Hz.

Dimensions: 230 x 250 x 245 mm

Weight: 2.6 kg



### ELK 102246 AC - Drive

The AC-Drive is suitable to control the speed of an AC motor. It is perfect in many industrial applications e.g. pumps, fans, drilling machines etc.

The AC - Drive can be set with 100 different parameters e.g. acceleration & retardation times, current limit, over load, alarm, speed ranges. It has also a built -in PID regulator.

Here we focus the use of soft start and soft stop, rpm control and study the electronic overload protection.

#### General data

Max motor power 0.4 kW

Input voltage: 230 V 1-ph, 50 - 60 Hz

Output voltage: 0-230 V 3-ph

Current. 2.5 A, Output frequency 0.5-120 Hz

Dimensions: 230 x 250 x 245 mm

Weight: 2.6 kg



### AUT 302013 Sensor Module

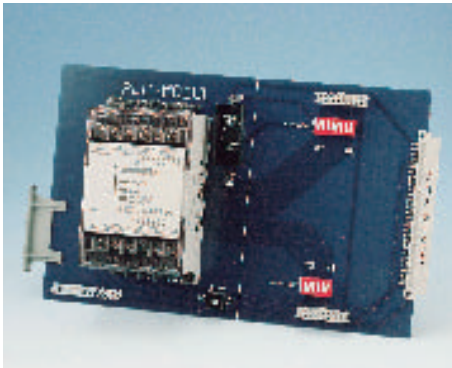
The Sensor Module has to be connected to the Base Unit 2000. The Sensor Unit accommodated three different sensors; inductive, capacitive and optical. The sensors are mounted into a measuring device where the test object is pushed in front of the sensor. By adjusting the sensitivity of the different sensors, the expected signals may be adjusted. The sensors are used also for the rotary index table.

Dimensions: 240 x 140 x 50 mm

Weight: 0.5 kg

## PLC - System

A PLC is a small Mini -Computer for industrial use comprising all necessary logic functions gathered in one housing. The input to our PLC is done from, for example, different sensors or electrical contacts. The output of the signals is done via contactors, pneumatic valves etc.



### AUT 302000 PLC Module

The PLC - Module has to be connected to the Base Unit 2000. To program a PLC, a programming unit is used, connected to a programming port. Alternatively a PC software may be used for programming.

The PLC-module contains a PLC-system with sockets to connect any to chosen module card. For the sockets there are several switches to simulate faults at the different in- and outputs.

#### General data

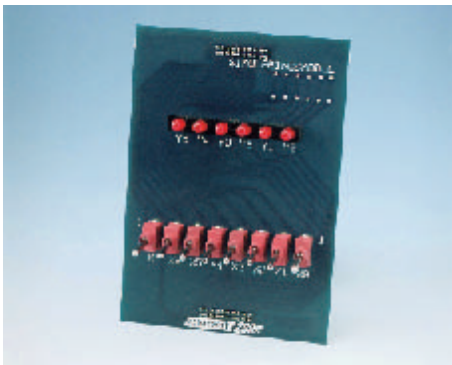
Mitsubishi Melsec FX0-14 MR PLC ( 24 V )

8 inputs and 6 outputs

Input and output of the PLC is connected to a 20 pin socket

Dimensions: 240 x 140 x 55 mm

Weight: 0.5 kg



### AUT 302001 Simulation Module

The signal levels on the inputs can be altered through a simulation module, plugged into the sockets of the PLC module.

#### General data

Shows input status with 6 LED and has out-going signals simulated by 8 on/off switches.

Dimensions: 100 x 140 x 40 mm

Weight: 0.1 kg



### AUT 302008 Socket Adapter

To connect the PLC module to an control object, a 4 mm socket adapter is used.

It is plugged onto the sockets of the PLC module and thus all in- and outputs of the PLC-system are connected to the 4 mm sockets adapter. Thereupon it is easy to connect the PLC system to another control object with 4 mm lab leads.

The socket adapter has also four electrical switches to be able to give in-signals to the PLC-system. The electrical switches can be turned to NC or NO.

Dimensions: 100 x 140 x 40 mm

Weight: 0.1 kg

## Programming Tools

### AUT 310070 Hand-Programming Unit with AUT 310160 Signal Cable

Hand-Programming Unit for programming Melsec PLC system, incl. cable equipped with connectors between Hand-Programming Unit and PLC.

Alternative:

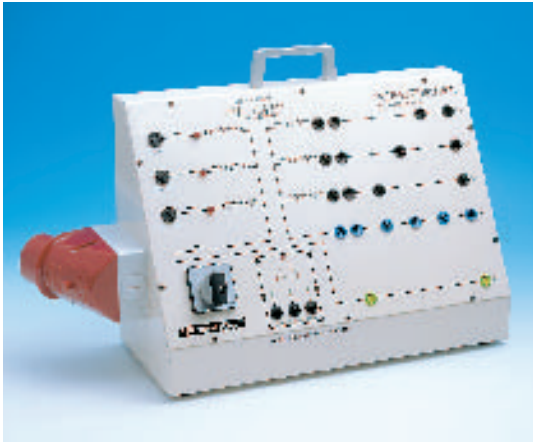
### AUT 310712 Programming Software for PC with AUT 310145 SC-09 Signal Cable

Programming software GX-Developer for programming of PLC from a PC, incl. Cable equipped with connectors between PC and PLC.

Dimensions: 160 x 85 x 30 mm

Weight: 0.3 kg





### ELE 102232 Three Phase Terminal

The AC-motor can be connected to a 3-phase net by a 3-phase terminal with a 5-pole 16 A electrical output as to standard CEE17. Inside the terminal panel there is a control device for the 3-phases and the neutral line. The different phases are fused and in the terminal box is an insulation transformer (1:1) as well.

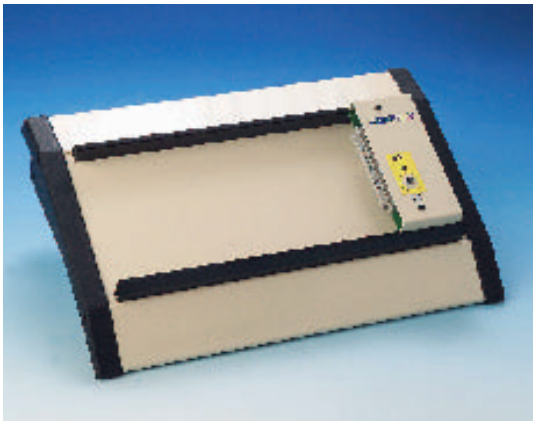
The terminal panel is equipped for current- and voltage measuring on all phases and includes a phase sequence display where LEDs indicate the phase sequence. The connection from the 3-phase terminal panel to the AC-motor is done with lab leads, directly or via the Contactor Unit. Only 4 mm safety lab sockets are used.

#### General data

Supply voltage 400/230 V 3-ph, 50 - 60 Hz

Dimensions: 510 x 190 x 320 mm

Weight: 8.3 kg



### ELE 102000 Base Unit 2000

Base Unit 2000 is the base for the Lab System 2000. It is a Control Box comprising power supply, circuit box and PCB-holder. Into the Base Unit laboratory cards can be fitted. The cards have been carefully designed to suit each particular area of study. The lab cards when fitted are automatically powered via D-sub connector. Base Unit 2000 is a common unit to be connected to different equipment. The Base Unit is connected to 230 V AC and feeds voltage to the connected modules which are inserted between a pair of short guides and there connected to a 64-pole housing.

#### General data

Supply voltage 230 V , 50 - 60 Hz 1-phase

The unit has 6 outputs with following data:

Output 1 - 3: DC 12V / 3 A with LED indication and fuses

Output 4 - 6: AC 12V / 3 A with LED indication and fuses

Dimensions: 370 x 180 x 75 mm

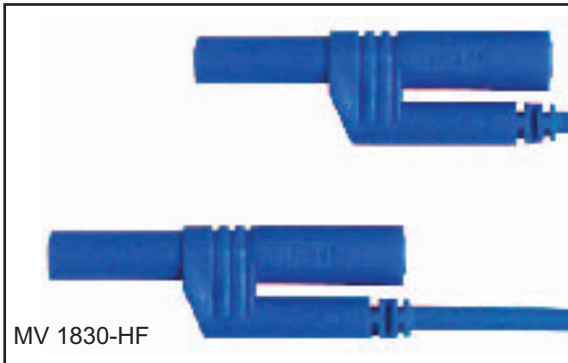
Weight: 4 kg

### ELE 102002 IK Storage Rack

A system Storage Rack for lab modules. The Storage Rack will protect the Lab Cards against electrical and mechanical damage.

Dimensions: 140 x 160 x 330 mm



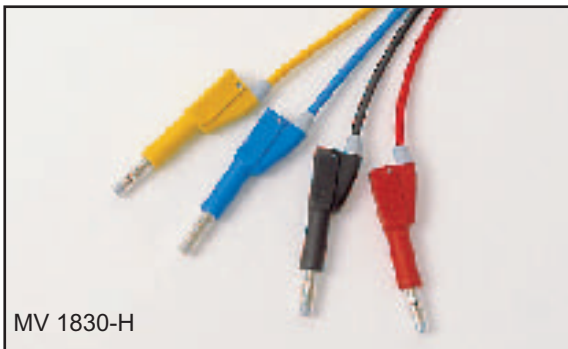


MV 1830-HF

**MV 1830-HF Laboratory Flex Set, Safety Plugs**

A stiff protection socket is covering the plug.  
Set of 100 leads in 5 different colours, red, yellow, blue, black and yellow/green in 4 different lengths, 25, 50, 100 and 200 cm, 5 of each.

Area 1.5 mm



MV 1830-H

**MV 1830-H Laboratory Flex Set, Safety Plugs**

A spring operated protection socket is covering the plug.  
Set of 100 leads in 5 different colours, red, yellow, blue, black and yellow/green in 4 different lengths, 25, 50, 100 and 200 cm, 5 of each.

Area 1.5 mm

**MV 1830 Laboratory Flex Set**

Set of 100 leads in 5 different colours, red, yellow, blue, black and yellow/green in 4 different lengths, 25, 50, 100 and 200 cm, 5 of each.

Area 2.5 mm



MV 1830

**LEY 500590 Set of Jumpers**

Set of 10 pcs black Jumpers, 4 mm

**XGB BOK 103615 Experiments Book & Motor Control**

During the experiments studies are performed with motor circuits and basic as well as advanced circuits for motor control. The equipment is connected with lab leads.

The experiments are performed with AC- and DC-motors. They can be loaded steplessly with a magnetic powder brake.

Experiments are made with different control equipment used to drive and control motors. Examples of control equipment are contactors, AC - Drives, DC-drives and PLC. This equipment may be fixed in different units or on a module card to be connected to the Base Unit 2000.

Contents

- Ratings of a Motor
- Clockwise and Counter Clockwise Rotation of a Motor
- Overload Protection
- Control of a Motor
- Y / D & Connection
- Faultfinding Control Circuit
- Motor Control of AC & Drives
- Motor Control of DC & Drives
- Motor Control with PLC Connected to Drives
- Faultfinding on PLC
- Sensors
- Control of a Rotary Index Table



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## System for Automatic Contactor Control

This is an educational package for the teaching of automatic contactor control.

The package is designed for fundamental theoretical and practical laboratory teaching of automation with special emphasis on helping the pupil to understand solutions and to solve practical problems.

The textbook presents a theoretical description of background, components with applications, and drawing of circuit diagrams.

The descriptions of components are supplemented by practical tests and the learning of circuits.

The textbook contains practical applications, each element based on a brief presentation for theory with subsequent practical tests. The practical tests are based on a learning technique aimed at variation of the method:

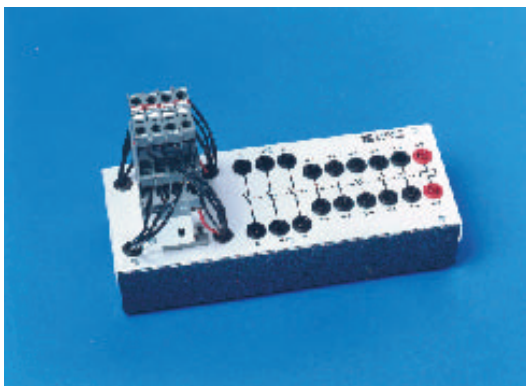
Functional description with wiring up and check. Construction of circuit diagram after functional description with wiring up and check. Wiring up and check of the theoretical solutions in the textbook.

### Selection of experiments with Automatic Control

Contactor construction/theory.  
 Control devices and control circuits.  
 Operation and release times/voltages.  
 Understanding and drawing circuit diagrams.  
 Thermal overloads, theory and operation.  
 Induction motor starting.  
 Delayed undervoltage release.  
 Automatic star delta system.  
 Reverse current braking.  
 Heavy starting.  
 Traffic light control.  
 Dahlander 2 speed starter.  
 Fault finding, logic diagrams.

### Equipment specification

2 pcs MV 1400 Pushbutton panel  
 1 pc MV 1401 Fault tracing panel  
 4 pcs MV 1402 Contactor  
 1 pc MV 1403 Signal lamp panel  
 1 pc MV 1404 Asynchronous machine with flywheel  
 2 pcs MV 1412 Motor-driven time relay  
 1 pc MV 1413 Pneumatic time relay  
 1 pc MV 1414 Pushbutton panel  
 1 pc MV 1415 Cam switch  
 3 pcs MV 1416 Thermal overload relay  
 1 pc MV 1422 Dahlander 2 speed motor with flywheel  
 1 pc MV 1500 Load switch  
 1 pc MV 1501 Selector switch



### MV 1402 Contactor

The contactor is one of the most common components in automation. It is used, for instance, in remote control and automatic control systems.

#### General data

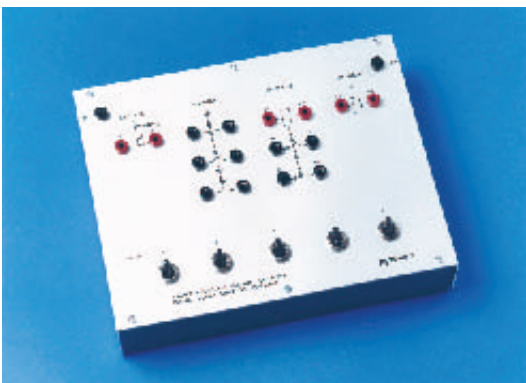
3 main contacts with thermal current rating 25 A at resistive load

5 auxiliary contacts (3 make and 2 break) with thermal current rating 10 A

Operating coil, 50 Hz or 60 Hz, 230 V

Dimensions 130 x 245 x 150 mm

Weight 1.3 kg

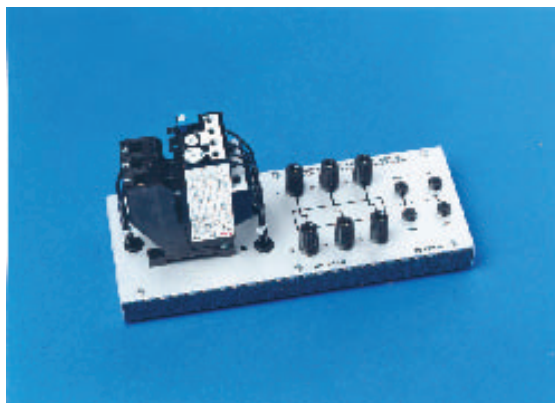


### MV 1401 Fault Tracing Panel

The fault tracing panel gives practice in systematic fault tracing. Together with various items of equipment the panel forms a complete control circuit for counter current braking. Five faults can be seen with five switches.

Dimensions 50 x 170 x 130 mm

Weight 2 kg



### MV 1416 Thermal Overload Relay

for protection against overloading of motors, radiators etc. On operation of the overload relay it's contacts are actuated and the supply is cut off.

#### General data

1 make and 1 break contact

MV 1416 has current range: 0.6-1 A to be used together with asynchronous machine MV 1404.

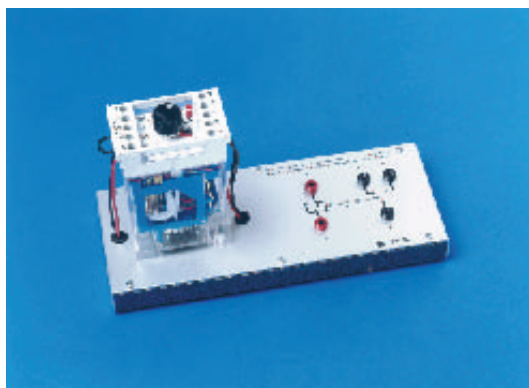
Manual restore button (used when relay has operated). The overload relay is of plug-in type with transparent cover.

Dimensions 130 x 245 x 145 mm

Weight 0.8 kg

### Thermal Overload Relay MV 1426

As above but with current range 3.5-5 A for asynchronous machine MV 1007.



### MV 1412 Motor-driven Time Relay

a slow-to-operate relay, i. e. the contacts are actuated after the preset time has elapsed. It is used in electrical processes in which a precise time lag is desired between, for example, two relay operations.

#### General data

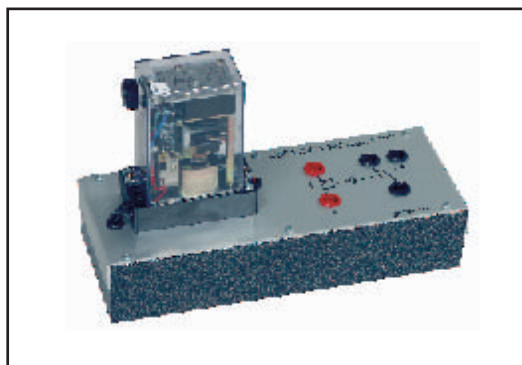
Synchronous-motor-driven, 50 Hz or 60 Hz, 230 V.

Infinitely variable time setting between 0 - 30 h in 6 ranges (lowest range 0-3 sec.) by means of duplicate pointers. One pointer marks the preset time, the other follows the time scale to 0 sec. After cutting-off the current the relay returns to the preset time.

1 change-over contact

Dimensions 130 x 245 x 150 mm

Weight 1.3 kg



### MV 1413 Pneumatic Time Relay

a slow-to-release relay, i. e. it returns to normal after the preset time has elapsed. Same applications as for the motor-driven time relay MV 1412.

#### General data

The relay is electromagnetic-pneumatic and is unaffected by voltage or frequency variations,

shock or vibrations. With the knob on the side of

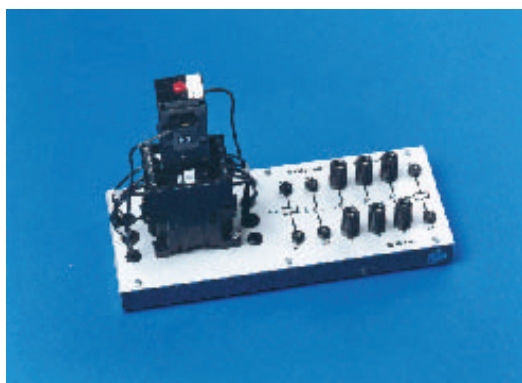
the relay the time can be preset at any point between

0.2 and 180 sec.

1 change-over contact.

Dimensions 130 x 245 x 132 mm

Weight 1 kg



### MV 1430 Contactor with on-position latch

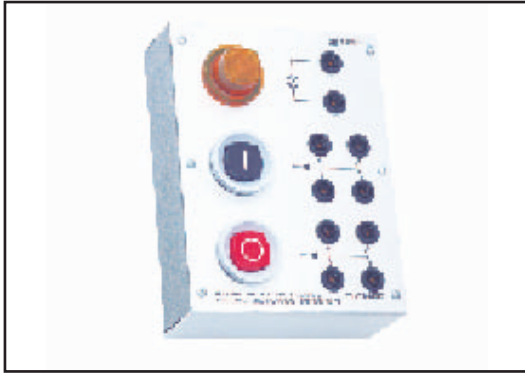
This unit is a contactor with an on-position latch. A typical application of this contactor is the simulation of air-blast circuit-breakers in the installation relay range. Such circuit-breakers often have tripping coils.

The contactor has three main contacts, one auxiliary contact (make NO) and a tripping coil and a closing coil for 230 V 50 Hz / 60 Hz operating voltage.

General electrical data as MV 1402.

Dimensions 130 x 245 x 180 mm

Weight 2.4 kg.



### MV 1400 Pushbutton Panel

MV 1400 is a suitable control device for most of the exercises in the text book. It consists of :

- a signal lamp
- an OFF-button with one break and one make contact
- an ON-button with one break and one make contact.

The buttons are of non-locking type with instantaneous action so that contact operations are felt on depressen of a button.

Dimensions     75 x 175 x 130 mm  
 Weight           1 kg



### MV 1414 Pushbutton Panel

MV 1414 is used as an emergency stop in the text book exercises. It has the same function as MV 1400 with the exception that the pushbuttons are mushroomshaped and of locking type.

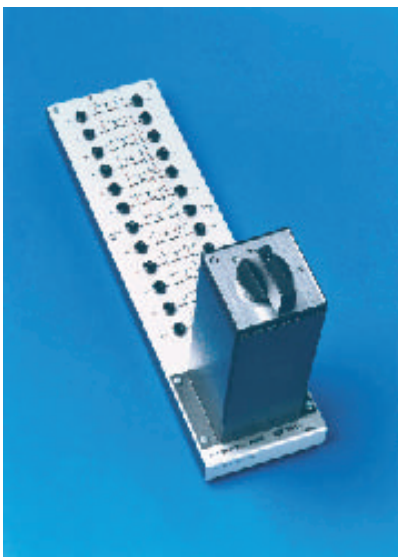
Dimensions     75 x 175 x 130 mm  
 Weight           1 kg



### MV 1403 Signal Lamp Panel

MV 1403 contains 6 signal lamps, 2 red, 2 green and 2 yellow, which may symbolize for example L 1 ( R ), L 2 ( S ) and L3 ( T ).

Dimensions     75 x 175 x 130 mm  
 Weight           0.5 kg



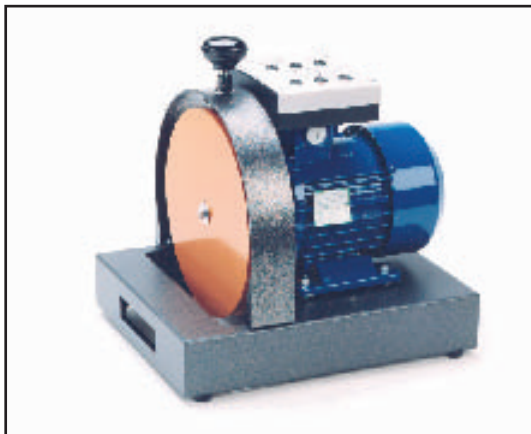
### MV 1415 Cam Switch

for star-delta (Y-D) start and counter current braking.

#### General data

12 contacts with current rating 16 A. The contact movement is effected with cam discs actuated by the knob. The selection disc is engraved B-O-Y-D, B is the position for counter current brakeing. The knob returns under spring action to O from B and Y positions and can thus not remain in these positions. Switch-off takes place direct from D to O, i. e. the Y position is bypassed.

Dimensions     96 x 355 x 210 mm  
 Weight           2 kg



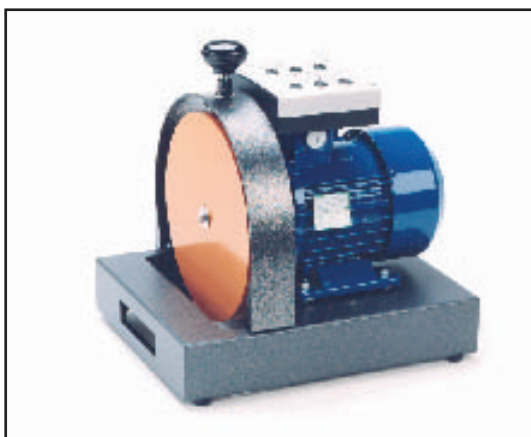
### MV 1404 Asynchronous Machine with Flywheel

To be used in the exercises contained in the Textbook "Automatic Control". The flywheel permits the performance of exercises such as "heavy start" and counter current braking. A flywheel brake is provided.

#### General data at 50 Hz

Power	0,25 kW
Current	Voltage
1.15A	230 V D
0.65 A	400 V Y
0.60 A	440 V Y
cos phi = approx. 0.85	

Speed	2800 rpm at 50 Hz and 3400 rpm at 60 Hz
Weight of flywheel	11 kg
Dimensions	300 x 450 x 280 mm
Weight	20 kg



### MV 1422 Dahlander Motor with Flywheel

Three-phase, two speeds

The motor is fitted with a flywheel which gives a starting time of about 2 s on the low speed and about 5 s on the high speed. A flywheel brake is provided. The number of poles can be changed from 8 to 4 by means of Dahlander pole-changing circuit. The motor is intended to be used in conjunction with the switchgear listed in this section.

#### General data at 50 Hz

Power	0.25 kW / 0.12 kW
Current	2.3 / 2.0 A
Voltage	230 V, 3 ph, 50 Hz
Speed	1400 / 700 rpm
Cos phi	approx. 0.8 / 0.55
Dimensions	350 x 280 x 310 mm
Weight	26 kg

This motor is also suitable for 60 Hz.



### MV 1500 Switch

Three-pole, 16 A, 250 V-DC / 500 V-AC, switch in semi-protected cabinet. Front panel showing symbols and technical data.

Marking of terminals	input	R,S,T
	output	U,V,W

Dimensions	95 x 200 x 80 mm
Weight	1 kg

### MV 1501 Selector Switch

Three-pole, 2-way, 16 A, 250 V-DC / 500 V-AC. Front panel showing symbols and technical data.

Marking of terminals	input	R,S,T
	output1	R1,S1,T1
	output2	R2,S2,T2

Dimensions	95 x 200 x 80 mm
Weight	1 kg

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## MV 2001 Fault Finding Trainer



MV 2001 is the equipment that gives the student effective training in hands-on fault finding on electrical circuits. The hardware combined with the PC-software gives the student especially good understanding using the diagram with the practical measuring procedure. The workbook is aimed for self-tuition. The student's circuit diagram is placed in a separate file which makes it easy for the teacher to check the results afterwards.



### MV 2001 comprises

- Measuring control unit incl. test pins  
To be connected to 230V 1-ph for power and to the computer serial port for communication
- Software on CD ROM (incl. corrected diagrams for the teacher)
- Workbook
- Teachers guide

Dimensions: 400x260x110mm

Weight: 6 kg

Not included:

PC min. Pentium II with CD-drive OP-system 98/NT/2000/2000XP

### Following exercises are prepared for faultfinding:

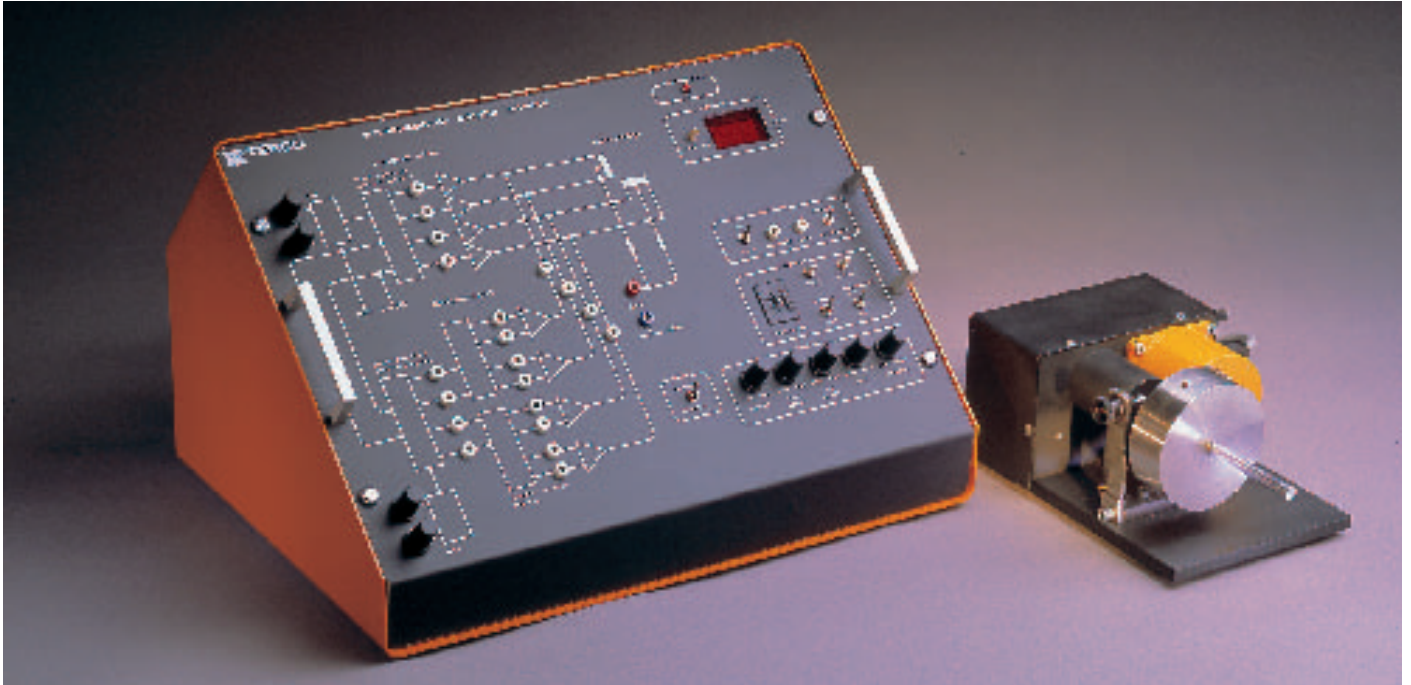
- 9 exercises with contactor controlled by a single control device
- 4 exercises with contactor controlled by two control devices
- 8 exercises with contactor controlled reversing switch
- 4 exercises with two contactor controlled reversing switches

*Terco reserves the right to make changes in the design and modifications or improvements of the products at any time without incurring any obligations*

## SD 1664 Stepper Motor Training Unit

SD 1664 is a unit for training and teaching stepper motor applications. The stepper motor has many applications where it is very useful and economic but unfortunately it has a lot of "side effects" which are a problem.

SD 1664 teaches how to overcome problems like frequency resonance, loss of pulses and overshots.



### SD 1664 Specification

- \* Max pulse frequency 1200 Hz
- \* Max torque 160 Ncm
- \* Three modes
  1. Continues
  2. Count
  3. Single step
- \* Two types of drive systems, unipolar and bipolar. Both types of drives are used in CNC-machines, etc. The controller has several facilities such as on/off, half/full step and clockwise / counter clockwise rotation.

In continuous mode (1) the motor runs with a speed according to speedref potentiometer. The frequency can be measured at a testpoint.

In count mode (2) it is possible to preset number of revolutions, ramping times and maximum speed. In single step mode (3) the rotor rotates one step for each push on the push button.

The equipment includes :

- Control Unit
- Stepper Motor Module
- Two flywheels with different moment of inertia
- Comprehensive Laboratory Manual

General Data	Control Unit	Stepper Motor Module
Dimensions (mm)	500 x 340 x 300	300 x 190 x 120
Weight (kg)	12	5
Supply voltage	220-240 V AC 50/60 Hz	1-phase

### SD 1664 Experiments

- 1 Torque characteristics / Speed
- 2 Pull in / pull out torque
- 3 Pull in / pull out rate
- 4 Holding torque
- 5 Max pull in rate
- 6 Max pull out rate
- 7 Max working torque
- 8 Start range
- 9 Slew range
- 10 Bipolar drive
- 11 Unipolar drive

## MV 4206-1 AC-Motor Drive

Three-Phase supply, semi 4-Quadrant Drive

Semi 4Q frequency converter with MOS FET technique and a fixed intermediate DC-link.

Covers the latest development in AC-motor operation with frequency converters. The equipment is designed to work according to different function principles and it is possible to explain several different types of frequency converters existing today.

4-Q-Drive: The Frequency Converter can be used in the conception of speed/torque control and electro-machine theory. The equipment is also suitable for experiments and tests in industries i.e. far beyond the area that the experiments show.

When braking, the energy is transferred by the DC-link and a brake chopper to a built-in load resistor.

There is also an additional adjustable DC-injection brake.

### Technical Specification

Input voltage: 3-phase 3 x 400 V + N + PE, 50-60 Hz

Input current: 16 A max

Output Power: 1.5 kW

Output voltage: 3 x 230 V

Max output current: 7 A

Max output frequency: 100 Hz

Choice of polygon: automatic

Breaking points: automatic

Internal switch frequency: 3 kHz max

Type of modulation: PWM sensorless vector

Intermediate DC-voltage: average value 300 V DC

Inverter bridge: MOSFET

Control voltage: +/- 12 V

Dimensions 520 x 450 x 280 mm

Weight 16 kg.

### Built-in Instruments and Oscilloscope Functions

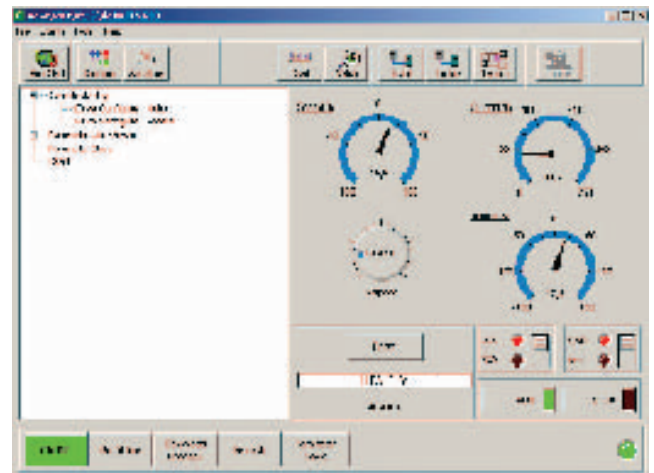
The enclosed software will make it possible to configure the internal connections and operating principles by using a standard PC. On the screen it is possible to monitor 3 analogue instruments and scroll a number of signals/parameters in parallel, which can be saved and printed. The number of parameters/tags possible to study exceeds 200.

### Standard Settings and Advanced Settings

Most parameters are set by default but settings can also be done manually from the front controls: Typically: Speed, Max Speed, Acc ram, Flux, Ret ramp, Ilim etc. Advanced settings, >200 parameters/tags, are performed by Operator Station on the unit, PC nearby the unit, connected to COM1 (COM2). As option we can deliver MV4206-1 with RS485 remote control.

### Manuals

consist of a theory section and exercise section together with a software description. The theory part explains for example general theory of the conditions for torque developed in an arbitrary machine, while the exercise section contains theory that are directly connected to the different experiments. The software is enclosed as a complete binder together with a corresponding CD.



*Terco reserves the right to make changes in the design and modifications or improvements of the products at any time without incurring any obligations*

## MV 4207-1 DC-Motor Drive

Single-phase 4-Quadrant Rectifier, Three-Phase supply

Covers the latest development in DC-motor operation with analogue control. The equipment is designed to work according to different industrial environments. The drive has signal in- and outputs for connections to slave and/or master drives.

To cover a wider range of machines regarding voltage and speed the primary supply is taken from a standard 3-phase outlet which will supply the inverter bridges by 1-phase 400 V.

The design will enhance the possibilities of learning the theory and practice of understanding the operation of 4Q-drives for both single drives and the basic understanding of three bridges and their commutation.

The 4-Q-DC-Drive can be used in the conception of speed/torque control versus electro-machine theory.

When braking, the energy is transferred directly to the supplying network by operating in all four quadrants.



### Technical Specification

Input voltage: 3-phase 3 x 400 V + N + PE, 50-60 Hz

Input max current: 16 A, rotor inductance is included

Output voltage: 0-250 V DC

Output current: 0 - 12 A (max 16 A)

Nominal output power: 2 kW

Design: Tutorial where the 4Q industrial/professional aspects are enhanced

Control: Manually operated Digital / Analogue

Front control parameters: 12

Feedback: DC-tacho or armature voltage

Built-in instruments: U+I+P signals, isolated, including MUX for oscilloscope.

Built-in protections and contactor relays

Dimensions 520 x 450 x 280 mm

Weight 23 kg.



### Standard Settings

12 Parameters are set manually:

Typically: Speed, Max Speed, Acc ram, Flux, Ret ramp, Ilim, Current/Speed proportional, Current demand in/out, etc.

Floating switches and potentiometers are used to study step response and stability.

The results of the dynamic response regarding voltage, current and immediate power can be studied fully isolated on a standard oscilloscope via the built in isolation amplifier and multiplexer.



### Manuals

consist of a theory section and an exercise section. The theory part explains for example general theory of the conditions for torque developed in an arbitrary machine, while the exercise section contains theory sections that are directly connected to the different experiments. The Manual consists of a complete binder together with an additional section, which will explain the UIP-unit (Voltage/Current/Power – unit) together with oscilloscope snap-shots showing different operation modes of the rectifier.

## MV 4207-3 DC-Motor Drive

Three-phase 4-Quadrant Rectifier, Three-Phase supply

Covers the latest development in DC-motor PC-controlled operation with 6 pulse 4Q rectifiers. The equipment is designed to work according to different function principles and it is possible to explain several different types of DC-drives depending on the purpose and industrial environment from traction to paper- and steel mills.

Output current/voltage can be chosen to optimize torque/angular speed or to optimize other parameters by using a PC and the enclosed software.

When braking, the energy is transferred directly to the supplying network by operating in all four quadrants.

The field rectifier can be programmed manually or from a PC for optimized field control.

The 4Q DC Drive can be used in the conception of speed/torque control versus electro-machine theory. The equipment is also suitable for experiments and tests in industrial applications.

### Technical Specification

Input voltage: 3-phase 3 x 400 V + N + PE, 50-60 Hz

Input max current: 16 A

Output voltage: 0 - 400 V DC

Output current: 0 - 12 A (max 16 A)

Nominal output power: 2 kW (max 3 kW)

Design: Tutorial but with the PC-controlled industrial / professional aspects enhanced.

Control modes: Manually by front components, Manually by Operator Station, PC by RS 232 + "CELite" + software

Front controls: Manually Digital > 20, Analogue > 4

Configuration: by PC or Operator Station

Self-tuning: by PC or Operator Station

Built-in protections and contactor relays

Dimensions 520 x 450 x 280 mm

Weight: 25 kg.

### Built-in Instruments and Oscilloscope Functions

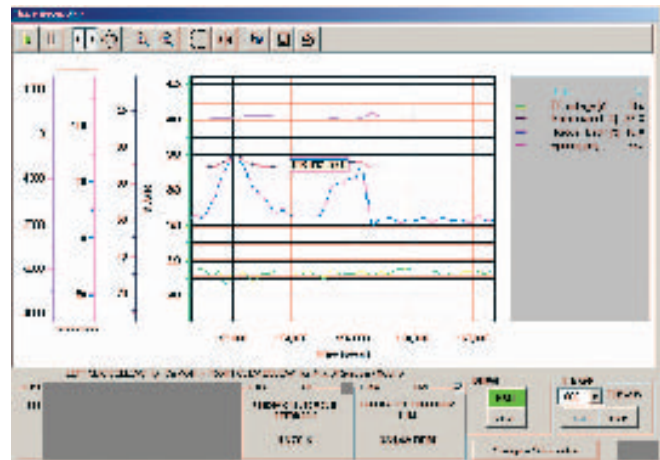
The enclosed software will make it possible to configure the internal connections and operating principles by using a standard PC. On the screen it is possible to monitor 3 analogue instruments and scroll a number of signals/parameters in parallel, which can be saved and printed. The number of parameters/tags possible to study exceeds 200.

### Standard Settings and Advanced Settings

Most parameters are set by default but settings can also be done manually from the front controls: Typically: Speed, Max Speed, Acc ram, Flux, Ret ramp, Ilim etc. Advanced settings, >200 parameters/tags, are performed by Operator Station on the unit, PC nearby the unit, connected to COM1 (COM2). As option we can deliver MV4206-1 with RS485 remote control.

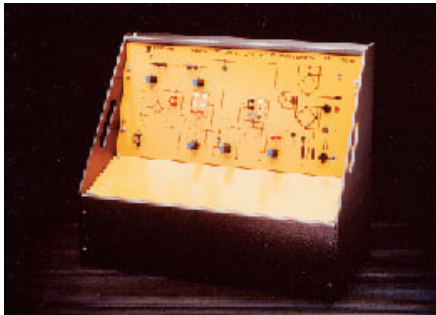
### Manuals

consist of a theory section and an exercise section. The theory part explains for example general theory of the conditions for torque developed in an arbitrary machine, while the exercise section contains theory that are directly connected to the different experiments. The software is described in an enclosed separate binder together with a corresponding CD.



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**Other Drives available and presented in our brochures "Electrical Machines Laboratory" and "Scan Lab Systems & Electrical Machines Laboratory".**



**MV 4200 Thyristor Unit**

The Thyristor Unit MV 4200 is equipped with a speed regulator, a current regulator and a SCR-trigger. The time constant of the regulators can be set in steps with three different values each.

**Technical Specification**

Power	1.9 kW
Tachometer input	10 V at 1000 rpm
Field control output	200 V DC, 2 A
Rotor control output	0-200 V DC max 10 A
Mains voltage	220-240 V 50- 60 Hz 1-ph
Dimensions	500 x 420 x 260 mm
Weight	23 kg



**SM 2658 PWM DC-Machine Control Module, 1 Q**

The unit is designed using MOSFET technology and shows how to optimize: Speed, Control and Efficiency on a DC-Machine during dynamic conditions.

**Technical Data**

Max current	6 A
Terminal for excitation	190 V / 2 A
Duty cycle	0-100 %
Current limit	0-100 %
Control signal	0-10 V
Power supply	220-240 V 1-phase AC, 50-60 Hz



**SM 2651 1 Q DC-Control Module**

This Module operates in armature voltage or tacho feedback mode as well as in open loop mode.

**Technical Data**

Output voltage	0-170 V DC
Output current	6 A
Excitation	190 V 2 A
Power supply	220-240 V 1-ph AC, 50-60 Hz



**SM 2652 4 Q DC-Control Module**

Scan Lab 4 Q DC-Control Module is a rectifier that operates in open loop, armature voltage feedback, tacho feedback or torque feedback mode.

**Technical Data**

Principle of operation	4 Q double full bridges
Output Voltage	0-170 V
Output current	6 A
Excitation	190 V 2 A
Power supply	220-240 V 1-ph. AC, 50-60 Hz



**SM 2661 AC-Control Module**

This AC Control Module is a PWM flux vector type frequency control, controlled by a microprocessor. All power components are based on MOSFET technique.

**Technical Data**

Output voltage	3 x 0-300 V AC, 0-100 Hz
Output power range	400 - 750 W
DC-link over voltage	Blocking of inverter bridge
Braking chopper	(SM 2668)
Power supply	3 x 220-240 V AC, 50-60 Hz

**SM 2668 Brake Chopper Module**

The Brake Chopper Module is used together with the AC-Control Module SM 2661 to provide a semi 4 Q mode of operation for induction motors.

**Technical Data**

Brake voltage (from SM 2661)	300-380 V DC
Control voltage	0-5 V DC
Power supply	220-240 V 1-phase AC, 50-60 Hz
Size of test machine	Max 500 W

# Terco Headoffice



Terco headoffice and factory outside Stockholm, Sweden.

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