Program example

M221 with SD328 via Modbus RTU

Table of Contents

Introduction

1

Overview

This chapter gives the introduction.

Contents of this chapter

This chapter contains the following topics:

Before You Begin

General

The products specified in this document have been tested under actual service conditions. Of course, your specific application requirements may be different from those assumed for this and any related examples described herein. In that case, you will have to adapt the information provided in this and other related documents to your particular needs. To do so, you will need to consult the specific product documentation of the hardware and/or software components that you may add or substitute for any examples specified in this documentation. Pay particular attention and conform to any safety information, different electrical requirements and normative standards that would apply to your adaptation.

⚠ WARNING

REGULATORY INCOMPATIBILITY

Be sure that all equipment applied and systems designed comply with all applicable local, regional and national regulations and standards

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved. Failure to observe this information can result in injury or equipment damage.

The use and application of the information contained herein require expertise in the design and programming of automated control systems. Only the user or integrator can be aware of all the conditions and factors present during installation and setup, operation, and maintenance of the machine or process, and can therefore determine the automation and associated equipment and the related safeties and interlocks which can be effectively and properly used. When selecting automation and control equipment, and any other related equipment or software, for a particular application, the user or integrator must also consider any applicable local, regional or national standards and/or regulations.

Some of the major software functions and/or hardware components used in the proposed architectures and examples described in this document cannot be substituted without significantly compromising the performance of your application. Further, any such substitutions or alterations may completely invalidate any proposed architectures, descriptions, examples, instructions, wiring diagrams and/or compatibilities between the various hardware components and software functions specified herein and in related documentation. You must be aware of the consequences of any modifications, additions or substitutions.

A residual risk, as defined by EN/ISO 12100-1, Article 5, will remain if
- it is necessary to modify the recommended logic and if the added or modified components are not properly integrated in the control circuit.
- you do not follow the required standards applicable to the operation of the machine, or if the adjustments to and the maintenance of the machine are not properly made (it is essential to strictly follow the prescribed machine maintenance schedule).
- the devices connected to any safety outputs do not have mechanically-linked contacts.

⚠ CAUTION
EQUIPMENT INCOMPATIBILITY Read and thoroughly understand all device and software documentation before attempting any component substitutions or other changes related to the application examples provided in the document **Failure to follow these instructions can result in injury, or equipment damage.**

Start-Up and Test

Before using electrical control and automation equipment after design and installation, the application and associated functional safety system must be subjected to a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such testing be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ CAUTION
EQUIPMENT OPERATION HAZARD •Verify that all installation and set up procedures have been completed. •Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices •Remove tools, meters, and debris from equipment. **Failure to follow these instructions can result in injury, or equipment damage.**

Verify that the completed system, including the functional safety system, is free from all short circuits and grounds, except those grounds installed according to local regulations. If high-potential voltage testing is necessary, follow the recommendations in equipment documentation to help prevent injury or equipment damage.

Operations and Adjustments

General

Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly installed and operated.
In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the hands and other parts of the body are free to enter the pinch points or other hazardous areas where serious injury can occur. Software products alone cannot protect an operator from injury. For this reason, the software cannot be substituted for or take the place of point-of-operation protection.

⚠ WARNING
UNGUARDED MACHINERY CAN CAUSE SERIOUS INJURY •Do not use this software and related automation equipment on equipment which does not have point-of -operation protection. •Do not reach into machinery during operation. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-ofoperation protection is outside the scope of the examples and implementations suggested herein. It is sometimes possible to adjust the equipment incorrectly and this produce unsatisfactory or unsafe operation. Always use the manufacturer instructions as a guide to functional adjustments. Personnel who have access to these adjustments must be familiar with the equipment manufacturer instructions and the machinery used with the electrical equipment. Only those operational adjustments actually required by the machine operator should be accessible to the operator. Access to other controls should be restricted to help prevent unauthorized changes in operating characteristics.

M221 with SD328 via Modbus RTU

2

This document describes a small application using a M221-PLC and one SD328 drive connected via ModbusRTU. This program example works the same way also for LXM05.
It is not intended to replace any specific product documentation. On the contrary, it offers additional information to the product documentation, for installing, configuring and starting up the system. A detailed functional description or the specification for a specific user application is not part of this document. Nevertheless, the document outlines some typical applications where the system might be implemented.

The program example includes how to activate the operation modes:
-Homing
-Profile Velocity mode
-Point to point
-How to write and read parameters

MODBUS.ORG

Designed 11.11.2015 by

Please contact your local Schneider Electric partner.
www.schneider-electric.com

System configuration

M221ME32TK
Serial line used as Modbus master

SD328
Modbus address 2

Configuration of SD328

Following parameter settings are mandatory in SD328:

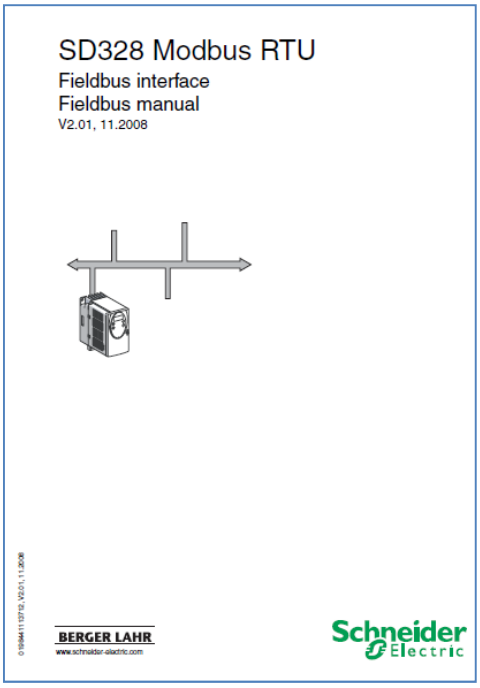
Name	Value	Unit	Description	Range	Modbus
DEVcmdinterf	ModbusDevice		Specification of the control mode	0..3	1282
IOposInterfac	ABinput		Signal selection position interface	0..1	1284
IOdefaultMode	none		Start-up operating mode for 'Local control mode'	0..6	1286
IOLogicType	source		Logic type of digital inputs/outputs	0..1	1288
SM_Type	VRDM3910/50LW		Motor type	0..99999999	3588
CTRLS_MotEn	NoEncCon		Processing of motor encoder position	0..3	5138
MBadr	2		Modbus address	1..247	5640
MBbaud	19.2KB		Modbus Baud rate	9600..38400	5638

Name	Value	Unit	Description	Range	Modbus
MBadr	2		Modbus address	1..247	5640
MBbaud	19.2KB		Modbus Baud rate	9600..38400	5638
MBformat	8Bit EvenParity 1Stop		Modbus data format	1..4	5642
MBdword_order	LowHigh		Modbus word sequence for double words (32 bit valu	0..1	5646

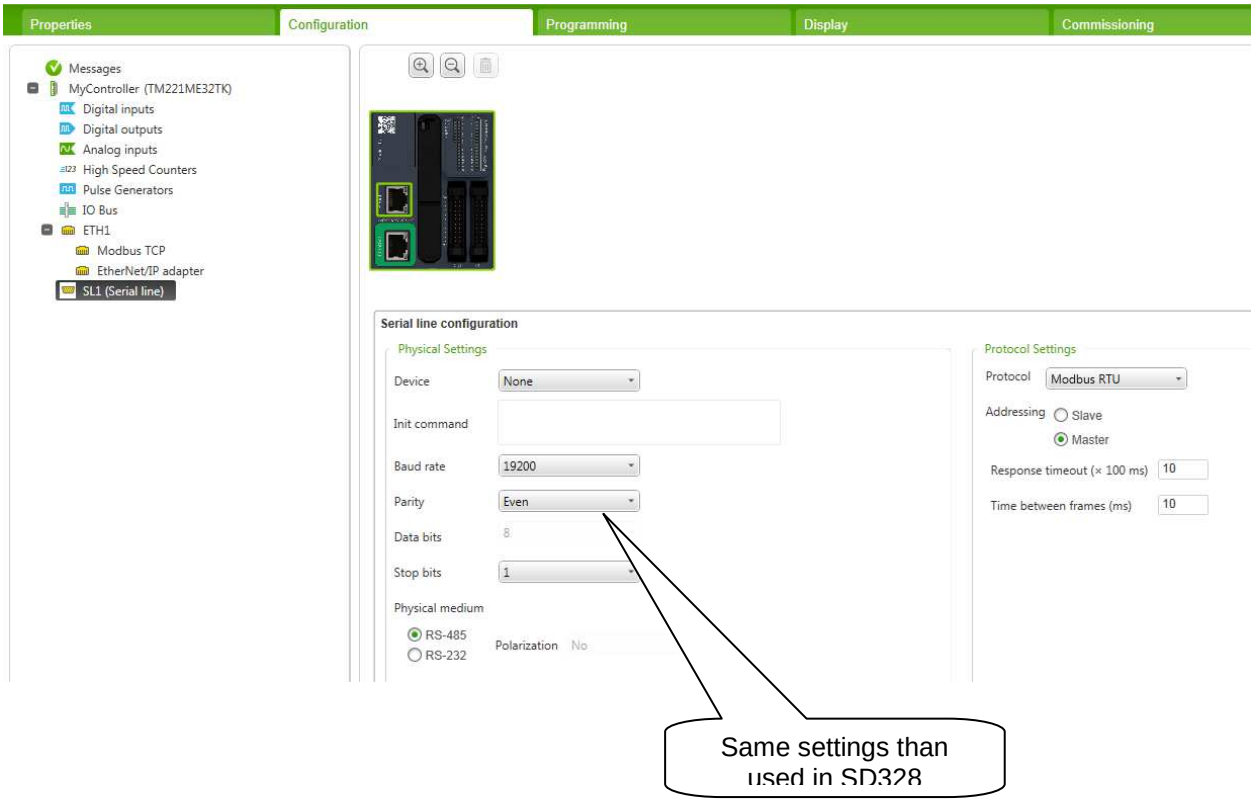
SD328 must be used as Modbus slave (DEVcmdinterface). Motor type (SM_Type) and encoder feedback (CTRLS_MotEn) must be set according the used motor.
Important is to switch the Modbus double word order (MBdword_order).

Modbus Interface of SD328

SD328 can be controlled according DS402. There is a dedicated manual for Modbus communication:

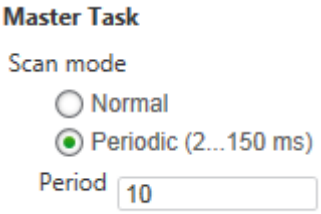


Modbus configuration in M221



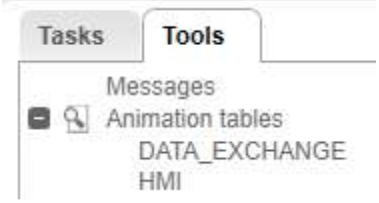
Task configuration

The rungs are called in a cyclic task:



Animation tables

The program can be controlled and monitored via Animation tables.



“Data exchange” shows the data exchange between plc and drive.

DATA_EXCHANGE

Add Insert

Used	Trace	Address	Symbol	Value	Force	Comment
☐	☐	%MD100	DCOMSTATUS			
☑	☐	%MD102	DCOMOPMD_ACT			
☑	☐	%MD104	P_ACTUSR			
☑	☐	%MD200	DCOMCONTROL			
☑	☐	%MD202	DCOMOPMODE			
☑	☐	%MD204	HMMETHOD			
☑	☐	%MD206	PVN_TARGET			
☑	☐	%MD208	PPP_TARGETUSR			
☑	☐	%MD210	PPN_TARGET			
☑	☐	%MD212	MBNODE_GUARD			

With “HMI” it is possible to control the drive.
E.g. by setting HMI_ENABLE the drive enables; HMI_FAULTRESET performs a fault reset.
HMI_OPMODE shows the current mode of operation; HMI_DRIVESTATUS shows the current drive status.
With HMI_HOMINGTYPE it is possible to choose the way homing is performed; by setting HMI_HOMING the movement will be started.
For the other modes of operation it is similar.

HMI

Add Insert

Used	Trace	Address	Symbol	Value	Force	Comment
☑	☐	%M10	HMI_ENABLE			
☑	☐	%M11	HMI_DISABLE			
☑	☐	%M12	HMI_QUICKSTOP			
☑	☐	%M13	HMI_FAULTRESET			
☑	☐	%MW0	HMI_OPMODE			
☑	☐	%MW1	HMI_DRIVESTATUS			
☑	☐	%MD2	HMI_ACTPOS			
☑	☐	%M14	HMI_HOMING_			
☑	☐	%MW6	HMI_HOMINGTYPE			
☑	☐	%M17	HMI_MOVE_VEL			
☑	☐	%MW8	HMI_VEL_SETSPEED			
☑	☐	%M16	HMI_PTP_REL			
☑	☐	%M15	HMI_PTP_ABS			
☑	☐	%MW12	HMI_PTP_SETSPEED			
☑	☐	%MD14	HMI_PTP_SETPOSITION			

Explanation of the source code

To control SD328 the following parameters are used:

DCOMcontrol	Modbus 6914	Control word
DCOMstatus	Modbus 6916	Status word
DCOMopmode	Modbus 6918	Mode of operation
DCOMpomact	Modbus 6920	Actual mode of operation

To display the current motor position:

P_actusr	Modbus 7706	Actual motor position in user units

For Homing:

HMmethod	Modbus 6936	Homing method

For Profile velocity:

PVn_target	Modbus 6938	Set speed

For Profile position:

PPp_targetusr	Modbus 6940	Set position
PPn_target	Modbus 6942	Set speed

For NodeGuarding

MBnode_guard	Modbus 5644	Node guarding time

Fieldbus control mode In fieldbus control mode, the operating states are set either via the commissioning software or the parameter `DCOMcontrol`. Bits 0 to 3 and Bit 7 are relevant for state transitions.

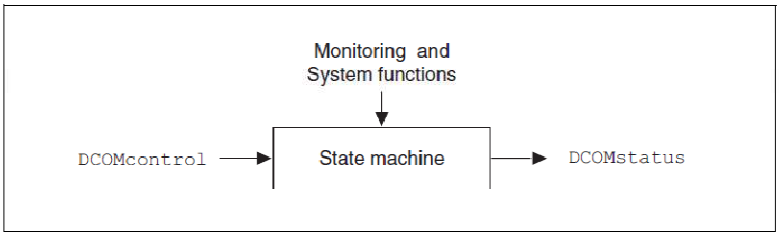


Figure 8.5 Changing and monitoring the operating state via parameters

Parameter name HMI menu	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
DCOMcontrol - -	Drivecom control word Refer to chapter Operation, Operating States, for bit coding information. Bit 0: Switch on Bit 1: Enable Voltage Bit 2: Quick Stop Bit 3: Enable Operation Bit 4..6: Operating mode specific Bit 7: Fault Reset Bit 8: Halt Bit 9..15: Reserved (must be 0)	- - 0 -	UINT16 UINT16 R/W - -	CANopen 6040:0_h Modbus 6914

DCOMstatus - -	Drivecom status word Refer to chapter Operation, State Machine for bit coding information. Bit 0-3,5,6: Status bits Bit 4: Voltage enabled Bit 7: Warning Bit 8: HALT request active Bit 9: Remote Bit 10: Target reached Bit 11: Reserved Bit 12: Operating mode specific Bit 13: x_err Bit 14: x_end Bit 15: ref_ok	- - 0 -	UINT16 UINT16 R/- - -	CANopen 6041:0$_h$ Modbus 6916

_DCOMopmd_act - -	Active operating mode See DCOMopmode for coding	- -6 - 6	INT8 INT16 R/- - -	CANopen 6061:0$_h$ Modbus 6920
DCOMopmode - -	Operating mode DS402 operating modes: 1: Profile position 3: Profile velocity 6: Homing 8: Cyclic synchronous position ---------- Manufacturer operating modes: -1: Jog -2: Electronic gear -7: Oscillator -8: Motion sequence	- -8 - 6	INT8 INT16 R/W - -	CANopen 6060:0$_h$ Modbus 6918

_p_actusr STA- - PACu STA- - PACu	Actual motor position in user units	usr - 0 -	INT32 INT32 R/- - -	CANopen 6064:0$_h$ Modbus 7706

HMmethod - -	Homing method 1: LIMN with index pulse 2: LIMP with index pulse 7: REF+ with index pulse, inv., outside 8: REF+ with index pulse, inv., inside 9: REF+ with index pulse, not inv., inside 10: REF+ with index pulse, not inv., outside 11: REF- with index pulse, inv., outside 12: REF- with index pulse, inv., inside 13: REF- with index pulse, not inv., inside 14: REF- with index pulse, not inv., outside 17: LIMN 18: LIMP 23: REF+, inv., outside 24: REF+, inv., inside 25: REF+, not inv., inside 26: REF+, not inv., outside 27: REF-, inv., outside 28: REF-, inv., inside 29: REF-, not inv., inside 30: REF-, not inv., outside 33: Index pulse neg. direction 34: Index pulse pos. direction 35: Position setting	- 1 18 35	INT8 INT16 R/W - -	CANopen 6098:0_h Modbus 6936

PVn_target - -	Reference speed in operating mode profile velocity The adjusted value is internally limited to the current parameter value in RAMPn_max.	min^{-1} - 0 -	INT32 INT32 R/W - -	CANopen 60FF:0_h Modbus 6938
PPp_targetusr - -	Target position in operating mode profile position Min./max values depend on: - Scaling factor - Software limit switches (if they are activated)	usr - 0 -	INT32 INT32 R/W - -	CANopen 607A:0_h Modbus 6940
PPn_target - -	Reference speed in operating mode profile position The adjusted value is internally limited to the current parameter value in RAMPn_max.	min^{-1} 1 60 -	UINT32 UINT32 R/W - -	CANopen 6081:0_h Modbus 6942
MBnode_guard - -	Modbus node guard Node guard 0: Inactive (default) >0: Monitoring time	ms 0 0 10000	UINT16 UINT16 R/W - -	CANopen 3016:6_h Modbus 5644

For each of this parameter a read or write request must be created. This is done with READ_VAR and WRITE_VAR functions of SoMachineBasic. The Modbus registers 6936, 6938, 6340 and 6342 can be written in a single request because of the following addresses.

Read Var properties

Used	Address	Symbol	Link	Id	Timeout	ObjType	FirstObj	Quantity	IndexData	Comment
☑	%READ_VAR0		1 - SL1	2	100	0 (Holding reg. - Mbs 3)	6916	2	100	
☑	%READ_VAR1		1 - SL1	2	100	0 (Holding reg. - Mbs 3)	6920	2	102	
☑	%READ_VAR2		1 - SL1	2	100	0 (Holding reg. - Mbs 3)	7706	2	104	

Write Var properties

Used	Address	Symbol	Link	Id	Timeout	ObjType	FirstObj	Quantity	IndexData	Comment
☑	%WRITE_VAR0		1 - SL1	2	100	0 (Mult. reg. - Mbs 16)	6914	2	200	
☑	%WRITE_VAR1		1 - SL1	2	100	0 (Mult. reg. - Mbs 16)	6918	2	202	
☑	%WRITE_VAR2		1 - SL1	2	100	0 (Mult. reg. - Mbs 16)	6936	8	204	
☑	%WRITE_VAR3		1 - SL1	2	100	0 (Mult. reg. - Mbs 16)	5644	2	212	

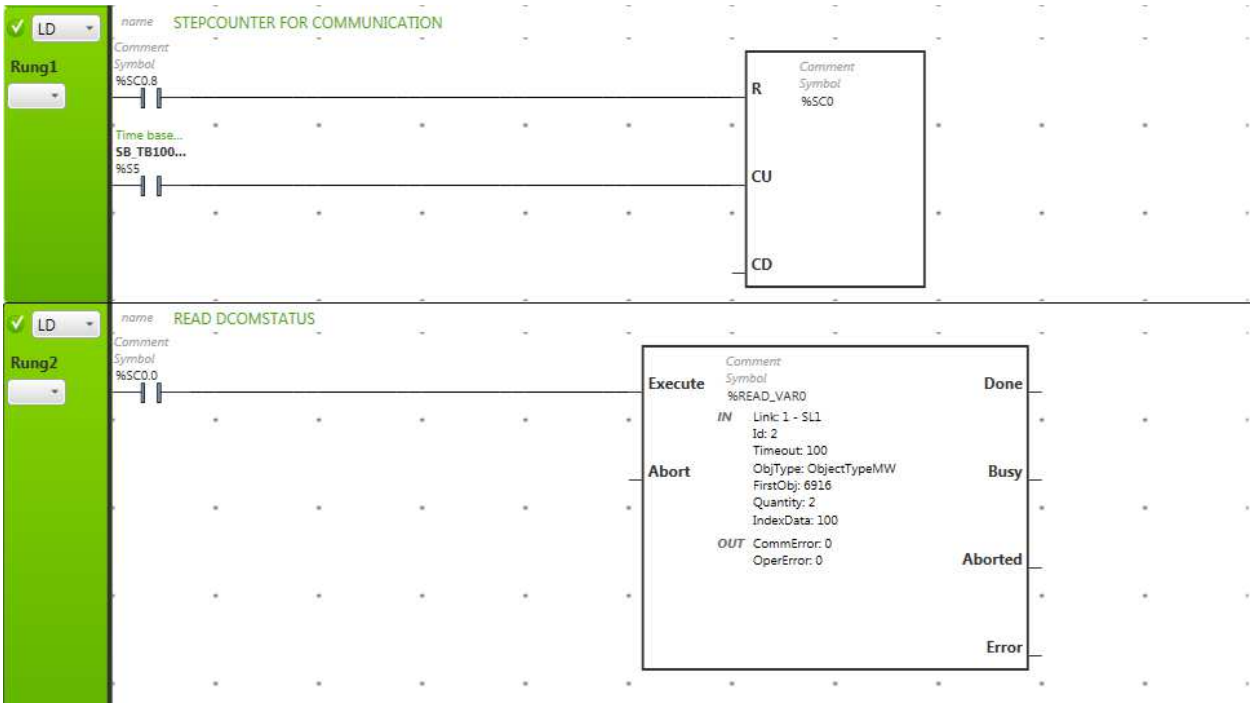
Communication via serial port 1

Modbus device address 2

Modbus register

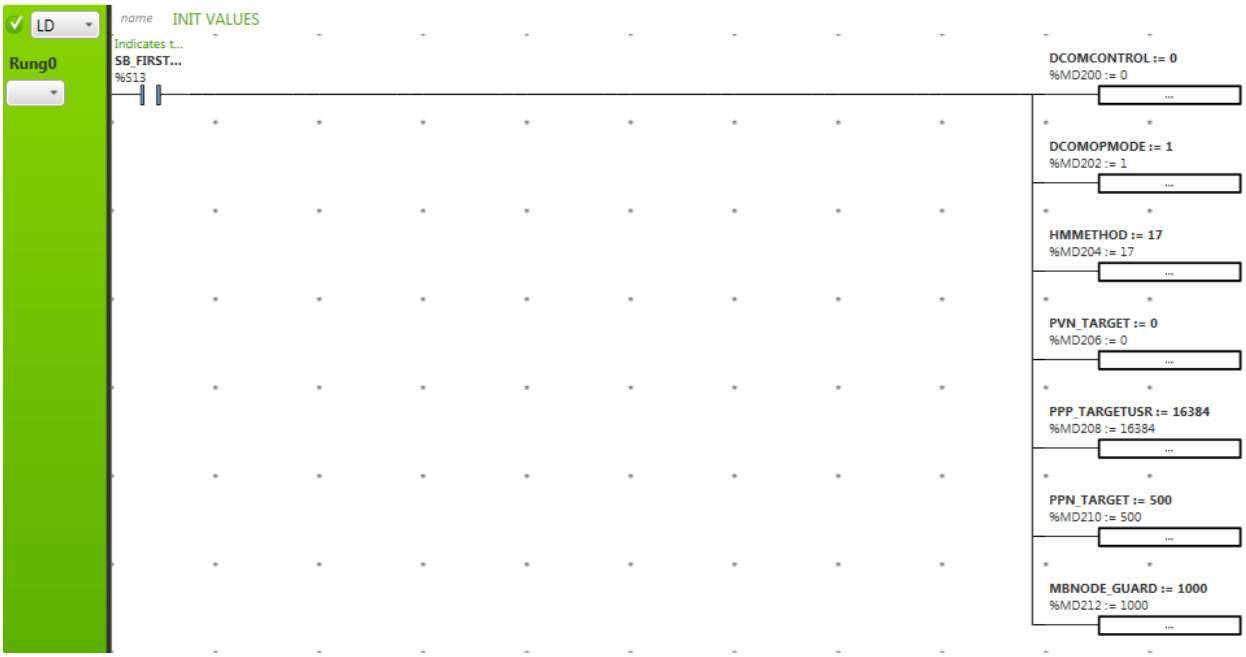
%MW addresses

In that program example overall seven Modbus requests are used. They must be handled in a proper way in order to avoid communication errors. Here it is done with the STEPCOUNTER function. Every 100msec the STEPCOUNTER counts up. The STEPCOUNTER bits %SC0.x are used to trigger the different READ_VAR and WRITE_VAR requests. The last STEPCOUNTER bit is used to reset the counter.

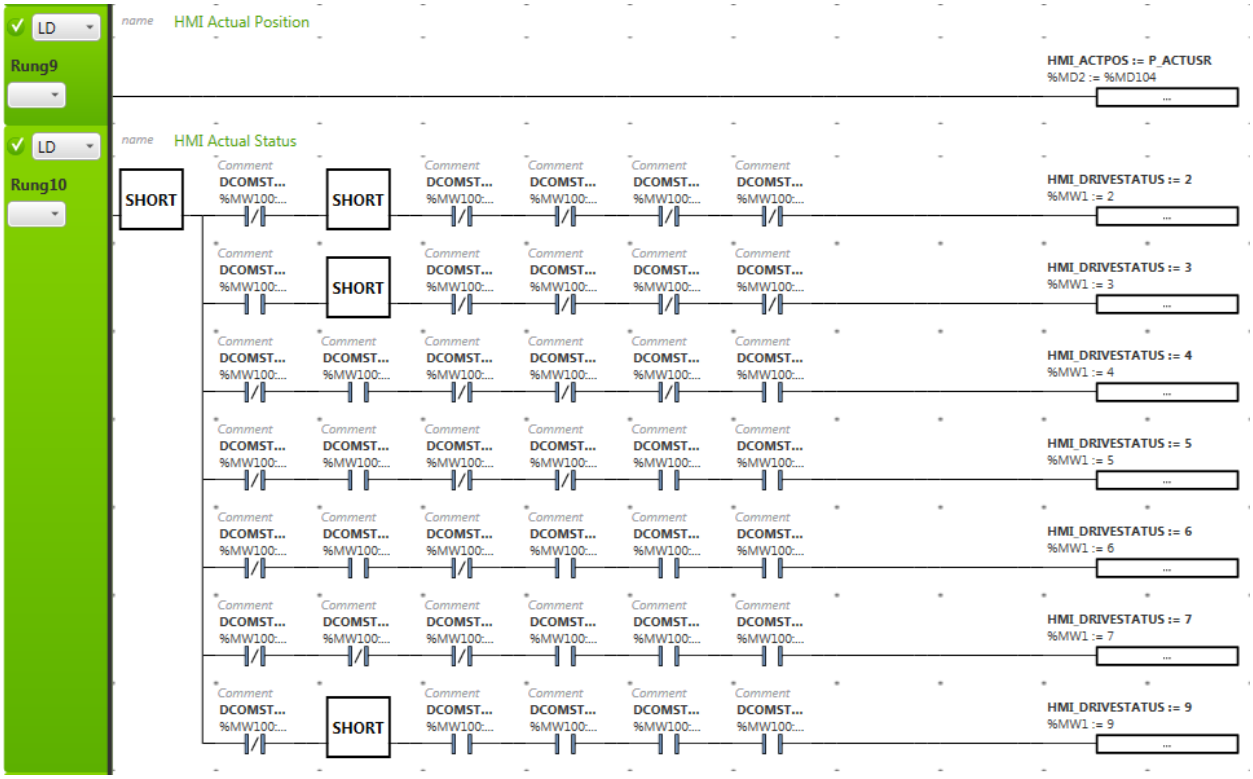


The Modbus requests are done in Rung 2-8.

Rung 1 is used to write initialization values to the communication registers in order to avoid communication errors.



In Rung 9 the actual motor position is transferred to the HMI variables.
In Rung 10 the actual drive status is generated. It is done according the table below.



Bits 0, 1, 2, 3, 5 and 6 Bits 0, 1, 2, 3, 5 and 6 of the `DCOMstatus` parameter provide information on the operating state.

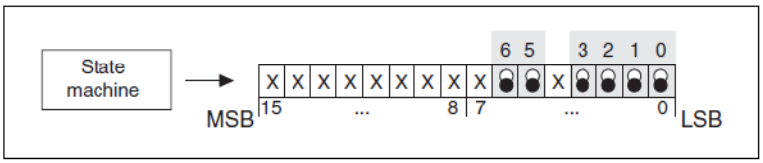
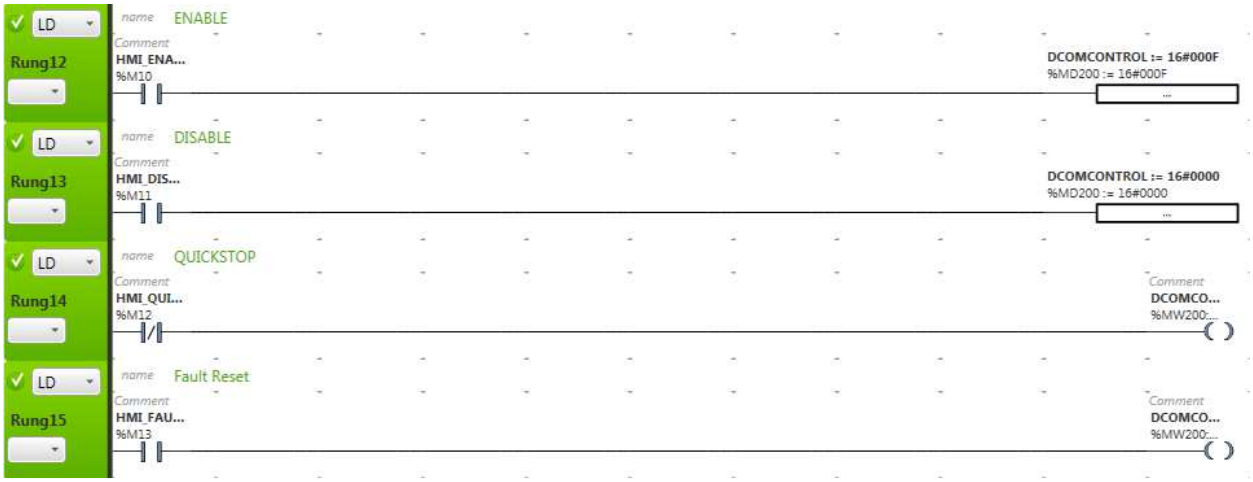


Figure 8.4 Indication of the operating state

Operating state	Bit 6 Switch on disable	Bit 5 Quick Stop	Bit 3 Fault	Bit 2 Operation enable	Bit 1 Switch On	Bit 0 Ready to switch on
2: Not ready to switch on	0	X	0	0	0	0
3: Switch on disabled	1	X	0	0	0	0
4: Ready to switch on	0	1	0	0	0	1
5: Switched on	0	1	0	0	1	1
6: Operation enable	0	1	0	1	1	1
7: Quick Stop active	0	0	0	1	1	1
8: Fault Reaction active	0	X	1	1	1	1
9: Fault	0	X	1	1	1	1

In Rung 11 the actual mode of operation is transferred to the HMI variables.

In Rung 12-15 the drive can be enabled, disable, ….. by manipulating the corresponding bits in DCOM control.



Homing

Starting homing Homing is triggered via bit 4=1 in parameter `DCOMcontrol`.

Status messages The drive provides information concerning positioning via bits 10 and 12 to 15 in the parameter `DCOMstatus`.

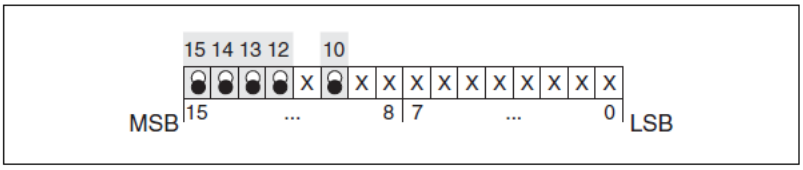


Figure 8.28 Status messages for the operating mode

Parameter value	Meaning
Bit 10: Target reached	0: Homing not completed 1: Homing completed (also in the case of cancellation via "Halt")
Bit 12: Homing attained	1: Homing successfully completed
Bit 13: x_err	1: Error
Bit 14: x_end	1: Homing completed, motor at standstill
Bit 15: ref_ok	1: Drive has valid reference point

Operating mode terminated The operating mode is terminated after successful homing, a motor standstill by "Halt" or an error.

According the Modbus manual the homing must be started in sequential way.

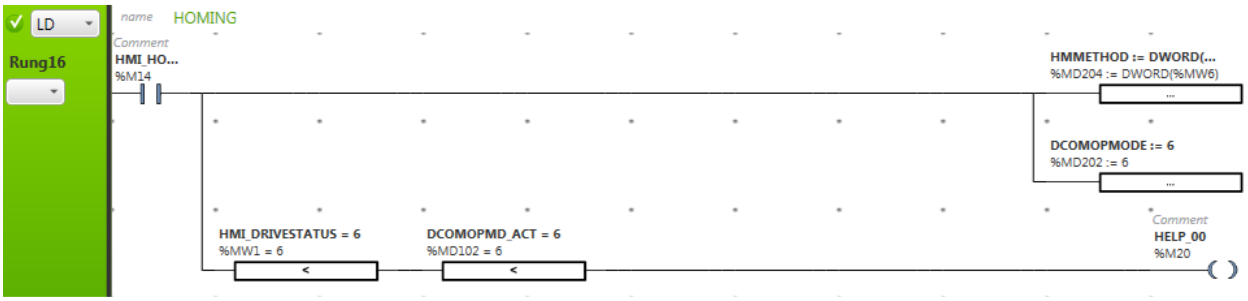
5.4.3 Operating mode Homing

Example Node address 1.

Description Fieldbus command / parameter name (address)	Value
▶ Reference speed for movement to limit switch 100 min^{-1} FC16 / HMn (10248)	0000 0064_h
▶ Reference speed for clearance movement 10 min^{-1} FC16 / HMn_out (10250)	0000 $000A_h$
▶ Disable Voltage FC16 / DCOMcontrol (6914)	0000 0000_h
▶ Shut Down FC16 / DCOMcontrol (6914)	0000 0006_h
▶ Operation Enable FC16 / DCOMcontrol (6914)	0000 $000F_h$
▶ Check operating state [1] FC 3 / DCCMstatus (6916)	
◁ Operating state active	0000 0007_h
▶ Start operating mode FC16 / DCOMopmode (6918)	0000 0006_h
▶ Check operating mode FC 3 / _DCOMopmd_act (6920)	
◁ Operating mode active	0000 0006_h
▶ Select reference movement method, LimN (17) FC16 / HMmethod (6936)	0000 0011_h
▶ Start Homing FC16 / DCOMcontrol (6914)	0000 $001F_h$
▶ Check Homing FC 3 / DCCMstatus (6916)	
◁ Drive has a valid reference point (Bit 12 = 1)	xxxx $1xxx_h$
▶ Reset startbit FC16 / DCOMcontrol (6914)	0000 $000F_h$

1) Must be checked cyclically.

Here it is done in a simple way.



To start the movement bit 4 in DCOM control must be set to 1. This is common also for other mode of operation. Multiple write access on the same bit leads to problems in terms of timing. Therefore a help flag is used (here %M20). At the end of the program code those help flags are merged to trigger bit 4 in DCOMcontrol.

Profile velocity

Start operating mode

If the type of operation, the operating state and the parameter values are set, the operating mode can be started by transfer of a set velocity in the parameter `PVn_target`.

Status messages

The drive provides information concerning positioning via bits 10 and 12 to 15 in the parameter `DCOMstatus`.

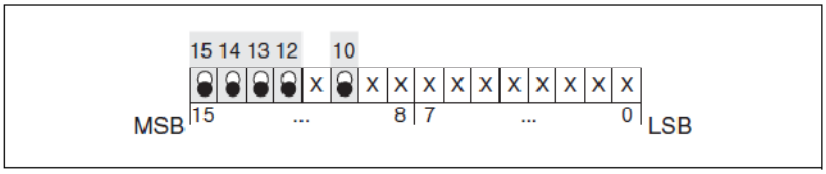


Figure 8.18 Status messages for the operating mode

Parameter value	Meaning
Bit 10: Target reached	0: Reference speed not reached 1: Reference speed reached (also in the case of motor standstill via "Halt")
Bit 12: speed=0	0: Motor shaft moves 1: Motor at a standstill
Bit 13: x_err	1: Error
Bit 14: x_end	1: Operating mode terminated
Bit 15: ref_ok	1: Drive has valid reference point

Operating mode terminated

The operating mode is terminated by a motor standstill caused by "Halt", by an error or when the reference value is set to 0.

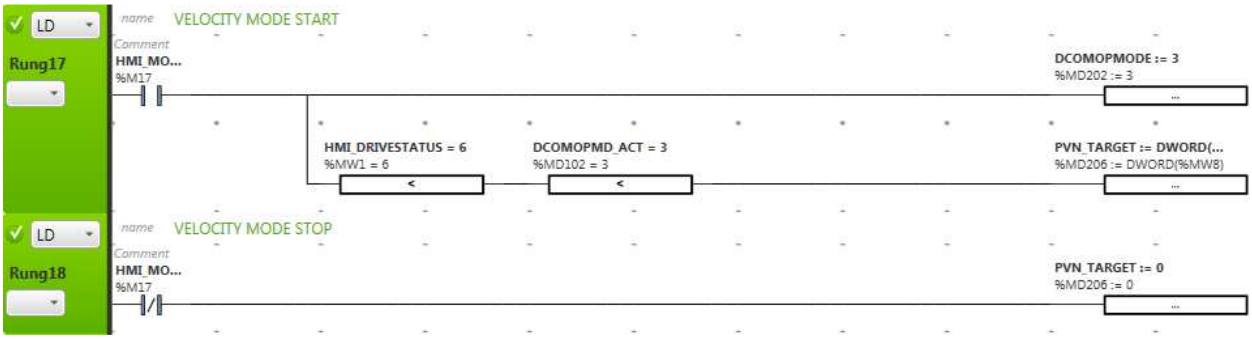
5.4.2 Operating mode Profile velocity

Example Node address 1.

Description Fieldbus command / parameter name (address)	Value
▶ Acceleration ramp 2000 min^{-1}*s FC16 / `RAMPacc` (1556)	0000 07D0$_h$
▶ Deceleration ramp 10000 min^{-1}*s FC16 / `RAMPdecel` (1558)	0000 2710$_h$
▶ Limitation of the reference speed 10000 min^{-1} FC16 / `RAMPn_max` (1554)	0000 2710$_h$
▶ Disable Voltage FC16 / `DCOMcontrol` (6914)	0000 0000$_h$
▶ Shut Down FC16 / `DCOMcontrol` (6914)	0000 0006$_h$
▶ Operation Enable FC16 / `DCOMcontrol` (6914)	0000 000F$_h$
▶ Check operating state [1)] FC 3 / `DCOMstatus` (6916)	
◁ Operating state active	0000 0007$_h$
▶ Start operating mode FC16 / `DCOMopmode` (6918)	0000 0003$_h$
▶ Check operating mode FC 3 / `_DCOMopmd_act` (6920)	
◁ Operating mode active	0000 0003$_h$
▶ Set reference speed 1000 min^{-1} FC16 / `PVn_target` (6938)	0000 03E8h
▶ Check target speed FC 3 / `DCOMstatus` (6916)	
◁ Target speed reached (Bit 10 = 1)	xxxx x4xx$_h$
▶ Set reference speed 0 min^{-1} FC16 / `PVn_target` (6938)	0000 0000$_h$
▶ Check target speed FC 3 / `DCOMstatus` (6916)	
◁ Target speed reached (Bit 10 = 1)	xxxx x4xx$_h$

1) Must be checked cyclically.

The movement starts directly if a set value <>0 is transmitted.



Profile position

Relative and absolute positioning

In the case of absolute positioning, the positioning distance is specified absolutely with reference to the zero point of the axis. A zero point must be defined with the Homing operating mode before absolute positioning can be used for the first time.

In the case of a relative positioning, the positioning distance is specified relatively with reference to the current axis position or the target position.

Absolute positioning or relative positioning is set with bit 6 via the parameter `DCOMcontrol`.

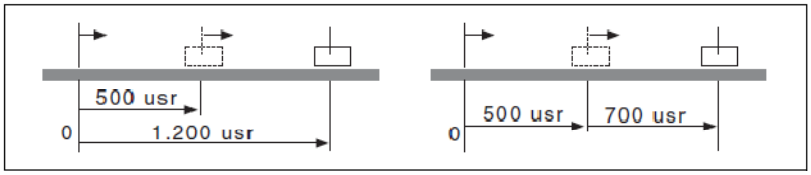


Figure 8.15 Absolute positioning (left) and relative positioning (right)Absolute positioning (left) and relative positioning (right)

Triggering positioning

Parameter value	Meaning
Bit 4: New target value	0->1: Start positioning movement or prepare subsequent positioning movement
Bit 5: Change setpoint immediately (only applicable with new target position 0->1)	0: Activate new position values when target position is reached 1: Activate new position values immediately
Bit 6: Absolute / relative	0: Absolute positioning 1: Relative positioning

A new positioning movement is started when the edge of bit 4 in the parameter `DCOMcontrol` rises.

The positioning movement can be triggered in 2 ways depending on bit 5.

- Bit 5 = 0:

  Positioning values (`PPp_targetusr`, `PPn_target`, `RAMPacc` and `RAMPdecel`), that are supplied while a positioning movement is active, are saved temporarily. The target position of the current positioning movement is approached. The new positioning movements according to the new values are executed only when the target position has been reached.

  If new positioning values are provided again, the temporarily saved positioning values are overwritten.

- Bit 5 = 1:

  Positioning values (`PPp_targetusr`, `PPn_target`, `RAMPacc` and `RAMPdecel`), that are supplied while a positioning movement is active, are immediately executed. The new target position is approached directly.

Status messages

The drive provides information concerning positioning via bits 10 and 12 to 15 in the parameter `DCOMstatus`.

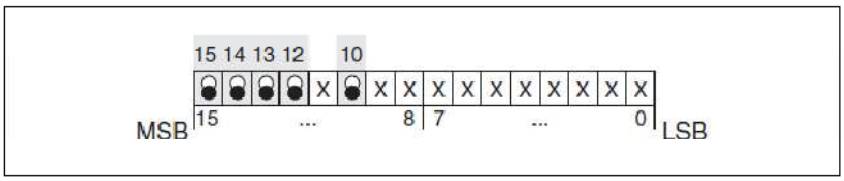


Figure 8.16 Status messages for the operating mode

Parameter value	Meaning
Bit 10: Target reached	0: Target position not reached (also in the case of "Halt" or error) 1: Target position reached
Bit 12: Target value acknowledge	0: New position possible 1: New target position accepted
Bit 13: x_err	1: Error
Bit 14: x_end	1: Positioning finished, motor at a stand-still
Bit 15: ref_ok	1: Drive has valid reference point

Positioning finished

Bit 14 indicates whether positioning has been finished. If the target position was reached, bit 10 changes to 1. If the positioning movement was canceled by "Halt" or by an error, bit 10 remains set to 0.

5.4.1 Operating mode Profile Position

Example Node address 1.

Description Fieldbus command / parameter name (address)	Value
▶ Acceleration ramp 2000 min^{-1}*s FC16 / RAMPacc (1556)	0000 07D0$_h$
▶ Deceleration ramp 4000 min^{-1}*s FC16 / RAMPdecel (1558)	0000 0FA0$_h$
▶ Limitation of reference speed 6000 min^{-1} FC16 / RAMPn_max (1554)	0000 1770$_h$
▶ Reference speed 4000 min^{-1} FC16 / PPn_target (6942)	0000 0FA0$_h$
▶ Disable Voltage FC16 / DCOMcontrol (6914)	0000 0000$_h$
▶ Shut Down FC16 / DCOMcontrol (6914)	0000 0006$_h$
▶ Operation Enable FC16 / DCOMcontrol (6914)	0000 000F$_h$
▶ Check operating state [1)] FC 3 / DCOMstatus (6916)	
◁ Operating state active	0000 0007$_h$
▶ Start operating mode FC16 / DCOMopmode (6918)	0000 0001$_h$
▶ Check operating mode FC 3 / _DCOMopmd_act (6920)	
◁ Operating mode active	0000 0001$_h$
▶ Store new reference position FC16 / PPp_targetusr (6940)	0000 0030$_h$
▶ Start absolute positioning FC16 / DCOMcontrol (6914)	0000 005F$_h$
▶ Check target position FC 3 / DCOMstatus (6916)	
◁ Target position reached (Bit 10 = 1)	xxxx x4xx$_h$
▶ Reset startbit FC16 / DCOMcontrol (6914)	0000 000F$_h$

1) Must be checked cyclically.

To trigger bit 4 in DCOMcontrol also a helpflag (here %M21) is used.