A. Asynchronous Motor - FREQUENCY CONTROL

Task: 1. To test the FREQUENCY CONTROL – by Frequency Converter using. By means of oscilloscope – trace the output voltage (and current) waveforms – being observed the PWM (Pulse Width Modulation) principle.

2. To measure – the Output Voltage vs. Converter’s Output Frequency dependence $V = V(f)$. The voltage reading would be realized by the ferromagnetic voltmeter using; the frequency would be read by means the converter display.

3. For as. motor , by NO-load Test – to measure the Current rms value (Root Mean Square Value) vs. Frequency $I_0 = I_0(f)$. The current reading – by ferromagnetic ammeter using; the frequency would be read by means the converter display.

4. For as. motor, by NO-load Test – to measure the Motor Speed vs. Frequency $n = n(f)$.

5. For FREQUENCY CONTROL of As. motor – to measure the Torque-Speed characteristic $n = n(M)$ – for frequency parameter: 30 Hz, 50 Hz, 60 Hz. The speed reading is realized - either by counter using; and either by tachodynamo using, too; the Torque can be read – either by means the DC-ammeter, as DC-current – converted to the Torque (converting constant 0,2 Nm / 1A ); - or either by Dynamometer using. The measurement is realized by the DC constant-excitation current. The loading test is realized by the variable resistor using – (connected in the armature circuit of DC-dynamo. During the measurement, the DC-rotor-dynamo – current has to be less than 24 A.

6. To compare the reading : current, voltage, power – being caught the analogue instruments, with; vs. the digital ones. To discuss the using possibility for an electronic instruments, in case NO-sinusoidal power supply.

Note:
1. PLEASE – NO - Changes in circuits-connection !!
2. The converter’s operation – first, the rectification of the power supply voltage is realized (by means of the diode-rectifier), and the DC-voltage filtering (by the Capacitor using); then the 3-phase voltage system (the variable rms voltage value; and variable frequency for the first harmonic sine-waveform ) is generated by the Transistor Inverter using – by means of PWM (Pulse Width Modulation). The converter start is done – the switch (turn-on). The output frequency is set – the potentiometer (in range 0 – 60 Hz).
3. The current (and voltage) reading is done through the galvanically separated sensors (as the output current). NO-insulation transformer is necessary to be used for the oscilloscope reading. Trace the voltage signal waveform (modulated – by means PWM).

Diagram:
B. As. Motor - SOFT START – by means the AC-Voltage Converter using - so called “SOFTSTARTER”

Task: 1. By oscilloscope using, trace – the ac-current (and voltage) waveform for an As. motor start; being used the various starting voltage levels, and the various starting-ramp, too. By start – being followed the motor operation – try to explain the motor noise-increasing, if the softstarter would be used.
2. By oscilloscope using, try to be caught the peak current starting value (what is independent from the starting voltage level, and from the starting-ramp, too).

Note:
1. The AC-voltage converter is done – as the Three-phase symmetrical fully controlled AC-Chopper; what means – a pair of thyristors in anti-parallel (or triac) – being connected into 3 – phases (or into 2 – phases, only – so called: Three-phase spare AC-chopper connection). By the phase control of thyristors – the rms voltage level is changed (in practice, by reducing the control angle at pre-set rate from pre-set value; so that a transient control period is invariably inserted, in order to forestall the development of heavy switch-on transient peak currents).
2. The relation – for the current-sensor: the output voltage $1V$ is as $1A$.

Diagram: Three-phase spare AC-chopper connection - for softstarter

Principle explanation - The AC-voltage converter (Single-phase AC-chopper) operation.
C. Rotation Reversing and Motor Operation by Single-phase Supply

Task: 1. For As. motor, to verify the direction change of rotation by reversing the phase sequence (two phases exchange – between themselves). To verify – the motor operation by the 2-phases supply, only. To follow, the current change, if one phase is disconnected.

2. To verify - the START Motor possibility, if this one is being delta connected; and single-phase supply. For motor – the starting torque can be realized – either by hand; - or either by string (for demanded sense). Note: PLEASE, BE CAREFUL ! To verify – the direction change possibility for rotation.

3. To verify – the starting motor possibility – being delta connected - by using the single-phase power supply system; and the Starting Capacitor is being connected into the third motor phase. To verify – the direction change possibility for rotation, if this Starting Capacitor is being used.

Note:

1. Starting Capacitor can be used the VERY-SHORT-time, only; and NO-so-much frequently!

2. The current – to be limited – the protective resistor is being used; in case the stand-still motor, for the single-phase power supply.

Diagram: