

The Siemens logo is displayed in a bold, teal, sans-serif font.

SIEMENS

Ingenuity for life

A man in a light blue shirt is seen from the side, looking at a tablet. The background is a blurred industrial factory setting. Overlaid on the image are various digital graphics: a '24/7' icon with a circular arrow, a 'NEWS' icon with a person silhouette, a 'Home' icon with a house, and a 'Industry Online Support' icon with a network diagram. A large teal box contains the main title.

S7-200 Smart USS Communication with SINAMICS V20

S7-200 SMART V2.4

<https://new.siemens.com/in/en/products/automation/systems/industrial/plc/simatic-s7-200-smart.html>

Siemens
Industry
Online
Support



Legal information

Use of application examples

Application examples illustrate the solution of automation tasks through an interaction of several components in the form of text, graphics and/or software modules. The application examples are a free service by Siemens AG and/or a subsidiary of Siemens AG ("Siemens"). They are non-binding and make no claim to completeness or functionality regarding configuration and equipment. The application examples merely offer help with typical tasks; they do not constitute customer-specific solutions. You yourself are responsible for the proper and safe operation of the products in accordance with applicable regulations and must also check the function of the respective application example and customize it for your system.

Siemens grants you the non-exclusive, non-sub licensable and non-transferable right to have the application examples used by technically trained personnel. Any change to the application examples is your responsibility. Sharing the application examples with third parties or copying the application examples or excerpts thereof is permitted only in combination with your own products. The application examples are not required to undergo the customary tests and quality inspections of a chargeable product; they may have functional and performance defects as well as errors. It is your responsibility to use them in such a manner that any malfunctions that may occur do not result in property damage or injury to persons.

Disclaimer of liability

Siemens shall not assume any liability, for any legal reason whatsoever, including, without limitation, liability for the usability, availability, completeness and freedom from defects of the application examples as well as for related information, configuration and performance data and any damage caused thereby. This shall not apply in cases of mandatory liability, for example under the German Product Liability Act, or in cases of intent, gross negligence, or culpable loss of life, bodily injury or damage to health, non-compliance with a guarantee, fraudulent non-disclosure of a defect, or culpable breach of material contractual obligations. Claims for damages arising from a breach of material contractual obligations shall however be limited to the foreseeable damage typical of the type of agreement, unless liability arises from intent or gross negligence or is based on loss of life, bodily injury or damage to health. The foregoing provisions do not imply any change in the burden of proof to your detriment. You shall indemnify Siemens against existing or future claims of third parties in this connection except where Siemens is mandatorily liable.

By using the application examples, you acknowledge that Siemens cannot be held liable for any damage beyond the liability provisions described.

Other information

Siemens reserves the right to make changes to the application examples at any time without notice. In case of discrepancies between the suggestions in the application examples and other Siemens publications such as catalogs, the content of the other documentation shall have precedence.

The Siemens terms of use (<https://support.industry.siemens.com>) shall also apply.

Security information

Siemens provides products and solutions with Industrial Security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit <https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at: <https://www.siemens.com/industrialsecurity>.

Table of contents

Legal information	2
1 Task	4
1.1 Overview of the automation task.....	4
1.2 Sequence control	5
2 Automation solution.....	6
2.2 Hardware and software components used.....	6
2.3 Setup	7
3 Functional mechanisms.....	8
3.2 USS protocol	8
3.3 Communication program	9
4 Commissioning	14
4.1 Installing and wiring the hardware.....	14
4.2 Downloading the SIMATIC program	15
4.3 V20 commissioning	18
5 Operation	24
5.1 Jog reverse.....	24
5.2 Jog forward.....	25
5.3 Auto mode	26
6 Appendix	27
6.1 Service and support	27
6.2 Application support.....	28
6.3 Links and literature	28
6.4 Change documentation	28

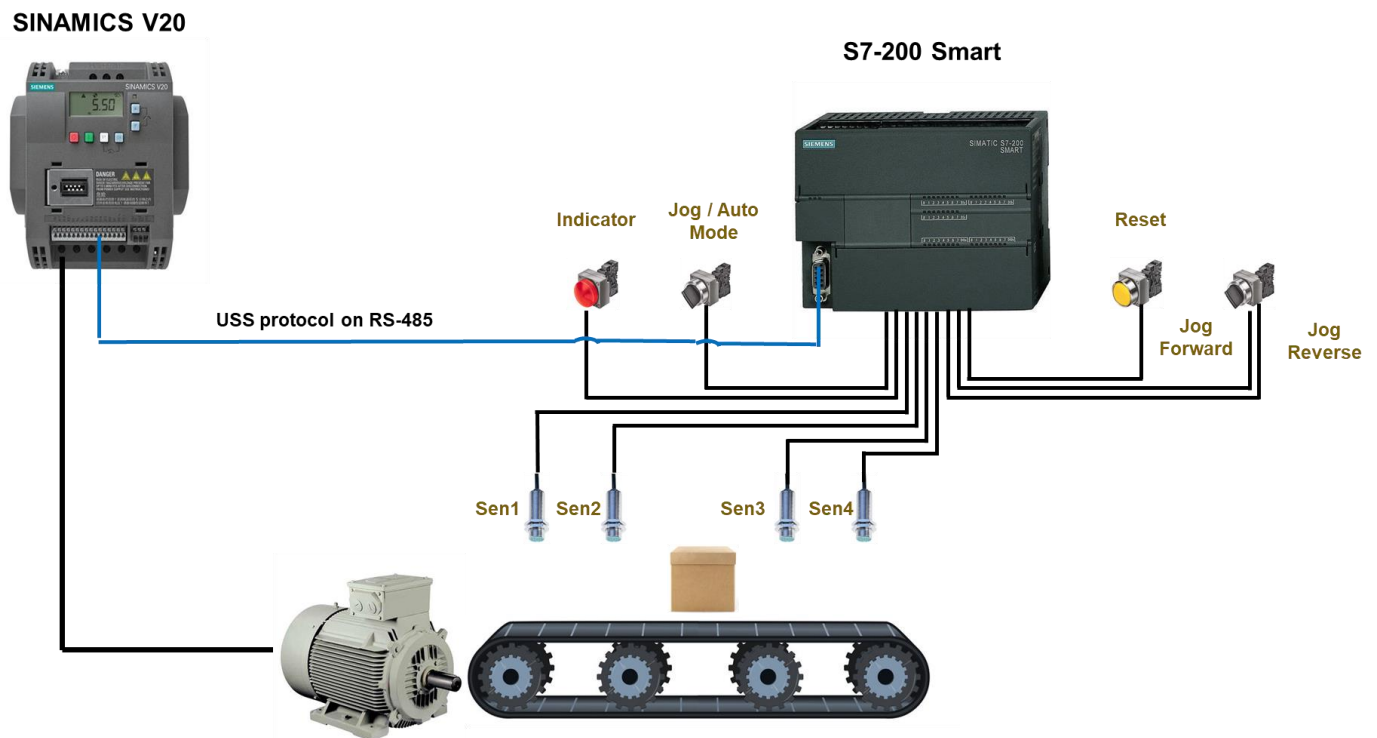
1 Task

Communication between an inverter and a PLC is often required in a diversity of general motion control applications. Taking reciprocating motions for example, communication between a controller (S7-200 Smart) and a frequency inverter (SINAMICS V20) takes place with the aid of the USS protocol.

1.1 Overview of the automation task

In the application, the inverter controls a motor. The motor controls a toothed belt through a gearbox. A mechanical arm in the toothed belt reciprocates horizontally at a speed set point within the specified range.

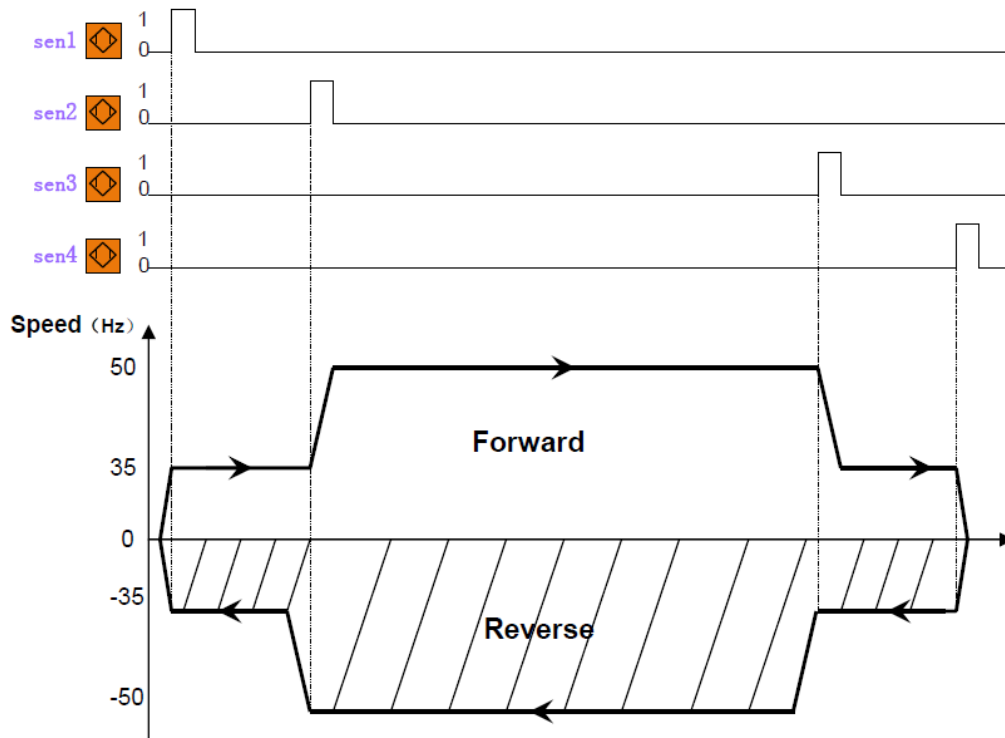
The following figure provides an overview of the automation task:



Note

These sensors used in the application example are inductive BERO proximity switches, which will not cause mechanical wear. Working principle: When the permeable material approaches the switch sensing surface, the magnetic field is subject to decay, causing the change of the output signal of the switch.

1.2 Sequence control



1.2.1 Figure 1-1--- Description of movement

Motion control requirements:

- Switch off the Jog/Auto mode button. Switch on the Jog reverse or Jog forward button and the motor can run at 30Hz.
- Switch on the Jog/Auto mode button, the toothed belt reciprocates between the positions of sen1 and sen4 automatically.
- To improve the stability of the system, there are two deceleration signals sen2 and sen3, the motor speed within the positions of sen2 and sen3 is not less than 50Hz, and the speed is changed to 35Hz in other positions.
- If the drive displays a fault code, the fault light will light. And press the reset button can reset fault light.

Control mode:

- The sensor signals are read into the PLC via digital input modules and the frequency converter is activated accordingly by the PLC.
- PLC deals with these digital inputs and issues commands to the inverter.

2 Automation solution

2.2 Hardware and software components used

2.2.1 Hardware components

No.	Component	Order number	Quantity
1	SIMATIC S7-200 Smart	6ES7288-1ST20-0AA0	1
2	SINAMICS V20, 3AC400V 0.37KW UNFILTERED ^{1*}	6SL3210-5BE13-7UV0	1
3	Transformer(380V/220V) ^{2*}		1
4	Motor 1.1kW	1LA7083-4AA60	1
5	Sensor ^{3*}	3RG40-13-0AG01	4
6	Circuit breaker	3RV1021-1JA10	1
		2RV1021-1JA10	1
7	JOG/AUTO switch button	3SB3602-2KA11	1
	Jog forward/Jog reverse button	3SB3610-2EA11	1
	Reset button	3SB3602-0AA31	1
	Fault light	3SB3644-6BA20	1
8	Ethernet Cable		2
9	RS-485 Terminator	6SL3255-0VC00-0HA0	1

- 1* The SINAMICS V20 order number information given in the table indicates that the mains supply voltage for the inverter is 3AC 380V and the inverter is an unfiltered variant. Some variants of SINAMICS V20 inverters also support the mains supply of 1AC 220V. Select the desired models according to your specific requirements. For more information about order numbers, access the following Web site:
<http://support.automation.siemens.com/CN/view/en/62072319>
- 2* The PLC order number information indicates that the CPU requires a 1AC 220 mains power supply. Select this transformer since in China, the mains supply voltage used in factories are usually 3AC 380V.
- 3* These sensors are inductive BERO proximity switches, rated operating distance is 5mm, dimension is M18*54mm, rated current is 200mA, rated voltage is DC15-34V, protection class is IP67, digital output NO, PNP type.

2.2.2 Software components

User can order these CDs that contain the following software tools:

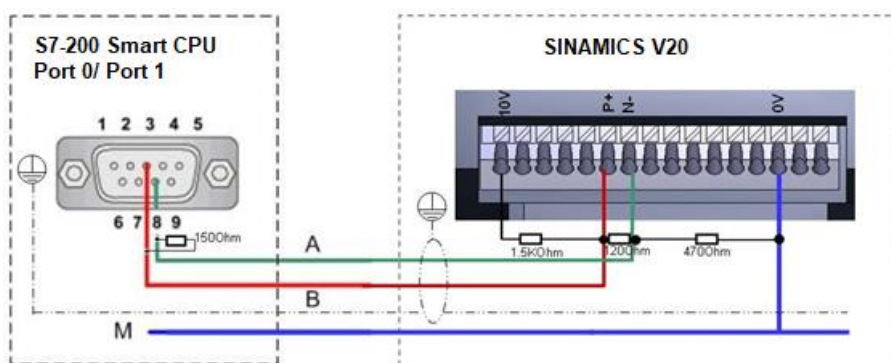
No.	Component	Order number	Quantity
1	STEP7 Micro/WIN SMART 2.4	6ES7288-SW01-0AA0	1

Note

Most of the hardware components shown in the table are commercially available in the global market. If unavailable in your country (or region), find an appropriate substitute at your own discretion.

The table lists key hardware components required for this project. Other accessories such as cables and wires, supports, terminal strips, and so on can be purchased separately.

2.3 Setup



2.3.1 Figure 2-1 Bus connection

Note

The SINAMICS V20 supports communication with Siemens PLC over USS on RS485. You can parameterize whether the RS485 interface shall apply USS protocol. USS is the default bus setting. A screened twisted pair cable is recommended for the RS485 communication.

Make sure that you terminate the bus correctly by fitting a 120 R bus termination resistor between the bus terminals (P+, N-) of the device at one end of the bus and a termination network between the bus terminals of the device at the other end of the bus. The termination network should be a 1.5 k resistor from 10 V to P+, 120 R from P+ to N- and 470 R from N- to 0 V. A suitable termination network is available from your Siemens dealer.

3 Functional mechanisms

3.2 USS protocol

The USS protocol was developed in order to exchange process data between a master and one or more slave stations on an RS485 bus. Each bus station is identified by a unique bus address.

The STEP7-Micro/WIN SMART Instruction Libraries provide subroutines, interrupt routines, and instructions to support the USS protocol.

The USS protocol is an interrupt driven application. In the worst case, the receive message interrupt routine requires up to 2.5 ms to execute. During this time, all other interrupt events are queued for service after the receive message interrupt routine has been executed. If your application cannot tolerate this worst case delay, then you may want to consider other solutions for controlling drives.

Initializing the USS protocol dedicates a S7-200 SMART CPU port for USS communications. You use the USS_INIT instruction to select either USS or PPI for port 0 or port 1. (USS refers to the USS protocol for Siemens drives.) When a port is set to use the USS protocol for communicating with drives, you cannot use the port for any other purpose, including communicating with an HMI. The second communications port allows STEP 7-Micro/WIN SMART to monitor the control program while USS protocol is running.

The USS instructions affect all of the SM locations that are associated with Freeport communication on the assigned port.

The USS subroutines and interrupt routines are stored in your program. The USS instructions increase the amount of memory required for your program by up to 3050 bytes. Depending on the specific USS instructions used, the support routines for these instructions can increase the overhead for the control program by at least 2150 bytes and up to 3050 bytes.

The variables for the USS instructions require a 400-byte block of V memory. The starting address for this block is assigned by the user and is reserved for USS variables.

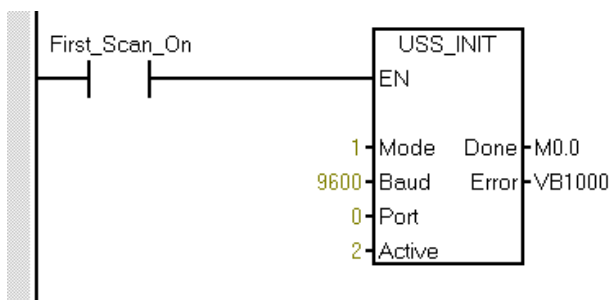
Some of the USS instructions also require a 16-byte communications buffer. As a parameter for the instruction, you provide a starting address in V memory for this buffer. It is recommended that a unique buffer be assigned for each instance of USS instructions.

When performing calculations, the USS instructions use accumulators AC0 to AC3. You can also use the accumulators in your program; however, the values in the accumulators will be changed by the USS instructions.

The USS instructions cannot be used in an interrupt routine.

3.3 Communication program

3.3.1 Initialize interface



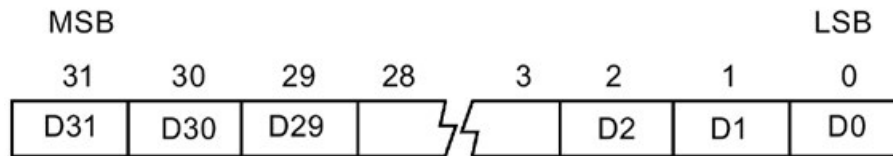
Before sending a command from the controller to a slave, make sure that you activate the initialization of the interface of the S7-200 Smart controller. This is achieved using the USS_INIT block, which among other things fixed the baud rate. The USS_INIT instruction is used to enable and initialize, or to disable Siemens drive communications. Before any other USS instruction can be used, the USS_INIT instruction must be executed without errors. The instruction completes and the "Done" bit is set immediately, before continuing to the next instruction (see Figure 3-1).

3.3.2 Figure 3-1

Input/output	Date Type	Value
EN	BOOL	Initialization is required after every time the communication state is changed. The EN channel should be pulsed to activate this initialization.
Mode	BYTE	Choose communication protocol by using following USS input value. 1: Select USS protocol for port 0. And start using this protocol. 0: Select PPI protocol for port 0. And stop using USS protocol.
Baud	DWORD	Baud rate: 1200, 2400, 4800, 9600, 19200
Port	BYTE	Sets the physical communication port (0 = RS485 integrated in CPU, 1 = RS485 or RS232 located on the optional CM01 signal board)
Active	DWORD	Indicates which drives are active. Some drives only support addresses 0 through 30.
Done	BOOL	After execute USS_INIT instruction Done=1.
Error	BYTE	If something is wrong with executing instructions, an error code is displayed.

3.3.3 Table 3-1 Function block definition

An RS485 bus transmission uses the USS protocol via a 2-wire connection between a master (e.g. CPU ST30) and up to 32 slaves (e.g. SINAMICS V20). It is necessary here to identify each slave via a unique address between 0 and 31.



3.3.4 Figure 3-2

This figure shows the description and format of the active drive input. Any drive that is marked as "Active" is automatically polled in the background to control the drive, collect status, and prevent serial link time-outs in the drive.

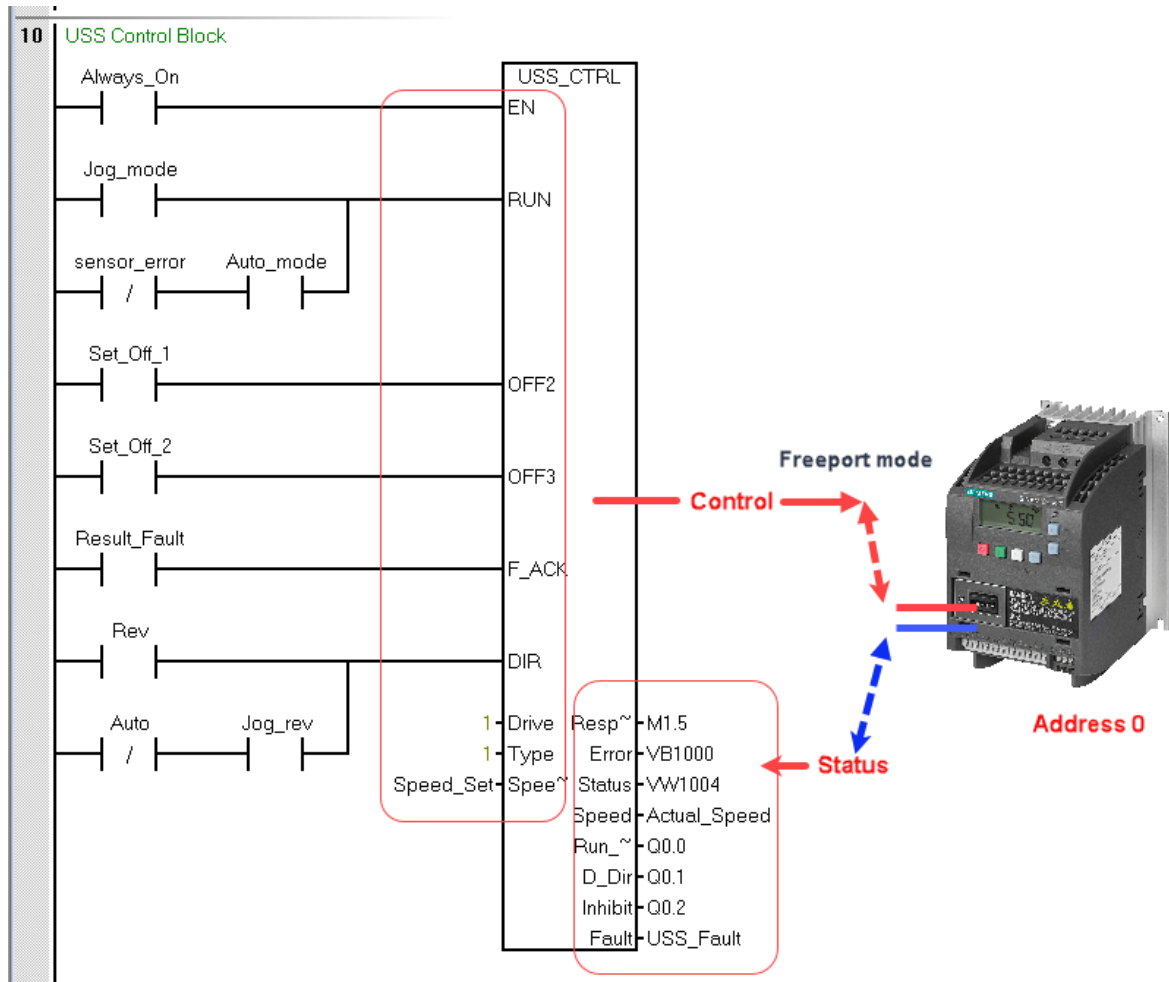
- D0 (Drive 0 active bit):
 - 0 - drive not active
 - 1 - drive active
- D1 (Drive 1 active bit):
 - 0 - drive not active
 - 1 - drive active

3.3.5 USS protocol execution error codes

Error Code	Description
0	No error
1	Drive did not respond.
2	A checksum error in the response from the drive was detected.
3	A parity error in the response from the drive was detected.
4	An error was caused by interference from the user program.
5	An illegal command was attempted.
6	An illegal drive address was supplied.
7	The communications port was not set up for USS protocol.
8	The communications port is busy processing an instruction.
9	The drive speed input is out-of-range.
10	The length of the drive response is incorrect.
11	The first character of the drive response is incorrect.
12	The length character in the drive response is not supported by USS instructions.
13	The wrong drive responded.
14	The DB_Ptr address supplied is incorrect.
15	The parameter number supplied is incorrect.
16	An invalid protocol was selected.
17	USS is active; change is not allowed.
18	An illegal baud rate was specified.
19	No communications: the drive is not ACTIVE.
20	The parameter or value in the drive response is incorrect or contains an error code.
21	A double word value was returned instead of the word value requested.
22	A word value was returned instead of the double word value requested.
23	Invalid port number
24	Signal board (SB) port 1 is missing or not configured.

3.3.6 USS control block

The inputs of the USS_CTRL function block are used to control the inverter and set the desired speed. The inverter status signals are provided by the outputs of the USS_CTRL block. The **USS_CTRL** (port 0) or **USS_CTRL_P1** (port 1) instruction is used to control an ACTIVE Micro Master drive. The USS_CTRL instruction places the selected commands in a communication buffer, which is then sent to the addressed drive (DRIVE parameter), if that drive has been selected in the ACTIVE parameter of the USS_INIT instruction. Only one USS_CTRL instruction should be assigned to each drive.



3.3.7 Figure 3-2

- The **EN** bit must be on to enable the USS_CTRL instruction. This instruction should always be enabled.
- **RUN** (RUN/STOP) indicates whether the drive is ON (1) or OFF (0). When the RUN bit is on, the Micro Master drive receives a command to start running at the specified speed and direction. In order for the drive to run, the following must be true:
 - DRIVE must be selected as ACTIVE in USS_INIT.
 - **OFF2** and **OFF3** must be set to 0.
 - **FAULT** and **INHIBIT** outputs must be 0.
- When **RUN** is off, a command is sent to the Micro Master drive to ramp the speed down until the motor comes to a stop. The OFF2 bit is used to allow the Micro Master drive to coast to a stop. The OFF3 bit is used to command the Micro Master drive to stop quickly.

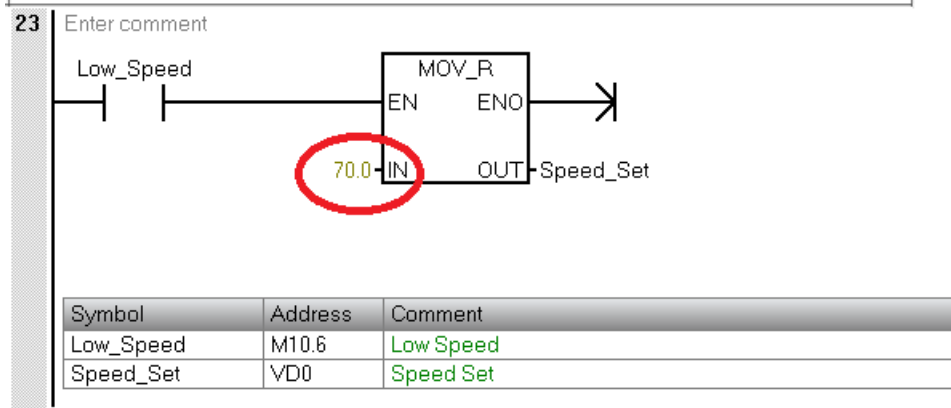
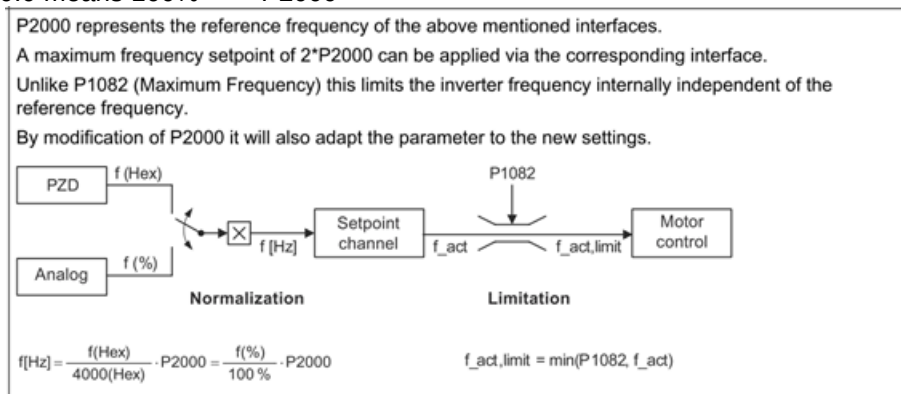
- The **F_ACK** (Fault Acknowledge) bit is used to acknowledge a fault in the drive. The drive clears the fault (Fault) when F_ACK goes from 0 to 1.
- The **DIR** (direction) bit indicates in which direction the drive should move.
- The **Drive** (drive address) input is the address of the Micro Master drive to which the USS_CTRL command is to be sent. Valid addresses: 0 to 31
- The **Type** (drive type) input selects the type of drive. For a Micro Master 3 (or earlier) drive, set Type to 0. For a Micro Master 4 drive, set Type to 1.
- **Speed_SP** (speed setpoint) is drive speed as a percentage of full speed. Negative values of Speed_SP cause the drive to reverse its direction of rotation. Range: -200.0% to 200.0%.

The inputs of speed: The speed setpoint is a percentage of the full speed, and the full speed can be set with P2000. Furthermore, the value of $P2000 \leq P1082$.

- P2000 represents the reference frequency for frequency values which are displayed and transferred as a percentage or a hexadecimal value.
- P1082 represents the maximum frequency. Set maximum motor frequency at which motor runs irrespective of the frequency setpoint. The value set here is valid for both clockwise and anticlockwise rotations.

Detail of speed signal:

- Hexadecimal 4000H means 100 % ==> P2000
- Real 100.0 means 100% ==> P2000



3.3.8 Figure 3-3

For example, the speed_set register is VD0, and we set $P2000=50\text{Hz}$

If you assign 70.0 to VD0, the actually speed setpoint will be $(70\%/100\%) \cdot 50 = 35\text{Hz}$.

- **Fault** indicates the state of the fault bit (0 - no fault, 1 - fault). The drive displays the fault code. (Refer to the manual for your drive). To clear the Fault bit, correct the cause of the fault and turn on the F_ACK bit.
- **Inhibit** indicates the state of the inhibit bit on the drive (0 - not inhibited, 1 - inhibited). To clear the inhibit bit, the Fault bit must be off, and the RUN, OFF2, and OFF3 inputs must also be off.
- **D_Dir** indicates the drive's direction of rotation.
- **Run_EN** (RUN enable) indicates whether the drive is running (1) or stopped (0).
- **Speed** is drive speed as a percentage of full speed. Range: -200.0% to 200.0%
- **Status** is the raw value of the status word returned by the drive.
- **Error** is an error byte that contains the result of the latest communication request to the drive. The linstructions, topic defines the error conditions that could result from executing the instruction.
- The **Resp_R** (response received) bit acknowledges a response from the drive. All the Active drives are polled for the latest drive status information. Each time the S7-200 receives a response from the drive, the Resp_R bit is turned on for one scan and all the following values are updated

Input/Output	Date Type	Value
EN	BOOL	Generally activated.
RUN	BOOL	Indicate the state of drive, activated (1) or forbidden (0).
OFF2	BOOL	Allow V20 taper off.
OFF3	BOOL	Allow V20 fleetly stop.
F_ACK	BOOL	Reset V20 failure.
DIR	BOOL	V20 turning direction 0: Anticlockwise 1: Clockwise
Drive	BYTE	V20 address 0-31
Type	BYTE	Select the type of drive. For V20 drive, set Type to 1.
Speed_SP	REAL	Drive speed as a percentage of full speed. REAL:-200~~200/-200~~200%, if negative value, V20 reverse
Resp_R	BOOL	Poll V20, when scan=1, update following value.
Error	BYTE	Wrong word. Look for: Error of executing USS instruction.
Status	WORD	V20 return to state value.
Speed	REAL	V20 actually speeds as a percentage of full speed. Range:-200.0% to 200.0%.
Run_EN	BOOL	V20 run state 1: run; 0: stop
D_DIR	BOOL	V20 turning direction 0: anticlockwise ;1: clockwise
Inhibit	BOOL	State of V20 forbidden position 0: start; 1: forbidden
Fault	BOOL	Indicate state of fault. Refer to V20 error list to confirm error

3.3.9 Table3-2 Function block definition

Note

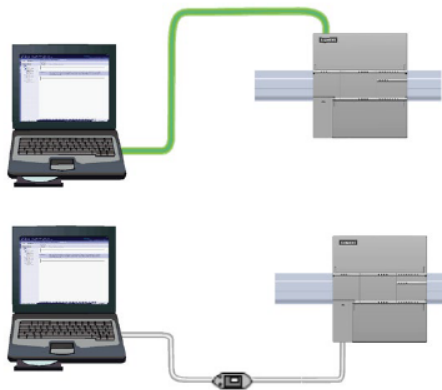
To clear forbidden positions, make sure you clear the active faults RUN, OFF2, OFF3 inputs also need be cleared. After error cleared, set F_ACK to clear Fault.

4 Commissioning

4.1 Installing and wiring the hardware

4.2.1 The USS protocol allows only one master which does not require an assigned address.

A CPU can communicate with a STEP 7-Micro/WIN SMART programming device on two types of communications networks:



A CPU can communicate with a STEP 7-Micro/WIN SMART programming device on an Ethernet network.

A CPU can communicate with a STEP 7-Micro/WIN SMART programming device on an RS485 network.

4.2.2 Figure 4-1 Configuring S7-200 with Micro/WIN SMART Project

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 STEP7 Micro/WIN SMART has been installed on the standard Windows PC for operator control.

CAUTION

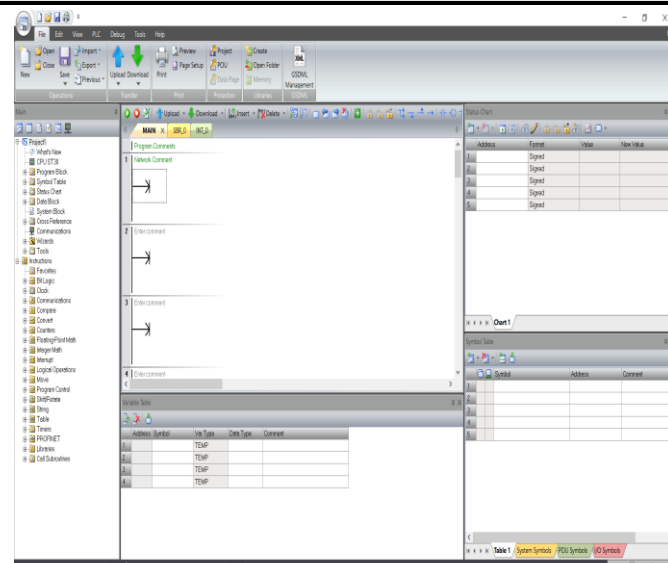
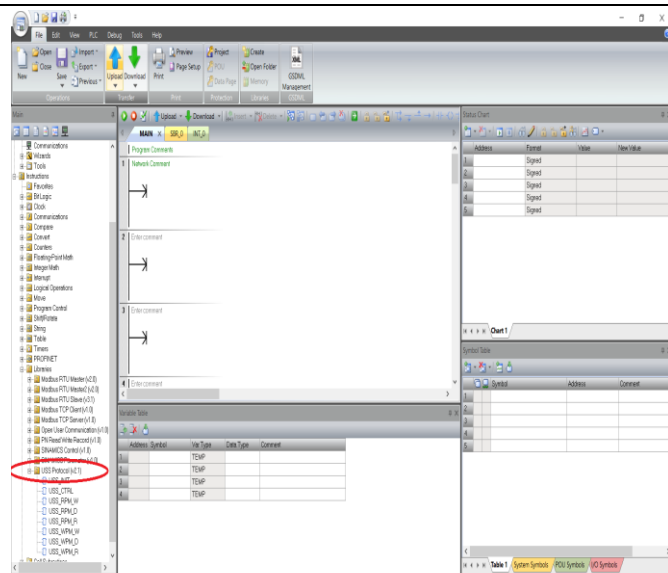
Please make sure that the reader clearly realizes

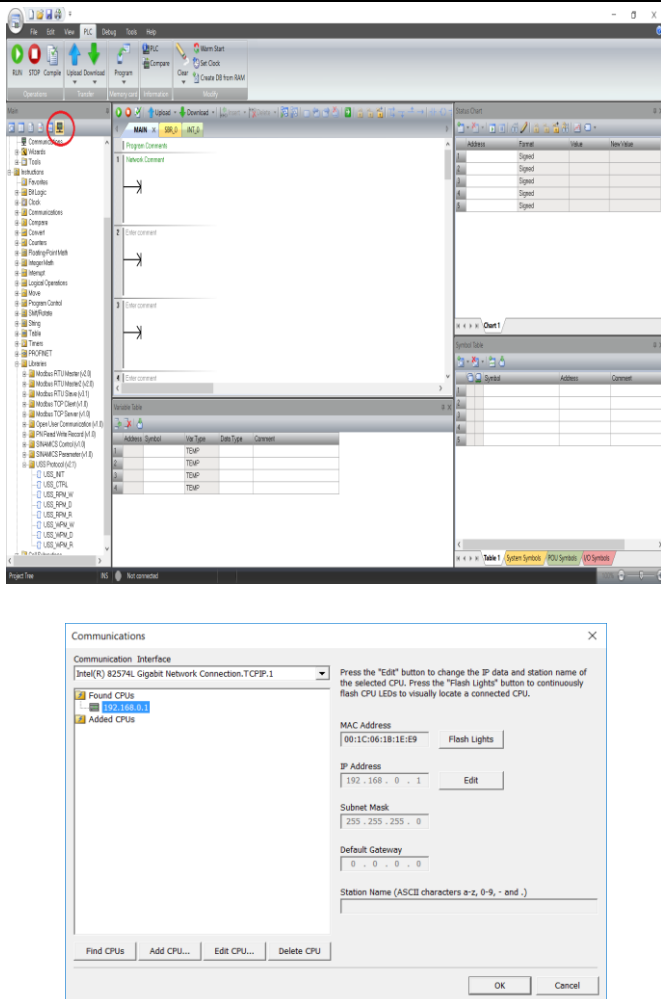
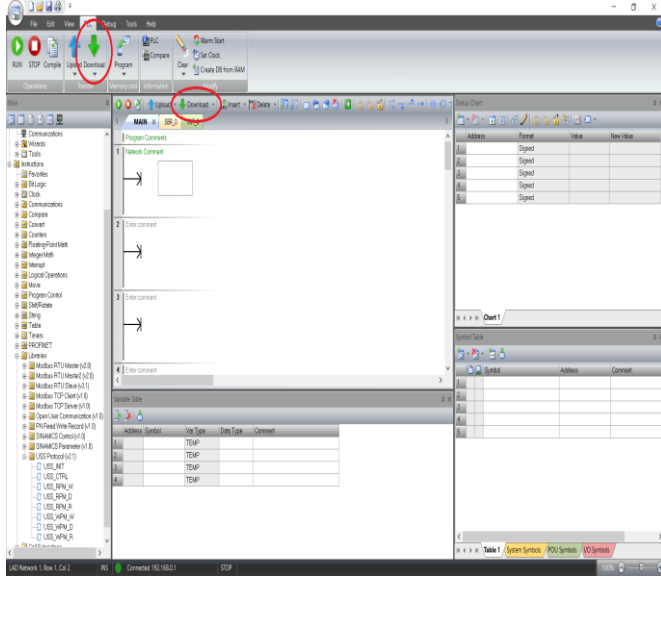
Please carefully read all safety and warning notices given in the operating instructions on the frequency converter and all warning labels attached to the device before doing any installation and commissioning procedures. Please maintain warning labels in a legible condition and do not remove them from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

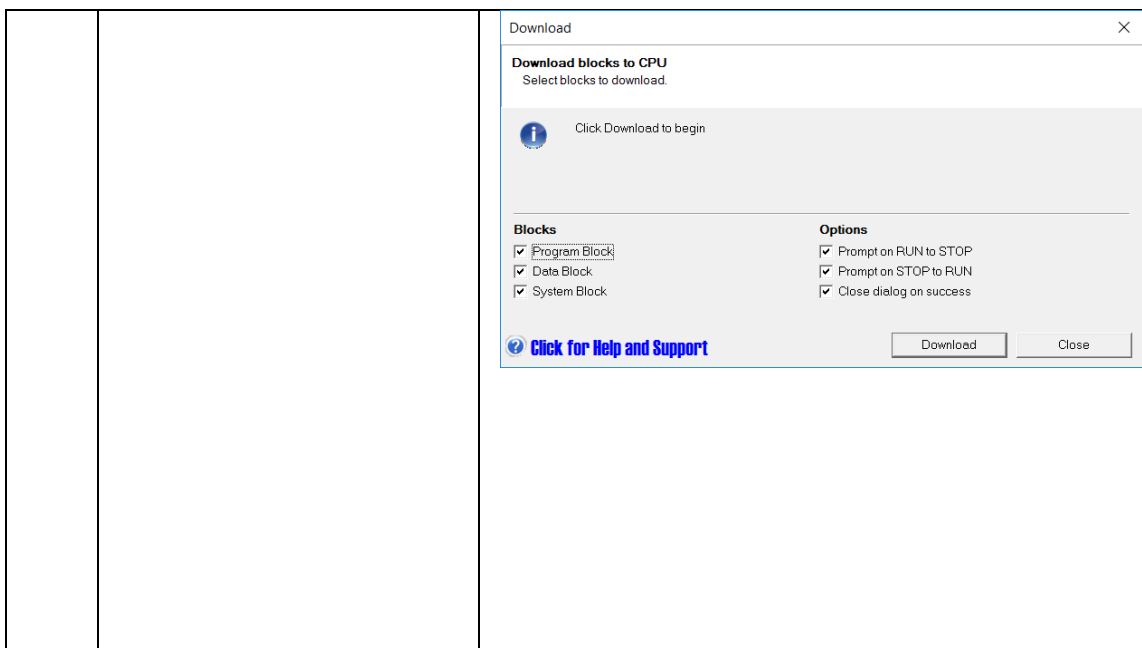
4.2 Downloading the SIMATIC program

This chapter describes the steps for the installation of the example code.

We offer you examples with test code test parameters as a download. The software examples support you during the first steps and tests with your STEP7-Micro/WIN SMART. The enable quick testing of hardware and software interfaces between the products described in the tool.

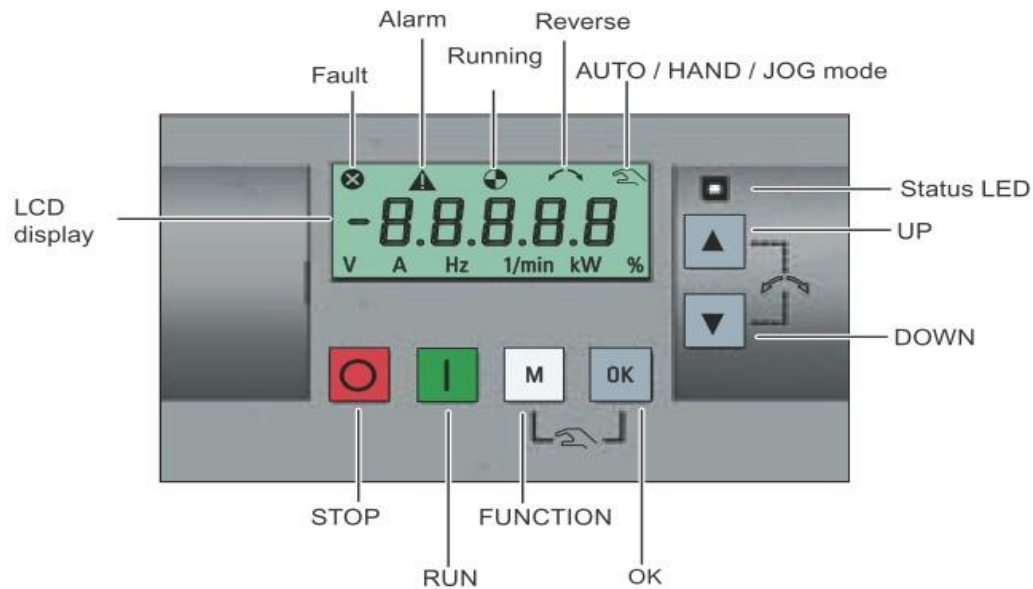
No.	Action	Remarks
1.	Start STEP7-Micro/WIN SMART	
2.	Check "USS protocol" in libraries	

No.	Action	Remarks
3.	Call up “Communication”. Click “Communication” and select the right “Find PLC”. (All types of S7-200 SMART are available.)	
4.	Select the IP address PLC selected and press “OK”. Now press “Download” and then select Stop PLC to download program and put it in RUN mode after downloading.	



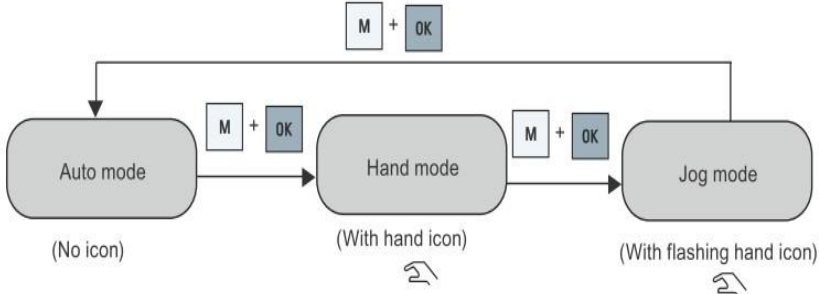
4.3 V20 commissioning

4.3.1 Introduction to the built-in BOP



Button functions

	Stops the inverter	
	Single press	OFF1 stop reaction: the inverter brings the motor to a standstill in the ramp-down time set in parameter P1121. Note: If configured to be an OFF1 stop, this button is inactive in AUTO mode.
	Double press (< 2 s) or long press (> 3 s)	OFF2 stop reaction: the inverter allows the motor to coast to a standstill without using any ramp-down timings.
	Starts the inverter If the inverter is started in HAND / JOG mode, the inverter running icon (⦿) displays. Note: This button is inactive if the inverter is configured for control from terminals (P0700 = 2, P1000 = 2) and is in AUTO mode.	
	Multi-function button	
	Short press (< 2 s)	- Enters the parameter setting menu or moves to the next screen - Restarts the digit by digit editing on the selected item - If pressed twice in digit by digit editing, returns to the previous screen without changing the item being edited
	Long press (> 2 s)	- Returns to the status screen - Enters the setup menu
	Short press (< 2 s)	- Switches between status values - Enters edit value mode or change to the next digit - Clears faults
	Long press (> 2 s)	Quick parameter number or value edit

	Hand / Jog / Auto Press to switch between different modes:  Note: Jog mode is only available if the motor is stopped.
	• When navigating a menu, it moves the selection up through the screens available. • When editing a parameter value, it increases the displayed value. • When the inverter is in RUN mode, it increases the speed. • Long press (> 2 s) of the key quickly scrolls up through parameter numbers, indices, or values.
	• When navigating a menu, it moves the selection down through the screens available. • When editing a parameter value, it decreases the displayed value. • When the inverter is in RUN mode, it decreases the speed. • Long press (> 2 s) of the key quickly scrolls down through parameter numbers, indices, or values.
	Reverses the direction of rotation of the motor. Pressing the two keys once activates reverse motor rotation. Pressing the two keys once again deactivates reverse rotation of the motor. The reserve icon (↶↷) on the display indicates that the output speed is opposite to the setpoint.

Normal editing on parameters

NOTICE

Pressing  or  for longer than two seconds to quickly increase or decrease the parameter numbers or indexes is only possible in the parameter menu.

This editing method can be used for editing small parameter numbers, indexes, or values.

- To increase or decrease the parameter number, index, or value, press  or  for less than two seconds.
- To quickly increase or decrease the parameter number, index, or value, press  or  for longer than two seconds.
- To confirm the setting, press .
- To cancel the setting, press .

4.3.2 Inverter parameters setting

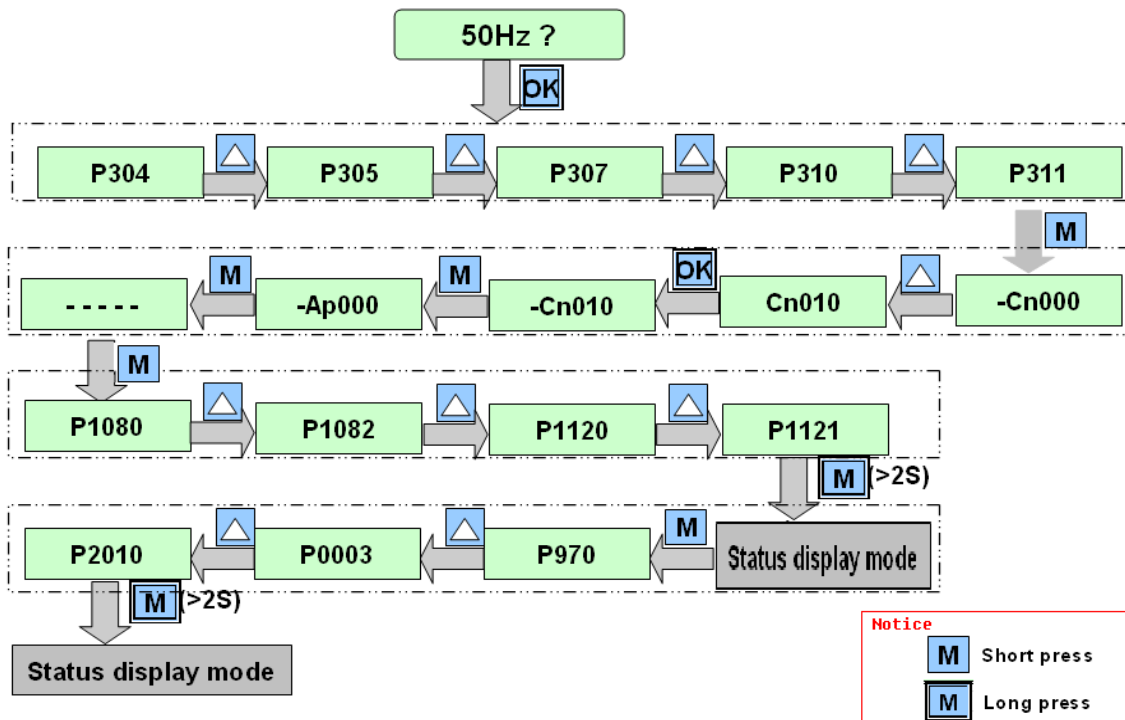


Figure 4-2 Overview of the SINAMICS V20 commissioning procedure

Note

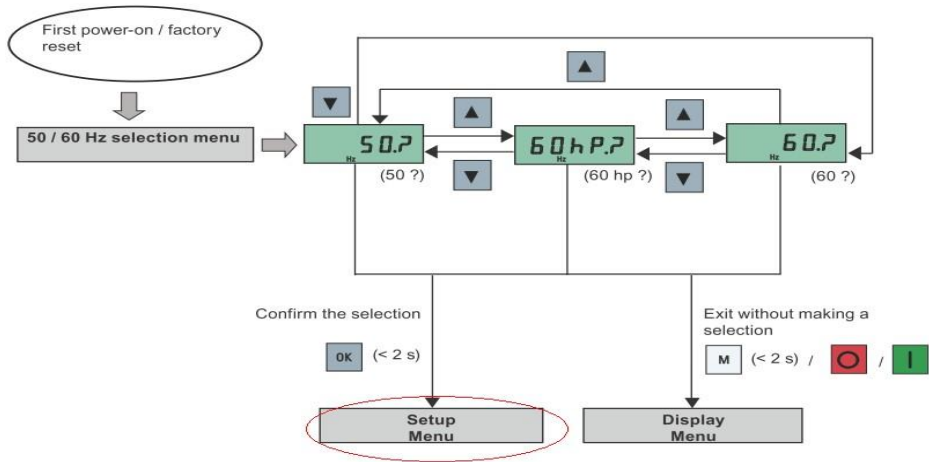
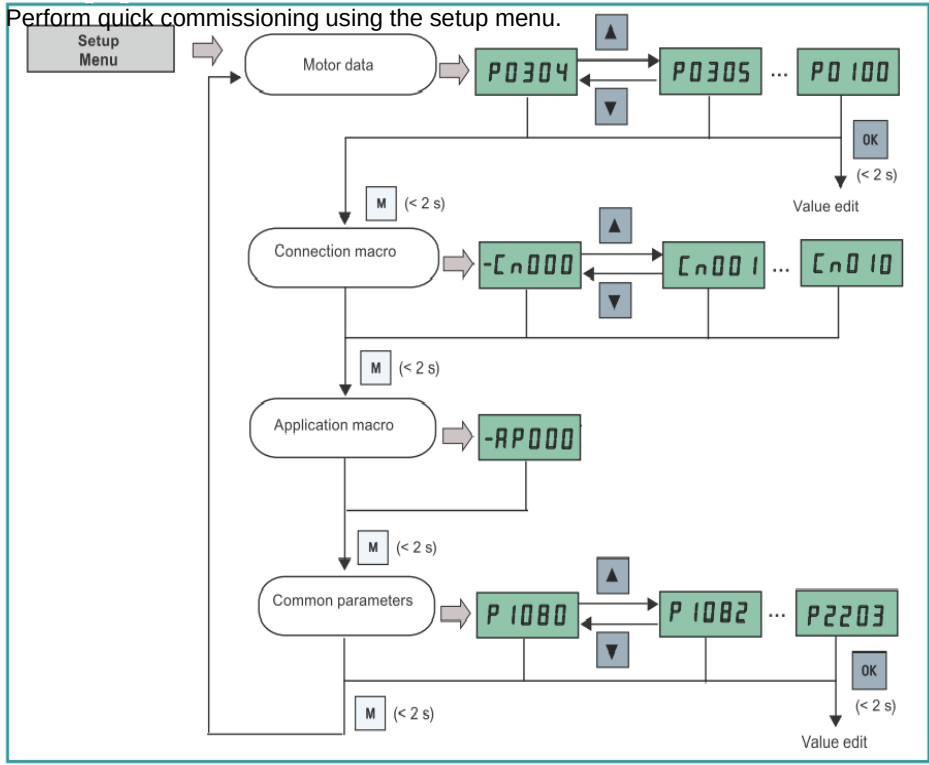
When commissioning the inverter, the connection macro setting is a one-off setting. Make sure that you proceed as follows before you change the connection macro setting to a value different from your last setting:

1. Do a factory reset (P0010 = 30, P0970 = 1)
2. Repeat the quick commissioning and change the connection macro

Failure to observe may cause the inverter to accept the parameter settings from both the currently and the previously selected macros, which may lead to undefined and unexplainable inverter operation.

However, communication parameters P2010, P2011, P2021 and P2023 for connection macros Cn010 and Cn011 are not reset automatically after a factory reset. If necessary, reset them manually.

After changing P2023 setting for Cn010 or Cn011, power-cycle the inverter. During the power-cycle, wait until LED has gone off or the display has gone blank (may take a few seconds) before re-applying power.

Step	Instruction	Comment
1.	Install and connect the inverter system, check the following and then power on the inverter. - Check that all cables have been connected correctly and that all relevant product and plant/location safety precautions have been complied with. - Ensure that the motor and the inverter are configured for the correct supply voltage. - Tighten all screws to the specified tightening torque.	
2.	Set the 50/60 Hz selection menu. Choose 50Hz or 60Hz depending on in which region or country the inverter is used. Do a factory reset (P0010 = 30, P0970 = 1) 	
3.	Perform quick commissioning using the setup menu. 	

The setup menu guides you through the main steps required for quick commissioning of the inverter system. It consists of the following four sub-menus: <table border="1"> <thead> <tr> <th></th><th>Sub-menu</th><th>Functionality</th></tr> </thead> <tbody> <tr> <td>1)</td><td>Motor data</td><td>Sets nominal motor parameters for quick commissioning</td></tr> <tr> <td>2)</td><td>Connection macro selection</td><td>Sets macros required for standard wiring arrangements</td></tr> <tr> <td>3)</td><td>Application macro selection</td><td>Sets macros required for certain common applications</td></tr> <tr> <td>4)</td><td>Common parameter selection</td><td>Sets parameters necessary for inverter performance optimization</td></tr> </tbody> </table>				Sub-menu	Functionality	1)	Motor data	Sets nominal motor parameters for quick commissioning	2)	Connection macro selection	Sets macros required for standard wiring arrangements	3)	Application macro selection	Sets macros required for certain common applications	4)	Common parameter selection	Sets parameters necessary for inverter performance optimization												
	Sub-menu	Functionality																											
1)	Motor data	Sets nominal motor parameters for quick commissioning																											
2)	Connection macro selection	Sets macros required for standard wiring arrangements																											
3)	Application macro selection	Sets macros required for certain common applications																											
4)	Common parameter selection	Sets parameters necessary for inverter performance optimization																											
3-1.	Set motor parameters for quick commissioning	Notice: In the table below, the value of this parameter must be entered according to the ratings of the motor. <table border="1"> <thead> <tr> <th>Parameter</th><th>Description</th><th>Value</th></tr> </thead> <tbody> <tr> <td>P0304</td><td>Rated motor voltage[V]</td><td>380</td></tr> <tr> <td>P0305</td><td>Rated motor current[A]</td><td>2.6</td></tr> <tr> <td>P0307</td><td>Rated motor power[kW]</td><td>1.1</td></tr> <tr> <td>P0310</td><td>Rated motor frequency[Hz]</td><td>50</td></tr> <tr> <td>P0311</td><td>Rate motor speed[RPM]</td><td>1400</td></tr> </tbody> </table> When first power-up or after a factory reset and select 60Hz, please also give the right value to P0308 and P0309.	Parameter	Description	Value	P0304	Rated motor voltage[V]	380	P0305	Rated motor current[A]	2.6	P0307	Rated motor power[kW]	1.1	P0310	Rated motor frequency[Hz]	50	P0311	Rate motor speed[RPM]	1400									
Parameter	Description	Value																											
P0304	Rated motor voltage[V]	380																											
P0305	Rated motor current[A]	2.6																											
P0307	Rated motor power[kW]	1.1																											
P0310	Rated motor frequency[Hz]	50																											
P0311	Rate motor speed[RPM]	1400																											
3-2.	Set connection macros. Select Cn010	Connection macro Cn010 – USS control. This selection automatically sets the following parameters to the given values: <table border="1"> <thead> <tr> <th>Parameter</th><th>Description</th><th>Value</th></tr> </thead> <tbody> <tr> <td>P0700</td><td>Selection of command source</td><td>5</td></tr> <tr> <td>P1000</td><td>Selection of frequency</td><td>5</td></tr> <tr> <td>P2023</td><td>RS485 protocol selection</td><td>1</td></tr> <tr> <td>P2010</td><td>USS/MODBUS baud rate</td><td>8</td></tr> <tr> <td>P2011</td><td>USS address</td><td>1</td></tr> <tr> <td>P2012</td><td>USS PZD length</td><td>2</td></tr> <tr> <td>P2013</td><td>USS PKW length</td><td>127</td></tr> <tr> <td>P2014</td><td>USS/MODBUS telegram off time</td><td>500</td></tr> </tbody> </table>	Parameter	Description	Value	P0700	Selection of command source	5	P1000	Selection of frequency	5	P2023	RS485 protocol selection	1	P2010	USS/MODBUS baud rate	8	P2011	USS address	1	P2012	USS PZD length	2	P2013	USS PKW length	127	P2014	USS/MODBUS telegram off time	500
Parameter	Description	Value																											
P0700	Selection of command source	5																											
P1000	Selection of frequency	5																											
P2023	RS485 protocol selection	1																											
P2010	USS/MODBUS baud rate	8																											
P2011	USS address	1																											
P2012	USS PZD length	2																											
P2013	USS PKW length	127																											
P2014	USS/MODBUS telegram off time	500																											

3-3	Set application macros. Select AP000.	The SINAMICS V20 defines certain common applications. Each application macro provides a set of parameter settings for a specific application. If no any application macros are applicable for your specific application, use the default one AP000.															
3-4	Set common parameters	In the table below, the value of this parameter must be entered according to the special application. <table border="1"> <thead> <tr> <th>Parameter</th><th>Description</th><th>Value</th></tr> </thead> <tbody> <tr> <td>P1080</td><td>Minimum motor frequency[Hz]</td><td>0</td></tr> <tr> <td>P1082</td><td>Maximum motor frequency[Hz]</td><td>50</td></tr> <tr> <td>P1120</td><td>Ramp-up time[s]</td><td>0.5(without load)</td></tr> <tr> <td>P1121</td><td>Ramp-down time[s]</td><td>0.5(without load)</td></tr> </tbody> </table>	Parameter	Description	Value	P1080	Minimum motor frequency[Hz]	0	P1082	Maximum motor frequency[Hz]	50	P1120	Ramp-up time[s]	0.5(without load)	P1121	Ramp-down time[s]	0.5(without load)
Parameter	Description	Value															
P1080	Minimum motor frequency[Hz]	0															
P1082	Maximum motor frequency[Hz]	50															
P1120	Ramp-up time[s]	0.5(without load)															
P1121	Ramp-down time[s]	0.5(without load)															
3-5	Press the “M” button for 2 second to exit quick commission.																
4.	Update communication parameters according to the actual application example.	<table border="1"> <thead> <tr> <th>Parameter</th><th>Description</th><th>Value</th></tr> </thead> <tbody> <tr> <td>P0003</td><td>User access level</td><td>=3</td></tr> <tr> <td>P2010</td><td>USS baud rate</td><td>=6 (9600bps)</td></tr> <tr> <td>P2000</td><td>Reference frequency[Hz]</td><td>50</td></tr> </tbody> </table>	Parameter	Description	Value	P0003	User access level	=3	P2010	USS baud rate	=6 (9600bps)	P2000	Reference frequency[Hz]	50			
Parameter	Description	Value															
P0003	User access level	=3															
P2010	USS baud rate	=6 (9600bps)															
P2000	Reference frequency[Hz]	50															

Note

To switch on the inverter with the PLC, observe the following requirements:

- The baud rate of the inverter (P2010) and the PLC program must be the same.
- The USS address of the inverter and the PLC program must be the same.
- After parameterization, switch off the power and then restart the inverter and the PLC.

5 Operation

5.1 Jog reverse

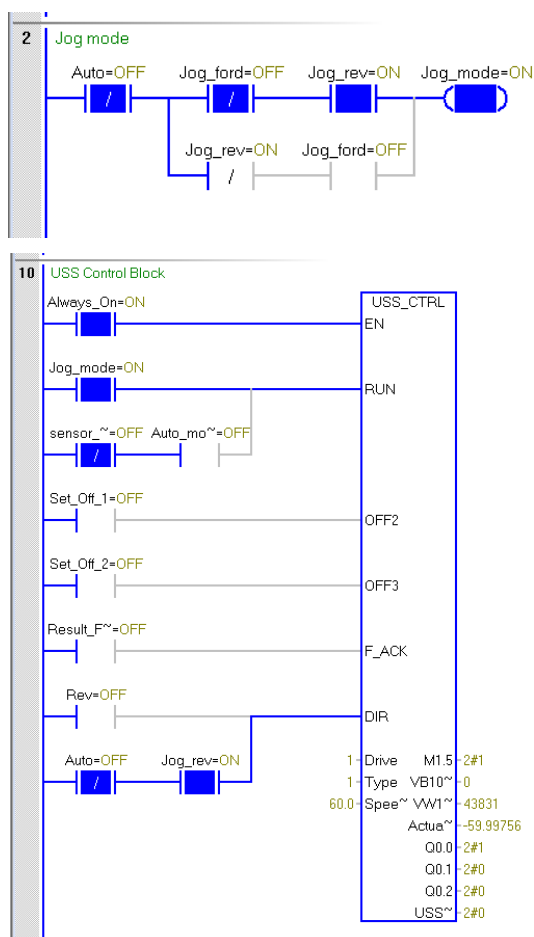
5.1.1 Display

When Jog reverses, switch off I1.0 and I1.6, switch on I1.5.

Input	Value	Description
I1.0	0	Select Jog mode
I1.5	1	Select Jog reverse
I1.6	0	Jog forward

5.1.2 Table 5-1 Jog reverse I/O address

When you set the input signals as indicated in the Table 5-1, the status changes are shown as follows:



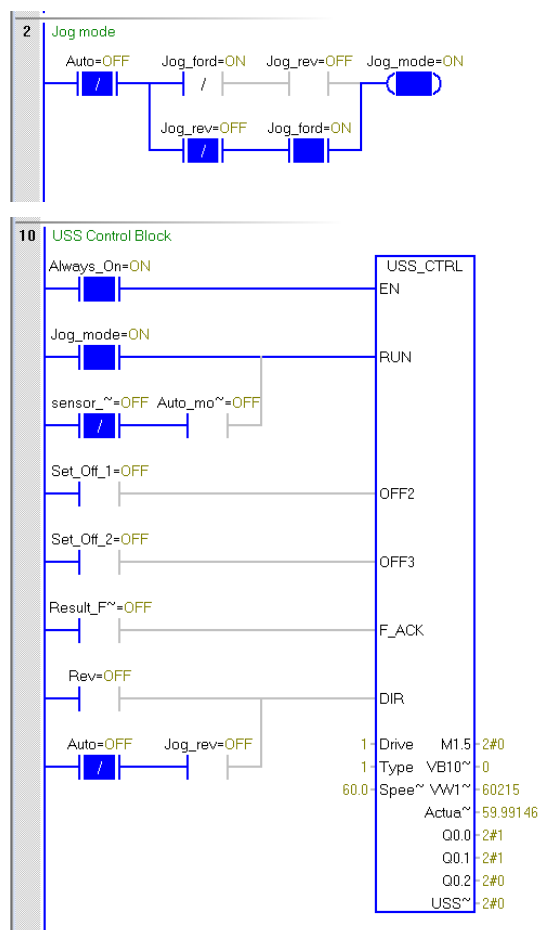
5.2 Jog forward

When Jog reverses, switch off I1.0 and I1.5 and then switch on I1.6.

Input	Value	Description
I1.0	0	Jog mode
I1.5	0	Jog reverse
I1.6	1	Select Jog forward

5.1.3 Table 5-2 Jog forward I/O address

When you set the input signals as indicated in Table 5-2, the status changes are shown as follows:



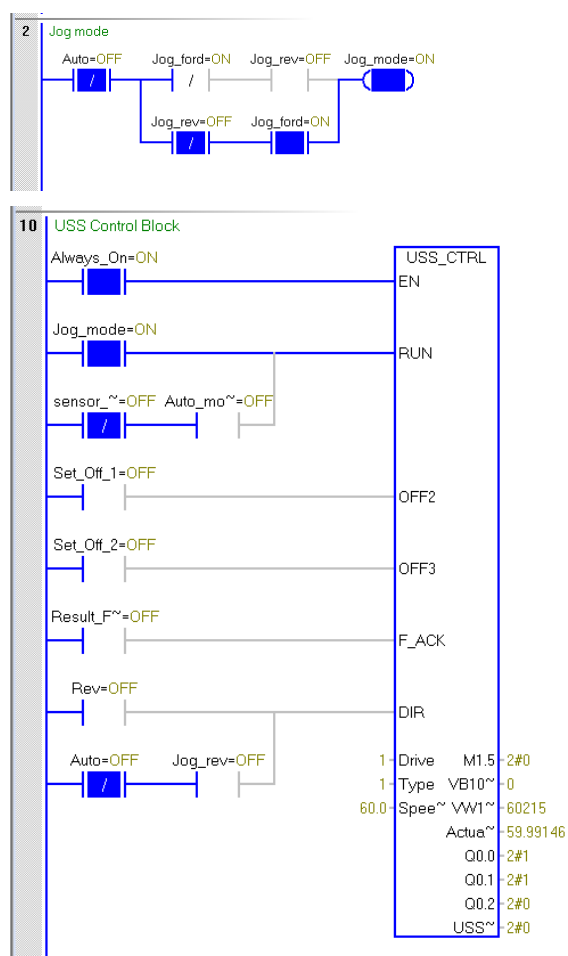
5.3 Auto mode

When Auto mode, switch on I1.0, I1.5, and I1.6.

Input	Value	Description
I1.0	1	Select Auto mode
I1.5	0	Jog reverse
I1.6	0	Jog forward

5.1.4 Table 5-3 Auto mode I/O address

When you set the input signals as indicated in Table5-3, the



6 Appendix

6.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:

support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers

– ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:

www.siemens.com/industry/supportrequest

SITRAIN – Training for Industry

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:

www.siemens.com/sitrain

Service offer

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:

support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:

support.industry.siemens.com/cs/ww/en/sc/2067

6.2 Application support

Siemens Ltd
 RC-IN DI FA TECH SUP
 Thane Belapur Road
 Thane 400601, India

Pre-sales Support
 Email: rginslpresales-fa.in@siemens.com

6.3 Links and literature

Table 6-1

	Topic	Title / link
/1/	Reference to the document	
/2/	Siemens Industry Online Support	http://support.automation.siemens.com
/3/	V20 manual	http://support.automation.siemens.com/WW/view/en/63899889
/4/	Industry Mall-Siemens DE	https://eb.automation.siemens.com/goos/WelcomePage.aspx?regionUrl=/de&language=en
/5/	S7-200 SMART System Manual	https://assets.new.siemens.com/siemens/assets/api/uuid:aa045b50-b9f4-4e46-a4c4-ca882c5f00ec/version:1573480788/s7-200-smart-system-manual-en-us.pdf
/6/	S7-200 SMART website	https://new.siemens.com/in/en/products/automation/systems/industrial/plc/simatic-s7-200-smart.html

6.4 Change documentation

Table 6-2

Version	Date	Modifications
V1.0	12/2019	First version