

## Servo drives / AC synchronous motors with U-Drive

The servo motors are three phase synchronous machines with permanent magnets, also known as brushless DC motors

### Technical characteristics

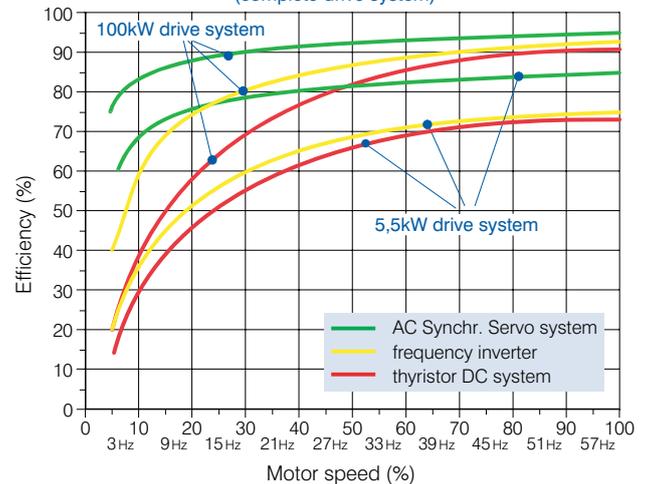
- The  $\cos \varphi$  is approx. 1 - from 0 to max. speed. With an thyristor DC drive system it is about 0 - 0.66%.
- High efficiency from 0.7 - 0.95. In comparison the thyristor DC drive system is about 0.08 - 0.66.
- Very high and nearly constant total efficiency is reached into the speed range of 50 - 100%.
- The load of the line depends on the power and the speed, therefore the result is a low loss in the line wire.
- No problems with line voltage fluctuation in the line; the range of the line voltage is 350-480V, 50/60Hz  $\pm$  10%.
- Simple motor construction, with the same regulation characteristics as a normal DC motor.
- High dynamics due to a low inertia moment.
- Digital feedback, giving very exact speed regulation. The position regulation in slave-operation is absolutely exact.
- Constant torque from 0 - max. speed (no burning of the collector at speed 0).

### Cost savings

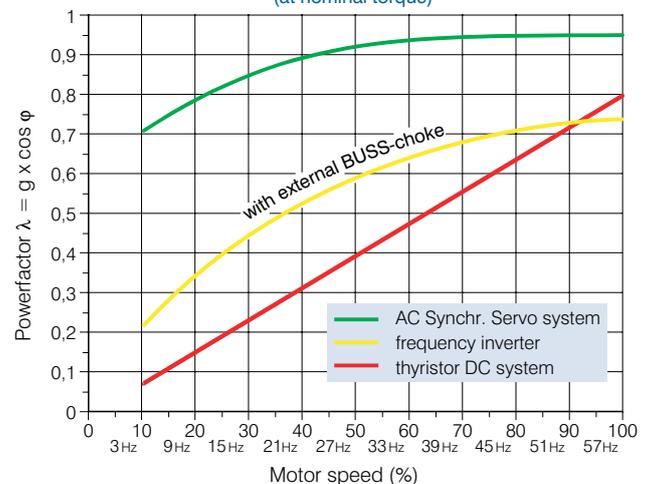
- No extern line choke or DC-choke is needed. Two exactly calculated BUSS-chokes are already integrated into the controller.
- An EMC-filter is also integrated into the controller, therefore no additional installation effort.
- Less personnel is necessary, because the maintenance for brushes, collector and DC tachometer does not occur.
- No need to extend the compensation system. ( $\cos \varphi \approx 1$  by a AC Synchronous Servo drive system)
- No additional costs for expansion or repairing the compensation system.
- High energy savings
- Cost savings with a 100kW AC Synchronous Servo drive system about e 18,000.- within 3 years.

At first sight, the purchase costs for a AC Synchronous Servo drive system are higher. But they amortize within 2 years in saving energy costs, costs for reactive current (compensation system) and for a minor maintenance. From that time on you can say that the drive system earns money for you. *p. t. o.* →

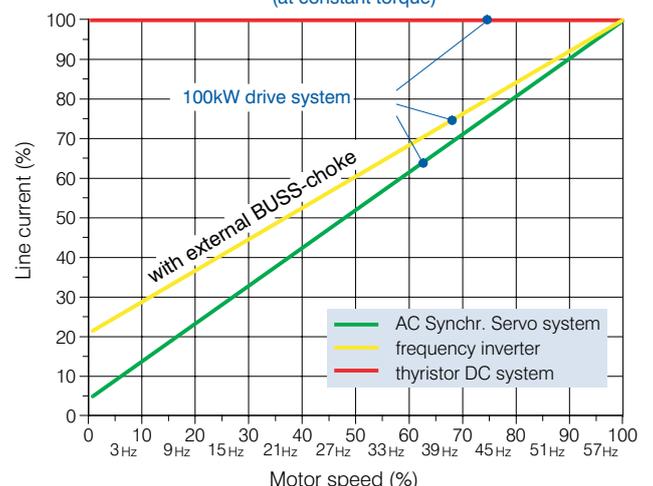
Typical efficiency diagram  
(complete drive system)



Powerfactor vs. motor speed  
(at nominal torque)



Line current vs. motor speed  
(at constant torque)



# AC Synchronous Servo Drive System In Comparison With Conventional Thyristor Controlled DC-Motor Drives

## A calculation of energy cost saving and economical efficiency

Up to now the conventional thyristor controlled DC motor was regarded as the most economic drive system with the least operating costs. The following is a comparison between such a conventional thyristor controlled DC motor and our brushless DC drive system.

Both systems are being compared under identical operating conditions and both systems are using a 100kW system unit.

### Conventional DC-Motor With Thyristor Control

○ Costs for cable installation to the switchboard: ..... Length of cable: 100m (Line supply current 260A) cross-section of cable 120mm square	2.300,- €
○ Current consumption at 70% max. speed and 100% load, 24 hrs, 5,5 days a week: 1 year = approx. 6800 hrs of operation. The system needs approx. 82.4 kW x 6800 hrs = 560.320 kWh Based on energy costs: € 0,08 per kWh The total costs for energy will be .....	44.825,- €
○ Compensation system for reactive current approx. .... (If such a system is not used, costs for reactive current will be approx. 5.000,- € annually)	5.000,- €
○ Costs for maintenance (brushes, collector, DC tachometer etc.) approx.....	2.000,- €
<b>This results in total operating costs (excluding the purchase price) of approx. ....</b>	<b>p.a. 54.125,- €</b>

### TAE AC Synchronous Servo Drive System

○ Costs for cable installation to the switchboard: ..... Length of cable: 100m (Line supply current 175A) cross-section of cable 70mm square	1.700,- €
○ Current consumption at 70% max. speed and 100% load, 24 hrs, 5 days a week: 1 year = approx. 6800 hrs of operation. The system needs approx. 76 kW x 6800 hrs = 516.800 kWh Based on energy costs: € 0,08 per kWh The total costs for energy will be .....	41.344,- €
○ Compensation system for reactive current is not necessary .....	0,- €
○ No costs for maintenance (brushes, collector, DC tachometer etc.) .....	0,- €
<b>This results in total operating costs (excluding the purchase price) of approx. ....</b>	<b>p.a. 43.044,- €</b>

The total operating costs of a 100kW drive system in 3 years	for the conventional DC drive system .....	147.775,- €
	for the brushless DC drive system .....	125.732,- €

This results in a cost saving of

**22.043,- €**

Cost savings with a 50kW drive system approx **11.000,- €**      Cost savings with a 200kW drive system approx **44.000,- €**

If lower speeds are requested during the operating process, the savings will accordingly be higher.