SyncPos Motion Controller
VLT 5000 synchronising/positioning option

The SyncPos motion controller for VLT 5000 is an integrated synchronising and positioning controller.

One controller can synchronise two axes. When using the virtual master function and multiple controllers it is possible to synchronise up to 32 axes (even more when using repeaters).

The position controller is a single axis controller which can perform relative or absolute positioning.

In addition to the synchronising and positioning functions the programmable controller can perform PLC like functions.

The SyncPos motion controller can be delivered as:
- Separate option card for updating VLT 5000 or
- Build into the VLT 5000

Ordering details can be found in the VLT 5000 Design Guide.

Synchronising of multiple axes using the virtual master function

Application examples

The SyncPos motion controller combined with the dynamic performance of VLT 5000 opens new possibilities for using frequency converters in a wide range of applications as for example:

- Bottle washing machines
- Palletizers
- Packaging machines
- Cranes
- Positioning on the fly for e.g. filling, cutting, spray painting and drilling
- Indexing tables
- Storage systems
- Pick and Place systems
- Vibrating tables
- Material handling
- Film wrapping
- Conveyors
Function overview

General features
- Coverage of the entire VLT 5000 series; power range 0.37-500kW, voltage range 200V-500V.
- Use of standard AC motors
- Motion controller fits inside the VLT 5000 drive to preserve IP/NEMA rating
- No extra panel space required
- Standard user interface - settings and messages via the VLT 5000 local control panel
- Utilizes the VLT 5000 series’ field bus options, including PROFIBUS, DeviceNet and Interbus
- Smooth change between three control modes: Closed loop speed control, synchronizing and positioning
- Standard incremental and absolute encoder interface (RS422, line driver) up to 220 kHz
- Improved encoder resolution thanks to quadrature signals

Synchronizing functions
- Speed synchronizing
- Position (angle) synchronizing, with or without marker correction
- On-line adjustable gear ratio
- On-line adjustable position (angle) offset
- Encoder output with virtual master function for synchronization of multiple slaves

Positioning functions
- Home function
- Absolute positioning
- Relative positioning
- Marker related positioning
- Programmable speed profiles
- Hardware and software end limits

Programmable controller functions
Easy-to-use high level programming language (BASIC-like) featuring:
- Definition of user parameters on VLT 5000 local control panel
- Handling of digital and analog I/O
- Read/write access to VLT 5000 parameters
- Conditional/unconditional jumps
- Calculation, comparison, bit manipulation and logical gating
- Error handling routine
- Digital input interrupts
- Time controlled interrupts

Windows based programming software featuring:
- Graphical PID controller optimizing tool
- Position teach-in function
- Parameter settings
- Program single stepping for debugging
- On-line help/manual
- Test programs

efesotomasyon.com
**Option card layout:**
Option card layout showing the position of connectors and dip switch.

**Input/Output data:**
The control card inputs and outputs can be allocated for the SyncPos application program. Together with the inputs and output of the SyncPos option card the available programmable inputs and outputs are thus:

2 Encoder inputs (one can be used as output).
3 Analogue inputs.
16 Digital inputs.
8 Digital outputs.
2 Digital/analogue outputs.
2 Relay outputs.

Detailed specification of the control card inputs and outputs can be found in the VLT 5000 design guide.
## Technical data, continued

**Terminals:**
- Type: Plugs with screw connections
- Maximum cable size: 1.3 mm² (AWG 16)

**Digital inputs, MK3A:**
- Number of inputs which are used by SyncPos program: 8
- Terminal designations: I1 – I8
- Voltage level: 0 – 24 V DC (PNP positive logic)
- Voltage threshold logical “0”: 6 V DC
- Voltage threshold logical “1”: 13.5 V DC
- Maximum voltage: 28 V DC
- Input impedance: 3 kΩ
- Min. pulse duration (ON INT): 1 msec

Galvanic isolation: All digital inputs are galvanically isolated by means of optocouplers, but with the same common as the digital outputs.

**Digital outputs, MK3C:**
- Number of outputs which are used by SyncPos program: 8
- Terminal designations: O1 – O8
- Voltage level: 0 – 24 V DC
- Maximum load: 0.7 A (with external power supply)
- Update rate: 1 msec

Galvanic isolation: All digital outputs are galvanically isolated by means of optocouplers, but with the same common as the digital inputs.

**External 24 V DC supply:**
(see VLT 5000 manual, page 10)

**Encoder input 1, MK3B (master):**
- Terminal designations: A1, A1, B1, B1, Z1, Z1.
  - Incremental:
    - Signal level: 5 V differential
    - Signal type: Linedriver, RS 422
    - Input impedance: 12 kΩ (Dip switch 1.1-4 = OFF)
  - Absolute:
    - Signal level: 5 V differential
    - Signal type: SSI
    - Data coding: Gray code
    - Data length: 25 bit
    - Parity: none
    - Clock frequency: 105 or 262 kHz
    - Protocol: Gray
    - Maximum positions per revolution: 8192
    - Maximum number of revolutions: 4096
Encoder input 2, MK3D (slave):

Terminal designations ................................................................. A2, A2, B2, B2, Z2, Z2

Incremental:
Signal level ................................................................................. 5 V differential
Signal type ...................................................................................... Linedriver, RS422
Input impedance ................................................................. 140 Ω
Maximum frequency ................................................................. 220 kHz (at 50 % duty cycle)
Phase displacement between A and B ...................................... 90° ±30°

Absolute:
Signal level ................................................................................. 5 V differential
Signal type ...................................................................................... SSI
Protocol ......................................................................................... Gray code
Data length .................................................................................... 25 bit
Parity .............................................................................................. none
Clock frequency ................................................................. 105 or 262 kHz
Maximum positions per revolution ........................................... 8192
Maximum number of revolutions ............................................. 4096

Encoder output, MK3B:

Terminal designations ................................................................. A1, A1, B1, B1, Z1, Z1

Signal type ...................................................................................... Linedriver, RS485
Maximum frequency ................................................................. 150 kHz
Minimum frequency ................................................................. 150 Hz
Maximum number of slaves ..................................................... 31 (more when using repeaters)
Maximum cable length .............................................................. 400 m

Dip switch 1.1 - 1.5

<table>
<thead>
<tr>
<th>Switch designation</th>
<th>OFF</th>
<th>ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Option card must be supplied from an external power supply (24 V)</td>
<td>Option card is supplied from control card (24 V)</td>
</tr>
<tr>
<td>1.2</td>
<td>Terminating resistor not connected (Z channel)</td>
<td>Terminating resistor connected (Z channel)</td>
</tr>
<tr>
<td>1.3</td>
<td>Terminating resistor not connected (B channel)</td>
<td>Terminating resistor connected (B channel)</td>
</tr>
<tr>
<td>1.4</td>
<td>Terminating resistor not connected (A channel)</td>
<td>Terminating resistor connected (A channel)</td>
</tr>
<tr>
<td>1.5</td>
<td>Option card must be supplied from an external power supply (Common)</td>
<td>Option card is supplied from control card (Common)</td>
</tr>
</tbody>
</table>

Default setting of switch 1.1 - 1.5 is ON.

SW. 1.2, 1.3 and 1.4 applies only to MK3B (the master encoder interface).

NB!
When using the virtual master function termination must be switched off (sw 1.2-1.4) in all options except on the first and the last station connected in the network.
Supply voltages:
The option card is supplied by the internal 24 V DC supply of VLT 5000, but as the available power is limited it can be necessary to use an external 24 V DC supply.
The 24 V DC supply of VLT 5000 can supply a total of 420 mA including the load on the control card (terminal 12, 13 and output 42 and 45).

Each digital input on the option card takes 8 mA. Each digital output on the option card can supply up to 0.7 A (external 24V-supply) depending on the load.
The load from the 24 V supply (internal or external) can be calculated as follows:

\[
\text{8 mA \times \text{number of digital inputs}} + \text{Load on digital outputs} \left(\text{mk3 C, O1 - O8}\right) + \text{load on 5 V supply} \left(\text{mk3 B/D, 5 V/com}\right) + \text{Load on control card} \left(\text{24 V supply, terminal 12/13 and outputs, terminal 42/45}\right)
\]

The 5 V output on the option card is generated from the 24 V supply. The maximum power on the 5 V side is 5 V \times 280 mA = 1.4 W, this corresponds to app. 60 mA on the 24 V side.

When an external 24 V DC voltage source is used the internal 24 V supply from the control card must be disconnected, this is done by opening switch 1.1 and 1.5.

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Connection examples

Incremental Encoder

External Supply/ Digital In/Output

Absolute Encoder

Virtual Master

The terminating resistors on both end of the bus have to be switch on with dip switch SW 1.2-4.
VLT® 5000 SyncPos option

Encoder connection for positioning applications

Encoder connection for master-slave synchronization

Encoder connections for the synchronizing with virtual master.