

## Micro Application Example



# applications & TOOLS

Easy Cabling and Cascading of Drives  
(with S7-224 XP, 4x SINAMICS G110 and TP  
177micro)

**SIEMENS**

Micro Automation Set 26

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## Foreword

Micro Automation Sets are fully functional and tested automation configurations based on A&D standard products for easy, fast and inexpensive implementation of automation tasks in small-scale automation. Each of these Micro Automatic Sets covers a frequently occurring subtask of a typical customer problem in the low-end range.

The sets help you to obtain answers with regard to required products and the question how they function when combined.

However, depending on the system requirements, a variety of other components (e.g. other CPUs, power supplies, etc.) can be used to implement the functionality on which this set is based. Please refer to the respective SIEMENS A&D catalogs for these components.

The Micro Automation Sets are also available by clicking the following link:

<http://www.siemens.de/microset>

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## 1 Application Areas and Usage

### Application Areas

This configuration is mainly intended for applications with several interconnected drives. Requirements for a dynamic speed change or controllable/adjustable speed can easily be met.

This configuration is particularly suitable for:

- Fan groups
- Compressor cascades/groups
- Pump cascades/groups

### Benefits

- All networked drives can be controlled by one central S7-200 CPU.
- Communication between converters can be programmed using prefabricated function blocks, all control functions can be used via a library
- Energy is saved by specific adaptation of the motor output to the output needed
- Protective mechanisms for motor are integrated into SINAMICS G110
- Converter design without a fan which eliminates the need for wearing parts (up to 750W, housing size FS A)
- Bus terminating resistor is integrated into the converter and can be activated using a DIP switch
- Optional availability of the converter with an integrated EMC filter
- A parameter set can be saved and downloaded using a basic operator panel Only the bus address have to be additionally adapted.



**Attention**

**What should be done to prevent electromagnetic interference:**

- Make sure a good conductive connection between the converter and the (grounded) metal mounting plate is provided.
- Ensure all devices in the cabinet are earthed using short earthing lines with a large diameter and are connected to a common earthing point or earthing bar.
- Ensure that the S7-200 CPU connected to the converter is connected to the same earthing or earthing point as the converter using a short line with a large diameter.
- Please use shielded control lines, e.g. a SIEMENS Profibus cable for setting up the RS485 bus
- Run control lines as far separated from power cables in separate installation channels as possible. Crossings between power and control lines should be at 90° angle.
- Connect the protective conductor of the motor to the earth connection (PE) of the respective converter.
- The line ends should be properly terminated and unshielded lines kept as short as possible.

Use shielded lines for motor connections, earth the shielding both on the converter and the motor side using cable clamps.

### 3 Hardware and Software Components

#### Products

Table 3-1

Component	Type	MLFB / Order information	No.	Manufacturer
CPU	S7-CPU 224 XP DC	6ES7 214-2AD23-0XB0	1	SIEMENS A&D
Micro panel	TP 177micro	6AV6640-0CA01-0AX0	1	
Power supply	LOGO! Power 24V 1.3A	6EP1331-1SH02	1	
Converter	SINAMICS G110 120W without filter; USS version, FS A,	6SL3211-0AB11-2UB1	4	
Control device SINAMICS	BOP	6SL3255-0AA00-4BA0	min. 1	
Low-voltage motor	4-pole, aluminum frame, 120W	1LA7060-4AB10	4	

**Note** For alternative usage of the CPU type 224 XP AC (6ES7214-2BD23-0XB0) the power unit LOGO! Power is not necessary. The Micro Panel can in this case be supplied via the CPU.

#### Accessories

Table 3-2

Component	Type	MLFB / Order information	No.	Manufacturer
Profibus cable (to connect the converter to the controller)	PB FC standard, 2-wire bus line, shielded, delivery packaging: Max. 1000m, minimum quantity: 20m (supplied by the meter)	6XV1830-0EH10	Length [m]	SIEMENS A&D
PROFIBUS connector	with PG connection	6ES7972-0BB12-0XA0	1	
Adapter	for attachment of the SINAMICS converter FS A to the top hat rail	6SL3261-1BA00-0AA0	(optional)	
Filter (e.g. for operation at the FI protective switch)	for low leakage currents	6SE6400-2FL01-0AB0	(optional)	
Inductor	Commutation inductor	6SE6400-3CC00-4AB3	(optional)	
Cable TP ↔ S7-200	Connecting cable 839-1T for PROFIBUS	6XV1830-1CH30	1	
Connecting cable PG/PC ↔ S7-200 CPU (alternative)	PC/PPI cable (COM connection)	6ES7901-3CB30-0XA0	1	
	USB/PPI cable (COM connection)	6ES7901-3DB30-0XA0		
	MPI cable (connection via CP)	6ES7901-0BF00-0AA0		
Stripping tool	PB FC Stripping Tool	6GK1905-6AA00	1	
	Spare blade cassettes (5 pcs.)	6GK1905-6AB00	Optional	

**Note** When simultaneously connecting PG/PC and TP 177micro (and frequency converters) to the controller, do not use the "TP 177micro to CPU" connecting cable specified in the 'Accessories' list. A Profibus cable must be prepared individually. Order two Profibus connectors instead of only one specified in the "Accessories" list and correspondingly more Profibus cable as well.

**Note**

The configuration, as it is, is intended for industrial application. For energy supply, industrial networks are usually implemented. It is therefore not necessary to use special filters/inductors with low leakage currents. If the configuration is used in sensible electricity networks (e.g. PCs on the same network), filters or inductors should be used.

### Configuration software/tools

Table 3-3

Component	Type	MLFB / Order information	No.	Manufacturer
STEP 7Micro/WIN	V4.0	<a href="#">6ES7810-2CC03-0YX0</a>	1	SIEMENS A&D
S7-200 Instruction Library	USS protocol	6ES7830-2BCC00-0YX0	1	
WinCC flexible	WinCC flexible 2005 Micro <sup>1</sup>	6AV6610-0AA01-1CA8 <sup>2</sup>	1	

<sup>1</sup> The product variant "WinCC flexible 2005 **Micro**" represents a minimum requirement.

<sup>2</sup> Update of "WinCC flexible 2004 Micro" to "WinCC flexible 2005 Micro" possible (6AV6610-0AA01-1CE8).

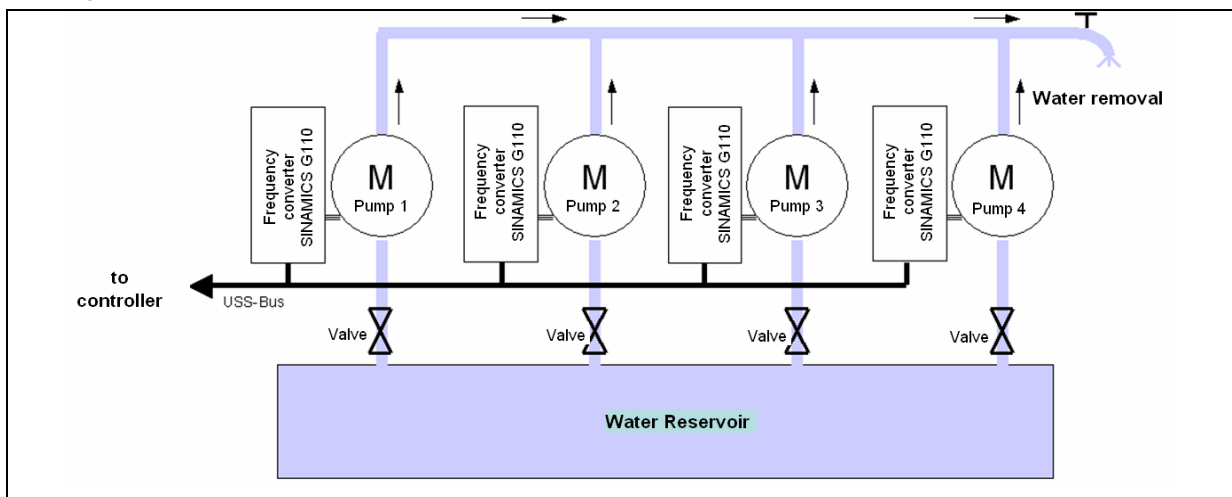
### 4 Function Principle

The configuration consists of a S7-224 XP CPU and four SINAMICS G110 drives. Visualisation is provided through TP 177micro.

All SINAMICS G110 drives are coupled to the S7-224 XP CPU through a serial RS485 interface on which the USS protocol is operated. The S7-224 XP CPU controls each individual inverter depending on the desired performance. This enables successively switching on the drives or controlling the speed.

Moreover, precise dosing and energy-saving response are thus enabled depending on the need. See following figures (an applicative example of water supply):

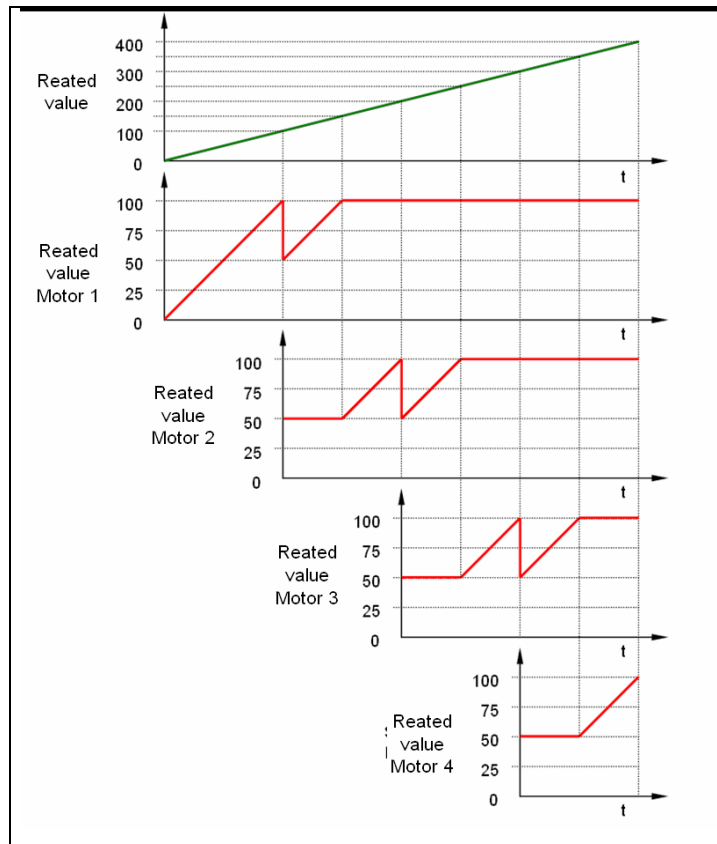
Figure 4-1



The following figure shows the setpoint value of water removal, represented in the first diagram in green. The four further diagrams show the four setpoint values of individual drives (red) depending on the setpoint value of water removal.

*(The diagrams only show the setpoint values specified by the S7-200 CPU for the frequency inverters. The converters use ramps parameterizable for the start and slowdown)*

Figure 4-2



The peaks of the setpoint values for individual motors result from the fact that a motor operation at a low speed is avoided.

If, for example, a total setpoint of 105% is predefined, motor 1 does **not** run at 100% and motor 2 at 5%, it rather means that motor 1 operates at 55% and motor 2 at 50%.

## 5 Configuring the Startup Software

### 5.1 Preliminary Remarks

For startup we offer you software examples with test code and test parameters as a download. The software examples support you during the first steps and tests with your Micro Automation Sets. They enable quick testing of hardware and software interfaces between the products described in the Micro Automation Sets.

The software examples are always assigned to the components used in the set and show their basic interaction. However, they are not real applications in the sense of technological problem solving with definable properties.

### 5.2 Download of the startup code

The software examples are available on the HTML page from which you downloaded this document.

Table 5-1

No.	File name	Content
1	Set26_HMI_V1d1_en.zip	WinCC flexible project
2	Set26_S7-200_V1d1_en.mwp	STEP7 Micro/Win project

### 5.3 Configuring components

#### Note

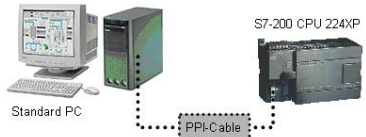
It is assumed here that the necessary software has been installed on your computer and that you are familiar with handling the software. Furthermore it is assumed, that Micro/Win has been installed on the standard Windows PC for operator control.

#### Warning

**Please carefully read all safety and warning notices given in the operating instructions on the converter and all warning labels attached to the device before doing any installation and commissioning procedures. Please maintain warning labels in a legible condition and do not remove them from the device.**


### Configuring S7-200 with MicroWin Project

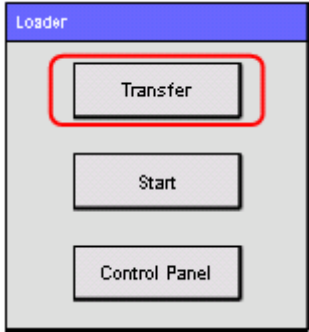
Table 5-2

No.	Function	Note																
1.	Connect all components with to the power supply and wire the converters with the controller as illustrated in the layout diagram. Do not connect Touch Panel TP 177micro to interface 1 of the CPU as yet.																	
2.	<ul style="list-style-type: none"> <li>Connect your development system (PG/PC) to the <b>S7-200</b> CPU according to the interface available via the connection cable in Table 3-2. When using the PC/PPI or the USB/PPI cable the respective local connection (COMx, USB) must be selected in <b>STEP7 Micro/WIN</b>.</li> <li>DIP switches of the PPI-cable have to be set as follows:</li> </ul> <table border="1" style="margin-left: 40px;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td> </tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td> </tr> </table>	1	2	3	4	5	6	7	8	0	0	0	0	1	0	0	0	 <p>Select local connection at "Set PG/PC Interface &gt; Properties &gt; Local connection"</p>
1	2	3	4	5	6	7	8											
0	0	0	0	1	0	0	0											
3.	Open the included <b>S7-200</b> project using <b>STEP7 MicroWin</b>																	
4.	Load the program to the <b>S7-200</b> CPU and restart it.																	

### Configuring SIMATIC TP177micro panel with WinCC flexible

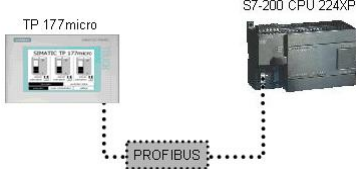
Table 5-3

No.	Instructions	Note																
1	<ul style="list-style-type: none"> <li>Connect <b>TP 177micro</b> to the DC 24V power supply</li> <li>Connect the PC and the <b>TP 177micro</b> with the RS232/PPI cable in Table 3-2 via serial port COM1. When using a different COM interface, this has to be considered accordingly in the transfer properties of the <b>WinCC flexible</b> project.</li> <li>DIP switches of the RS232/PPI-cable have to be set as follows:</li> </ul> <table border="1" style="margin-left: 40px;"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td> </tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	1	2	3	4	5	6	7	8	0	0	0	0	0	0	0	0	
1	2	3	4	5	6	7	8											
0	0	0	0	0	0	0	0											
2	Extract the <b>WinCC flexible</b> project to the hard disk.																	
3	Close the extracted <b>WinCC flexible</b> project.																	

No.	Instructions	Note
4	Turn on the power supply of TP 177micro and after the "bootloader" sequence select the "Transfer" button. The download of the WinCC flexible project can start if a dialog box called "Transfer...." is displayed on the panel.	
5	In <b>WinCC flexible</b> , now start the transfer of the configuration to the <b>TP 177micro</b> .	
6	Close the <b>WinCC flexible</b> project.	

### Starting communication between S7-200 and SIMATIC TP177micro panel

Table 5-4

No.	Function	Note
7	After the <b>S7-200</b> project and the <b>WinCC flexible</b> configuration have been loaded successfully, please connect the <b>S7-200</b> CPU (Port 1) and the <b>TP 177micro</b> via a PROFIBUS cable (e.g. via the 830-1T connecting cable from Table 3-2).	

### Configure the SINAMICS frequency inverter

**Note**

Please note, that each frequency converter in the network must have its individual address (0-3) assigned to it!

A maximum of 31 addresses can be defined for frequency converters.

Table 5-5

Step	Parameter	Index	Value (to be parameterized)	Comment
8				Adjust the position of the DIP switch to 50/60Hz networks before applying the mains voltage
9	P0010		30	Startup parameters on default settings
10	P0970		1	

Step	Parameter	Index	Value (to be parameterized)		Comment
11	P0010		1	Parameters of the quick start	Quick startup
12	P0100		0		Check the parameter setting to suit the DIP switch: Europe 50Hz, power in kW <sup>3</sup>
13	P0304		Motor nameplate		Rated motor voltage
14	P0305				Nominal motor current
15	P0307				Rated motor output
16	P0310				Rated motor frequency
17	P0311				Nominal motor speed
18	P0700		5		Command source (USS)
19	P1000		5		Frequency setpoint value (USS)
20	P1080		0, 0 Hz		Minimum frequency (affects control behavior)
21	P1082		50Hz		Maximum motor frequency
22	P1120		10.00		Startup ramp
23	P1121		10.00		Slowdown ramp
24	P3900		1		End quick startup
25	P0003		3	Access step	
26	P2000		50.00	Reference frequency 50 Hz (1 to 650 Hz)	
27	P2010	0	9	Speed of data transmission: 57600 Baud	
28	P2011	0	0-3	Address (Slave)	
29	P2012	0	2	USS PZD length	
30	P2013	0	127	USS PKW length	
31	P2014	0	300	Communication monitoring: Value 0 without monitoring; protocol must already be running; with "Arrow up" - change button	
32	P0971		1	Save data in E <sup>2</sup> PROM	

### Note

At the beginning and end of the Profibus cable, the terminating resistor must obligatory be switched on. For the frequency inverter, make your selection by operating the DIP switch on the front of INAMICS G110.

<sup>3</sup> These values are preset depending on the position of the DIP switch at the front of the SINAMICS G110 (except for parameter value 2). Details on interaction of P0100 and position of the DIP switch are given in the parameter list of SINAMICS G110. **Parameter value and position of the DIP switch must be related to parameter value 0 and 1!**

## 6 Live Demo

### 6.1 Operation

#### HMI screens

You have 6 HMI screens at your disposal. The following table provides a short description of these screens

Table 6-1

Illustration	Description
Overview/start picture	Overview of setpoint and actual values of the 4 pump stations. The bottom area of all screens is available and enables: the navigation between individual screens and change-over between the manual and automatic operating mode (incl. automatic setpoint)
Pump 1	In the manual operating mode, the setpoint value can be specified for each individual pump. In addition, the current status of the drive is also displayed.
Pump 2	In the manual operating mode, the setpoint value can be specified for each individual pump. In addition, the current status of the drive is also displayed.
Pump 3	In the manual operating mode, the setpoint value can be specified for each individual pump. In addition, the current status of the drive is also displayed.
Pump 4	In the manual operating mode, the setpoint value can be specified for each individual pump. In addition, the current status of the drive is also displayed.
System	System setting of the TP 177micro. e.g. language switching German/English.
Message window	Drive alarm messages and faults are configured as messages, displayed in the message window when on, and must then be acknowledged.

#### Digital inputs

Table 6-2

Address	Meaning
E 0.0	Enable Pump 1
E 0.1	Enable Pump 2
E 0.2	Enable Pump 3
E 0.3	Enable Pump 4
E 0.4	Rotation direction of all pumps (0=positive, 1=negative)
E 0.5	Acknowledge conversion error (all converters)

Address	Meaning
E 0.6	OFF2 ( Input parameter of operation USS_CTRL, 1= all pumps phasing out)
E 0.7	OFF2 ( Input parameter of operation USS_CTRL, 1= all pumps stopping fast)

### Automatic mode

The Startup code enables to specify a setpoint value in the range of 0-400% in automatic mode. The speed of SINAMICS G110 frequency converters is controlled depending on the specified setpoint value. See Figure 4-2: "Setpoint value according to the performance needed".

Micro Automation Set 26

Entry ID 21690362

## 7 Technical Data

### LOGO! Power 24V 1.3A

Parameter	Number/Size/Range	Remarks
Supply Voltage	AC 100-240V	
Output voltage	DC 24V	
Output current	1.3A	
Dimensions (W x H x D) in mm	54 (3 width modules) x 90 x 55	

### SIMATIC S7-CPU 224 XP

Parameter	Number/Size/Range	Remarks
Supply Voltage	DC 20.4 to 28.8 V or AC 85 to 264 V	
Output current, expansion module	340 mA	
Interfaces	2x RS 485, communication interface, expansion bus for modules	
Inputs/outputs	14DE/10DA and 2AE/1AA	
Protection system	IP 20 in acc. w. IEC 529	

### SIMATIC TP 170micro Touch Panel

Parameter	Number/Size/Range	Remarks
Storage	256kB	Flash/RAM
Supply Voltage	24V (rated current 0.24 A)	DC +18 to +30 V
Clock	Software clock, not battery-backed	can be synchronized by the controller
Dimensions	W x H (mm) 212 x 156	Mounting cutout W x H (mm) 198 x 142
Weight	0.7 kg	

### SINAMICS G110 frequency inverter

Parameter	Number/Size/Range	Remarks
Network	1 AC 200 V up to 240 V $\pm 10\%$	47 to 63 Hz
Output frequency	0 to 650 Hz	
Inverter efficiency		for devices <0.75kW 90% to 94% for devices >0.75 kW >95%
Overload capability	Overload current 1.5 x rated output current	(i.e. 150 % overload) for 60 s, afterwards 0.85 x rated output current for 240 s, cycle time 300 s
Digital inputs	3	
Digital output	1	electrically isolated optocoupler output (DC 24 V, 50 mA, Ohm-type, NPN-type)
Protection system	IP20	

### Motor 230V/400V $\Delta/Y$ 50Hz 0.12kW

Parameter	Number/Size/Range	Remarks
Rated speed	1350min <sup>-1</sup>	
Performance factor cos $\varphi$	0,75	
Rated current at 230V	0.73A	
Rated torque	0.85Nm	
Moment of inertia	approx. 0.00029kgm <sup>2</sup>	
Weight	Approx. 4.0kg	Design B3