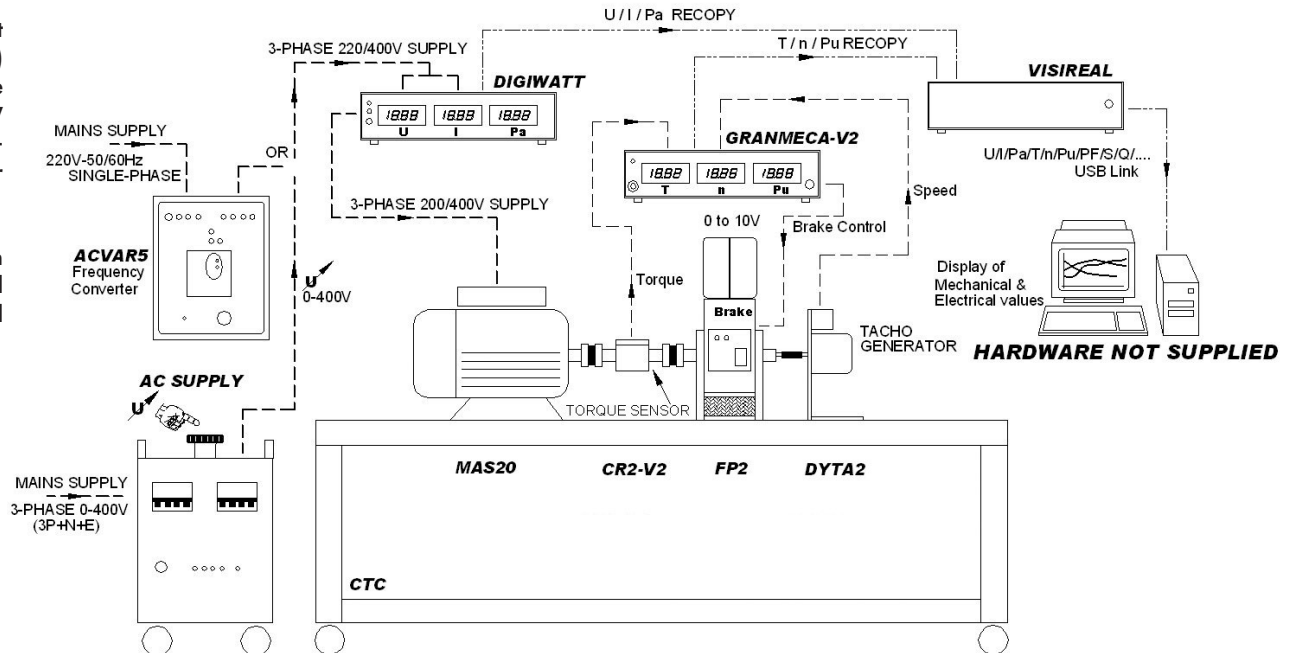# Complete kit for studying the 1.5kW asynchronous motor

The PACK-AC1 power unit kit (power unit + accessories) can be used for studying the short-circuited 220/400V 1500W, three-phase, asynchronous induction motor with rotor in short-circuit.

Several measurements can be taken and the motor load properties can be monitored on a PC.

TUTORIALS DESCRIBED IN THE INSTRUCTIONS SUPPLIED WITH MOTOR PACK REF. PACK-AC1

• **Study of the star/triangle coupling of the asynchronous motor.**
  - Understanding and undertaking motor wiring.
  - Measurements and comparison of the various voltage and current values according to the coupling type selected.
  - Measurement of properties on a PC.

• **Study of the operation of the motor controlled by the speed controller (frequency converter)**
  - Understanding and undertaking the wiring of the speed controller to the motor.
  - Adjustment of speed controller settings.
  - Adjustment of motor acceleration and deceleration rotation speed settings.
  - Measurement on a PC of the rotation speed properties as a function of time.

• **Study of motor operation with no load, with a load and with an overload, using the 230/400V three-phase power supply.**
  - Theoretical reminders of the mathematical formulae concerning an asynchronous induction motor.
  - Understanding and undertaking motor wiring with measuring and monitoring devices.
  - Calculation of the electrical and mechanical quantities of the motor based on its identification plate, such as:
    - *Synchronism speed*
    - *Number of pairs of motor poles*
    - *Slip*
    - *Power consumption*
    - *Power consumption*
    - *Efficiency*
    - *Reactive power*
    - *Apparent power*

- Creation of a table containing calculations and measurements of electrical and mechanical quantities at various points of the motor load:
  - *Current consumption*
  - *Power consumption*
  - *Rotation speed*
  - *Useful power*
  - *Motor torque*
  - *Power factor*
  - *Apparent power*
  - *Reactive power*
  - *Slip*
  - *Efficiency*
- Monitoring on the PC and comments about the various motor load curves
- Comparison of the theoretical calculation of values with those values measure during the motor tests
- Plotting of properties based on motor measurements such as:
  - *Torque as a function of the speed (or other variable)*
  - *Torque as a function of useful power (or other variable)*
  - *Efficiency as a function of useful power (or other variable)*
  - *Reactive power as a function of useful power (or other variable)*
  - *Current as a function of useful power (or other variable)*
  - *Power factor as a function of useful power (or other variable)*
  - *Rotation speed as a function of useful power (or other variable)*
  - *Slip as a function of useful power (or other variable)*

ref. PACK-AC1

ALSO AVAILABLE IN 300W. CONTACT US.

Instructions are supplied with the motor kit, including measurements, curves and theoretical reminders.
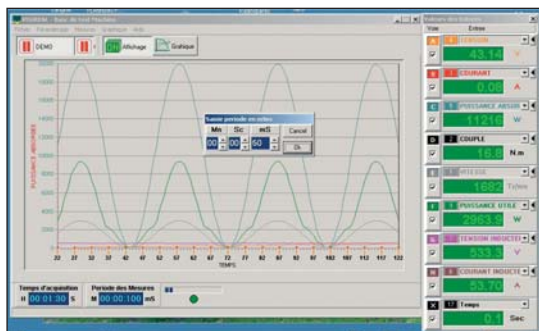
with PC monitoring

OPERATING PRINCIPLE

A speed controller, constant V/F frequency converter, controls the motor's rotation speed according to the various acceleration or deceleration ramps. A three-phase power supply on casters is also used to supply power to the motor, replacing the speed controller.

A 1500W ventilated powder brake loads the motor with values of between 0 and 125% inclusive of the rated load. A brushless torque sensor (requiring no maintenance) measures the various torque values, whereas a DC tacho-generator provides an image signal of the motor's rotation speed.

A first unit, with three digital displays, shows the electrical quantities such as voltage, current and power used by the motor. The second unit, which also has three displays, shows the mechanical quantities such as torque, rotation speed and useful power.
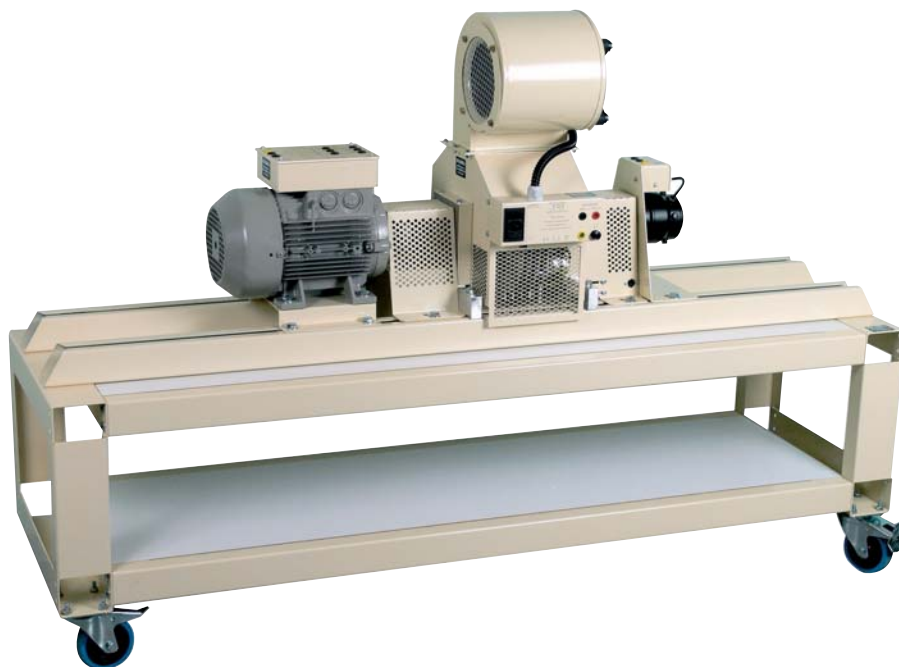
All of these quantities, as well as the motor load curves, can be displayed in real time on a PC, before being printed out.

Example of monitoring with a display of curves and values

Speed as a function of useful power

$n^* = f(Pu)$

Efficiency in terms of useful power

$\mu = f(Pu)$
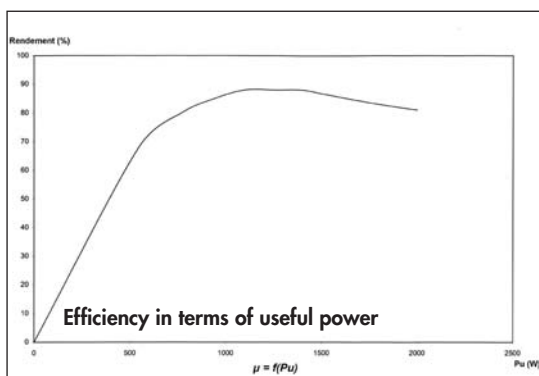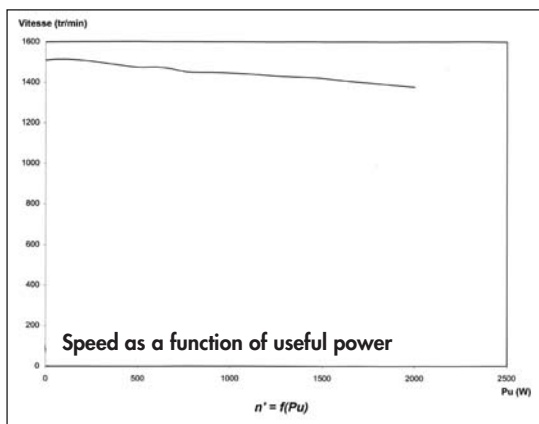
DESCRIPTION OF THE 12 ITEMS INCLUDED IN PACK-AC1 REFERENCE

3-phase asynchronous motor
Ref. MAS20 - Qty 1
(features P. 58)

Rotary torque sensor
Ref.CR2-V2 - Qty 1
(features P. 60)

Powder brake
Ref. FP2 - Qty 1
(features P. 59)

DC tachogenerator
Ref. DYTA2 - Qty 1
(features P. 60)

Stand on wheels
Ref. CTC - Qty 1
(features P. 60)

Guide rails
Ref. RGC - Qty 1
(features P. 59)

3-phase supply on wheels
Ref. TRT8PE - Qty 1
(features P. 98)

Frequency converter
Ref. ACVAR5 - Qty 1
(features P. 84)

Set of 38 safety leads
Ref. 300S - Qty 1 set
(features P. 211)

Digital wattmeter
Ref. DIGIWAT - Qty 1
(features P. 68)

Measurement of mechanical quantities
**Ref. GRANMECA-V2 - Qty 1**
(features P. 68)

Real time and monitoring system
Ref. VISIREAL - Qty 1
(features P. 69)

Complete kit for studying the 1.5kW asynchronous motor

The PACK-AC2 power unit kit (power unit + accessories) can be used for studying a 1500W asynchronous motor.
Charged by a 1500W three-phase alternator, the charge properties are plotted based on measurements taken by various analogue or digital devices.
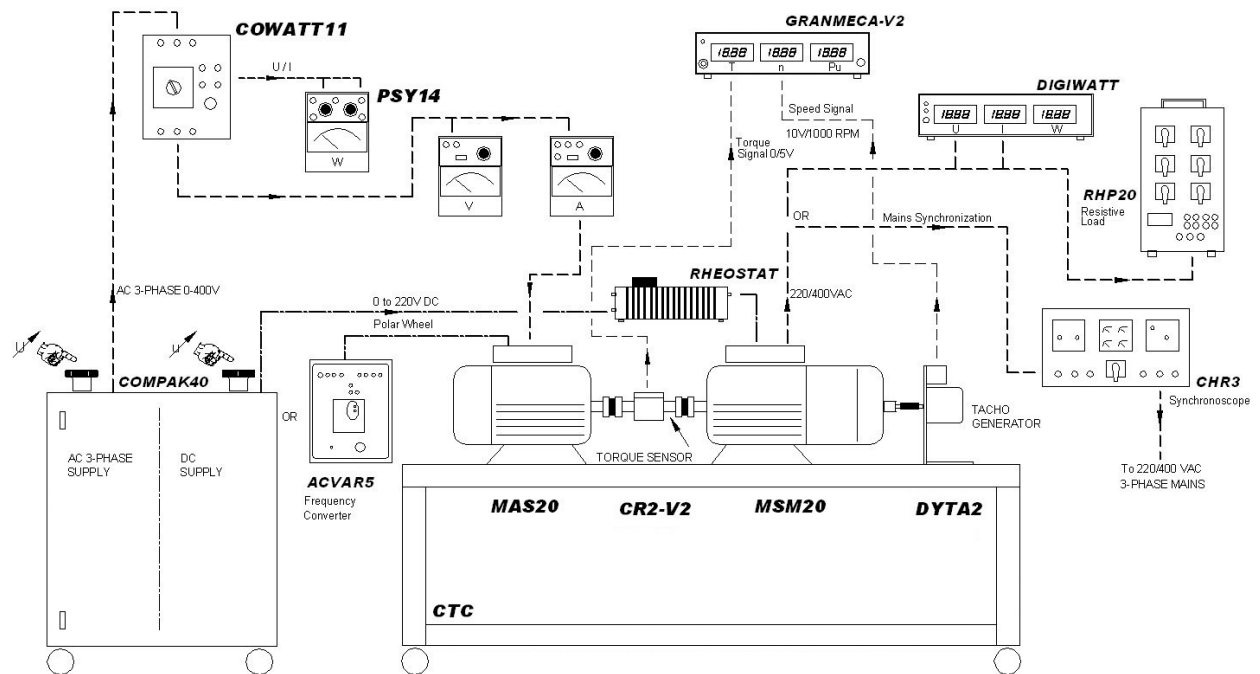
TUTORIALS DESCRIBED IN THE INSTRUCTIONS SUPPLIED WITH PACK-AC2

STUDY OF THE ASYNCHRONOUS INDUCTION MOTOR

• **Study of the star/delta coupling of the asynchronous motor.**
  - Understanding and undertaking motor wiring.
  - Measurements and comparison of the various voltage and current values according to the coupling type selected.

• **Study of the "two powers" method.**
  - Understanding and undertaking of wiring.
  - Power measurements P1/P2.
  - Calculation of the total power and total speed consumed by the motor.

• **Study of motor operation with no load, with a load and with an overload, using the 1500W alternator.**
  - Theoretical reminders of the mathematical formulae concerning an asynchronous motor.
  - Understanding and undertaking motor wiring with measuring devices.
  - Calculations of the electrical and mechanical quantities of the motor using its identification plate, such as:
    - Synchronism speed
    - Slip
    - Power consumption
    - Reactive power
    - Number of pairs of motor poles
    - Torque
    - Efficiency
    - Apparent power
- Creation of a table containing calculations and measurements of electrical and mechanical quantities at various points of the motor load:
    - Current consumption
    - Rotation speed
    - Motor torque
    - Apparent power
    - Slip
    - Power consumption
    - Useful power
    - Power factor
    - Reactive power
    - Efficiency
- Comparison of the theoretical calculation of values with those values measured during the motor tests
- Plotting of properties based on motor measurements such as:
    - Torque as a function of the speed*
    - Torque as a function of useful power*
    - Efficiency as a function of useful power*
    - Reactive power as a function of useful power*
    - Current as a function of useful power*
    - Power factor as a function of useful power*
    - Rotation speed as a function of useful power*
    - Slip as a function of useful power*
    - * or other variable

STUDY OF THE ALTERNATOR

• **Study of the star/delta coupling of the asynchronous motor.**
  - Understanding and undertaking alternator wiring.
  - Measurements and comparison of the various voltage and current values according to the coupling type selected.

• **Study of alternator operation with no load, with a load and with an overload, using a resistive load:**
  - Theoretical reminders of the mathematical formulae which apply to the alternator.
  - Understanding and undertaking alternator wiring with measuring devices.
  - Measurement and plotting of the properties of the magnetic circuit's hysteresis cycle.
  - Calculations of the electrical quantities of the alternator based on its identification plate, such as:
    - Number of pairs of poles
    - Power consumed by the rotary field
    - Power supplied
    - Joule loss
- Creation of a table containing calculations and measurements of electrical and mechanical quantities at various points of the motor load
- Comparison of the theoretical calculation of values with those values measured during the practical tests
- Plotting the properties of the alternator's load: voltage as a function of the supplied current
- Calculation of the voltage decrease as a function of the load
- Theoretical plotting of the shapes of the capacitive and inductive loads, compared with a resistive load
- Analysis of results and conclusion

• **Study of the operation of the synchronised alternator on the public network**
  - Understanding and undertaking alternator wiring on the network.
  - Use of the speed controller
  - Use of the synchroscope with its various displays
  - Synchronisation on the mains network

• **Study of the operation of a short-circuited alternator:**
  - Measurement of the short-circuit current and the current in the rotary field
  - Plotting of properties

ref. PACK-AC2

ALSO AVAILABLE IN 300W. CONTACT US.

Instructions are supplied with the motor kit, including measurements, curves and theoretical reminders.

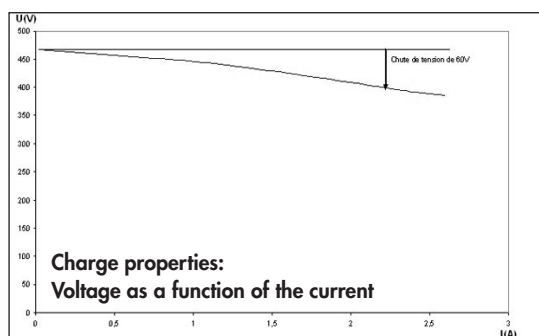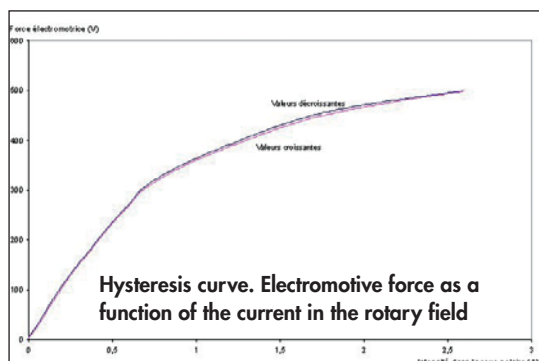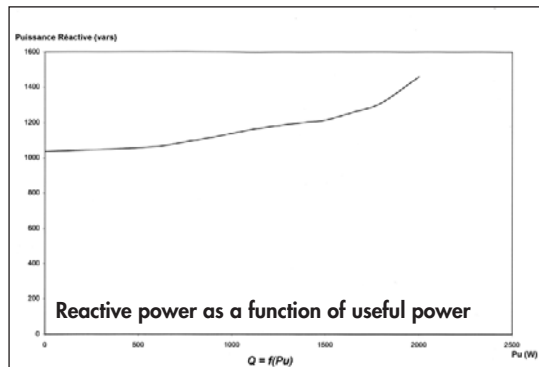# and three-phase alternator

OPERATING PRINCIPLE

A 1500W asynchronous motor, powered by a 3 X 400V source, is charged by means of an alternator. The electrical power generated by the alternator is drained either in the form of an adjustable resistive charge or throughout the public network.

The power consumed by the motor is measured using the "two powers" method by using a wattmeter switch and an analogue wattmeter.
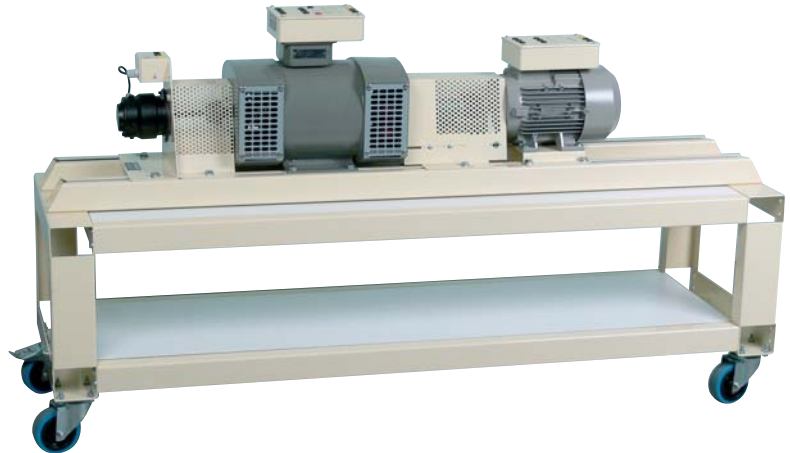
The voltage and current consumed by the motor are measured using an analogue voltmeter and ammeter.

On the alternator, the electrical quantities such as power, voltage and current supply are measured using a digital wattmeter with three displays.

A brushless torque sensor (requiring no maintenance) measures the motor torque, whereas the tachometer generator measures the rotation speed. An analogue unit with three displays shows the torque, speed and useful power values.

Reactive power as a function of useful power

Hysteresis curve. Electromotive force as a function of the current in the rotary field

Charge properties:
Voltage as a function of the current

DESCRIPTION OF THE 18 ITEMS INCLUDED IN PACK-AC2 REFERENCE

3-phase asynchronous motor
Ref. MAS20 - Qty 1
(features P. 58)
Rotary torque sensor
Ref.CR2-V2 - Qty 1
(features P. 60

3-phase alternator
Ref. MSM20 - Qty 1
(features P. 58)
DC tachogenerator
Ref. DYTA2 - Qty 1
(features P. 60

Stand on wheels
Ref. CTC - Qty 1
(features P. 60)
Guide rails
Ref. RGC - Qty 1
(features P. 59)

DC single-phase & 3-phase variable supply
Ref. COMPAK40
(features P. 89)

Resistive load 2000W
Ref. RHP20
(features P. 83)

3-phase wattmeter
Ref. PSY14 - Qty 1
(features P. 196)

Synchronoscope
Ref.CHR3 - Qty 1
(features P. 58)

Safety wattmeter switch
Ref. COWATT11 - Qty 1
(features P. 195)

Magnetoelectric voltmeter
Ref. PSY600V - Qty 1
(features P. 198)

Digital wattmeter
Ref. DIGIWAT - Qty 1
(features P. 68)

Measurement of mechanical quantities
Ref. GRANMECA-V2 - Qty 1
(features P. 68)

Rheostat
Ref. ECO2-106 - Qty 1
(features P. 94)

Set of 67 safety leads
Ref. 300S - Qty 1 set
(features P. 211)

20A magnetoelectric ammeter
Ref. PSY30UA - Qty 1
(features P. 199)
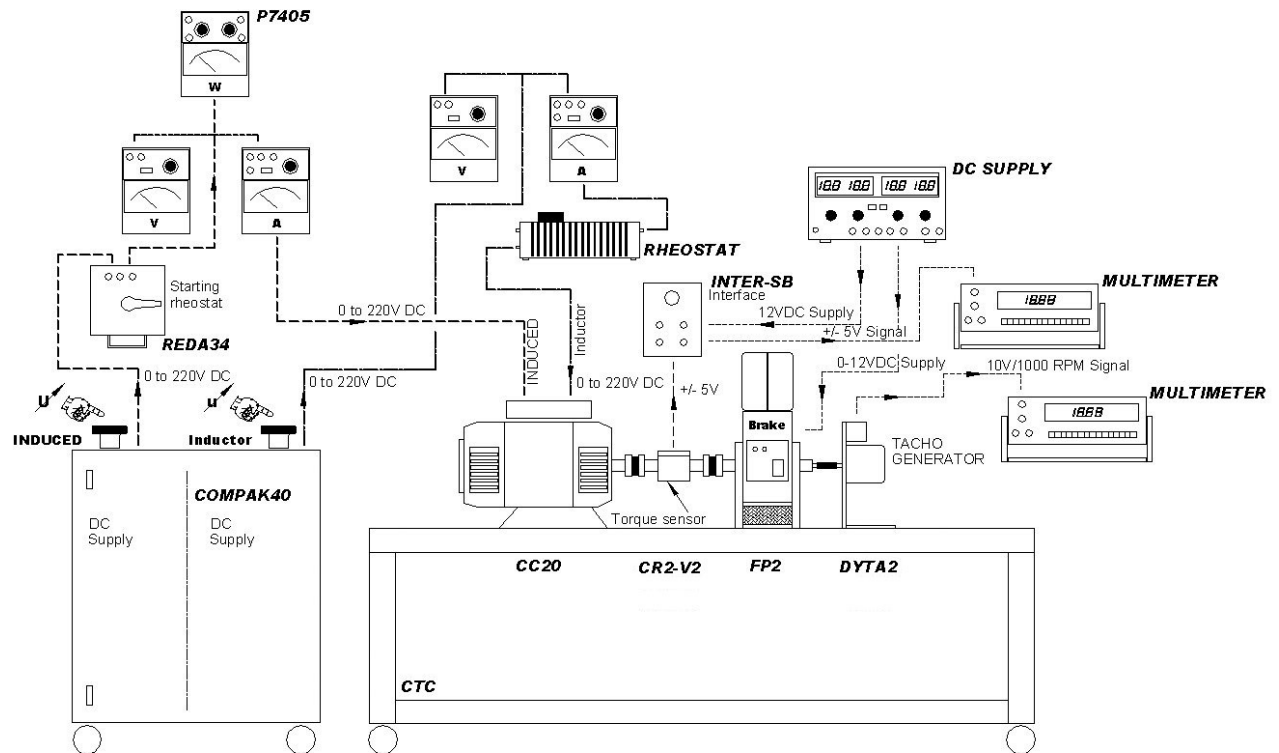
Frequency converter
Ref. ACVAR5 - Qty 1
(features P. 84)

Complete kit for studying the 1.5kW DC motor

The PACK-DC1 power unit kit can be used for studying a 1500W DC motor.
The load properties are plotted based on measurements taken by various analogue or digital devices.

TUTORIALS DESCRIBED IN THE INSTRUCTIONS SUPPLIED WITH MOTOR PACK REF. PACK-DC1

• **Study of connection schematics with shunt excitation and separate excitation (independent).**
- Understanding and undertaking motor wiring depending on the selected excitation type.
- Measurements and comparisons of the various consumed power, voltage and current values depending on the selected excitation type.

• **Calculation method used for determining the resistance value:**
- of the start-up rheostat
- of the excitation rheostat

• **Study of the motor's operation when unloaded, when loaded and when overloaded with separate excitation (independent) and with shunt excitation:**
- Theoretical reminders of the mathematical formulae applying to a DC motor.
- Understanding and undertaking motor wiring with measuring devices.
- Creation of a table containing calculations and measurements of electrical and mechanical quantities at various points of the motor load:
  ✔ Current consumption of field system/in the rotor
  ✔ Power consumption of field system/in the rotor
  ✔ Rotation speed
  ✔ Useful power
  ✔ Motor torque
  ✔ Counter-electromotive force
  ✔ Rotor Joule decrease
  ✔ Efficiency

• **Plotting of properties based on motor measurements such as:**
- Rotation speed as a function of the field system current
- Rotation speed as a function of the rotor current
- Efficiency as a function of the rotor current
- Torque as a function of the rotor current
- Power consumption as a function of the rotor current

• **Analysis of results and conclusion**

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ref. PACK-DC1

ALSO AVAILABLE IN 300W. CONTACT US.

Instructions are supplied with the motor kit, including measurements, curves and theoretical reminders.

OPERATING PRINCIPLE

A power supply with two independent outputs varying from 0 to 220V DC powers the armature and field system of the motor.

A starting rheostat is used for starting the motor without any surges and with overspeed protection.

A powder brake loads the motor with values of between 0 and 125% of the rated load. The torque sensor (brushless, no maintenance required) provides an image signal of the dynamic torque. The DC tachogenerator generates an image signal (10V/1000 rev/min) of the speed.
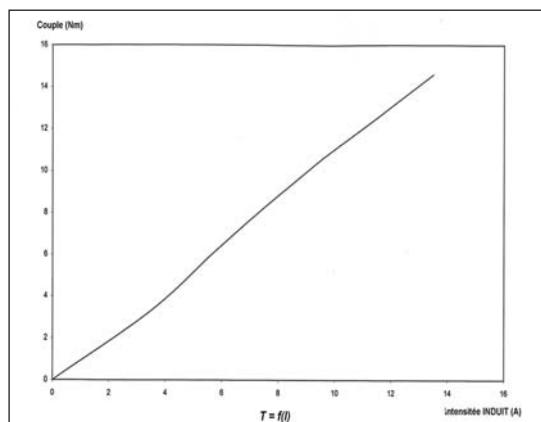
Various measuring devices can be used to plot the motor's load properties.
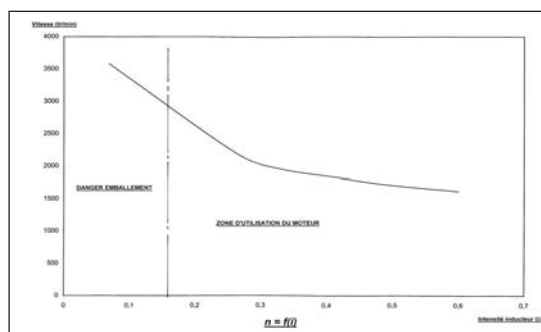
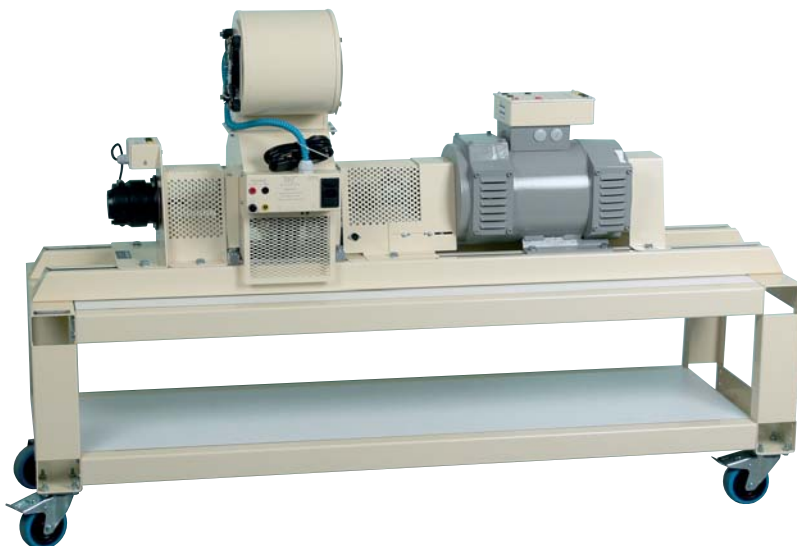**Speed as a function of the inductor current with separate excitation**
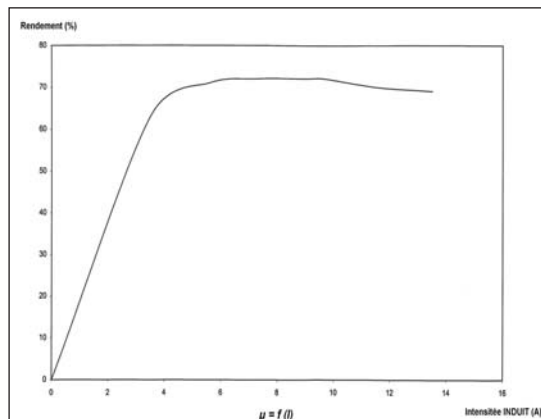
Efficiency as a function of the armature current with shunt excitation

Torque as a function of the armature current

DESCRIPTION OF THE 16 ELEMENTS INCLUDED PACK-DC1 REFERENCE

DC motor
Ref. CC20 - Qty 1
(features P. 59)
Capteur de couple rotatif
Ref.CR2-V2 - Qty 1
(features P. 60)

Powder brake
Ref. FP2 - Qty 1
(features P. 59)
DC tachogenerator
Ref. DYTA2 - Qty 1
(features P. 60)

Stand on wheels
Ref. CTC - Qty 1
(features P. 60)
Guide rails
Ref. RGC - Qty 1
(features P. 59)

DC variable supply
Ref. COMPAK40
(features P. 89)

Wattmeter
Ref. P7405 - Qty 1
(features P. 196)

Magnetoelectric voltmeter
Ref. PSY600V - Qté 2
(features P. 198)

20A magnetoelectric Ammeter
Ref. PSY30UA - Qty 2
(features P. 199)

Alimentation continue maître/esclave
Ref. GPS3303 - Qty 1
(features P. 175)

Torque measuring interface for brushless sensor
Ref. INTER-SB - Qty 1
(features P. 66)

Multimeter
Ref. GDM8135 - Qty 2
(features P. 181)

Safety starter Rheostat
Ref. REDA34 - Qty 1
(features P. 59)

Rheostat
Ref. ECO1-470 - Qty 1
(features P. 94)

Set of 46 safety leads
Ref. 300S - Qty 1 set
(features P. 211)