

EcoStruxure Machine Expert - Basic Example Guide

Modbus Master on Serial Line via
SR2MOD01 Modem

xSample_Modbus_Master_SL_via_SR2-
MOD01_Modem.smbe

12/2018



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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

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.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

WARNING

UNGUARDED EQUIPMENT

- 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.

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and 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.

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-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

WARNING

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 death, serious injury, or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- 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 operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book



At a Glance

Document Scope

This document describes an EcoStruxure Machine Expert - Basic example application that allows you to operate a Modbus master connection on Serial line 1 through SR2MOD01 modem.

The examples described here are intended for learning purposes only. In general, they are intended to help you understand how to develop, test, commission, and integrate application logic and/or the device wiring of the equipment associated with your own design in your control systems. The examples are not intended to be used directly on products that are part of a machine or process.

WARNING

UNINTENDED EQUIPMENT OPERATION

Do not include any wiring information, programming or configuration logic, or parameter values from any of the examples in your machine or process without thoroughly testing your entire application.

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

This document and its related EcoStruxure Machine Expert - Basic project file focus on specific instructions and function blocks of the Schneider Electric libraries and on specific features of EcoStruxure Machine Expert - Basic. They are intended to help you understand how to develop, test, commission, and integrate applicative software of your own design in your control systems.

The example is intended for qualified person who are new EcoStruxure Machine Expert - Basic users.

Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert - Basic V1.0.

Related Documents

Title of Documentation	Reference Number
EcoStruxure Machine Expert - Basic - Operating Guide	EIO0000003281 (ENG) EIO0000003282 (FRE) EIO0000003283 (GER) EIO0000003284 (SPA) EIO0000003285 (ITA) EIO0000003286 (CHS) EIO0000003287 (POR) EIO0000003288 (TUR)
EcoStruxure Machine Expert - Basic Example Guide - Modbus Slave on Serial Line via SR2MOD01 Modem	EIO0000003367 (ENG)

Product Related Information

WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.¹
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

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

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems" or their equivalent governing your particular location.

WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

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

 WARNING

UNINTENDED EQUIPMENT OPERATION

Do not include any wiring information, programming or configuration logic, or parameter values from any of the examples in your machine or process without thoroughly testing your entire application.

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

Chapter 1

Example Description

What Is in This Chapter?

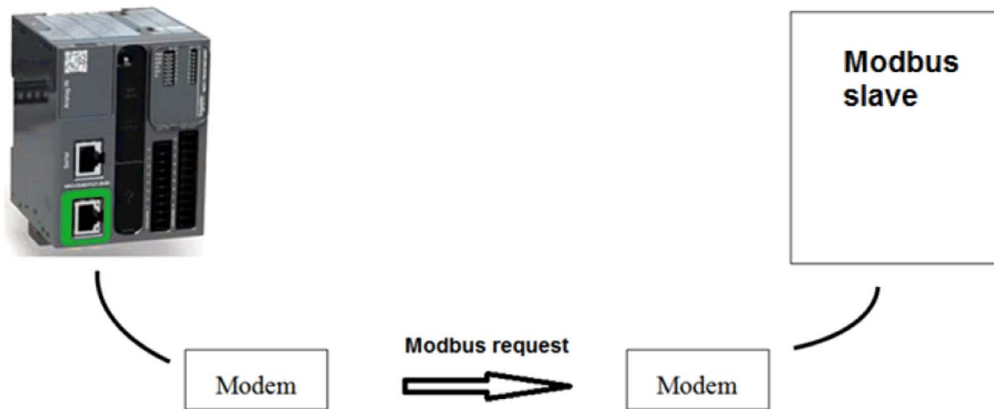
This chapter contains the following topics:

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Description

Presentation

This example guide explains how to configure a M221 Logic Controller to access a remote device through a public switched telephone network (PSTN) modem.



The project template uses:

- a SR2MOD01 modem
- a M221 Logic Controller as a master

NOTE: If you want to use the M221 as a slave, refer to EcoStruxure Machine Expert - Basic Example Guide Modbus Slave on Serial Line via SR2MOD01 Modem.

The template example program is designed to be integrated into your application. The comments of the objects used in the template help you to use this template.

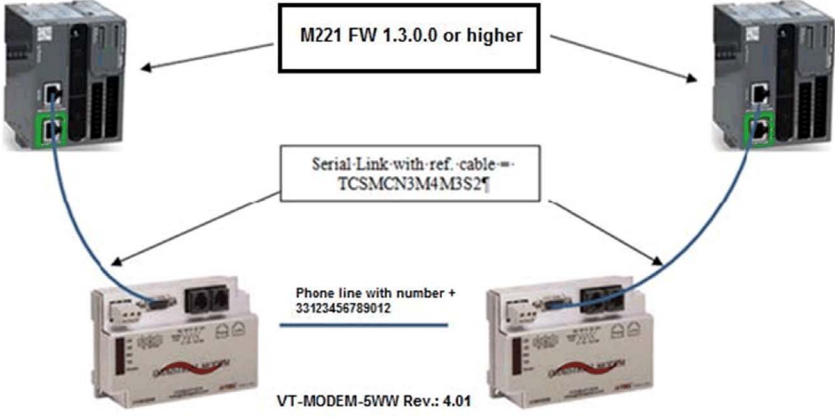
The animation tables in the template enable you to:

- Monitor the template.
- Configure the communication information (phone number and slave address).
- Diagnose the modem connection.
- Read and write data to the slave logic controller to which you are connected.

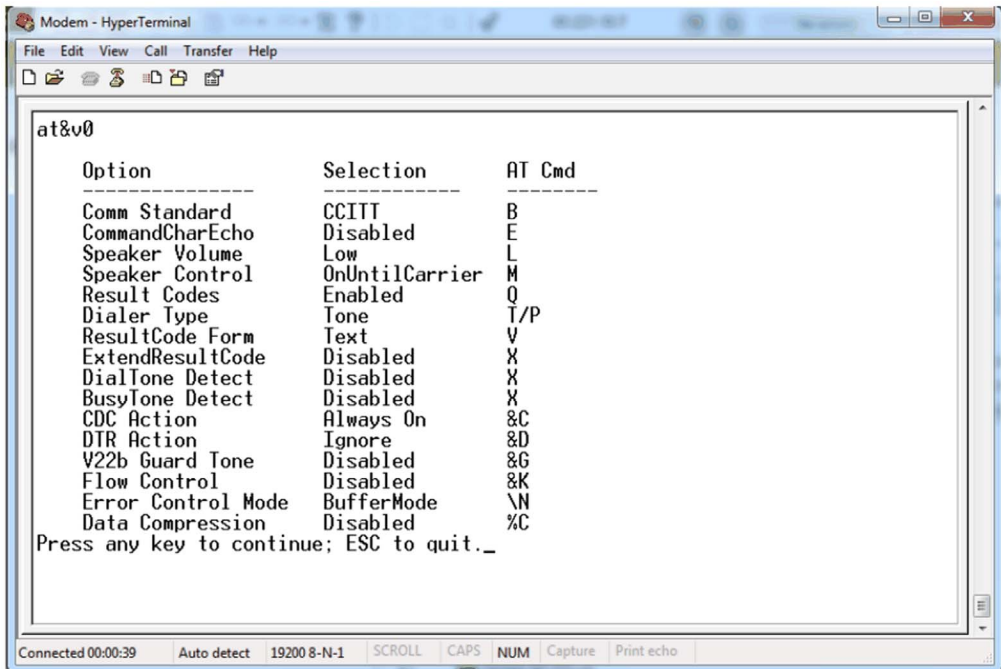
Configuring the SR2MOD01

If the SR2MOD01 is used for the first time, initialize it:

Step	Action
1	<p>In the EcoStruxure Machine Expert - Basic software, click Configuration tab → SL1 → Modbus. Result: The following window is displayed.</p> <p>Modbus</p> <p>Device settings</p> <p>Device: <input type="text" value="SR2MOD01"/></p> <p>Init command: <input type="text" value="ate0\n0\v1&d0&k0s0=1s89=0\$EB0#p0\$sb19200n0s28=1s37=13&w0"/></p> <p>Protocol Settings</p> <p>Transmission mode: <input checked="" type="radio"/> RTU <input type="radio"/> ASCII</p> <p>Addressing: <input type="radio"/> Slave <input checked="" type="radio"/> Master</p> <p>Response timeout (× 100 ms): <input type="text" value="10"/></p> <p>Time between frames (ms): <input type="text" value="30"/></p>
2	Select the same settings.
3	In the Init command field, enter <code>ate0\n0\v1&d0&k0s0=1s89=0\$EB0#p0\$sb19200n0s28=1s37=13&w0⁽¹⁾</code> .
4	Click Apply .
5	Connect the SR2MOD01 to the M221 serial port.
<p>(1) If you use a different modem, to configure the Init command, refer to Configuring Modbus and ASCII Protocols (see <i>Modicon M221, Logic Controller, Programming Guide</i>).</p>	

Step	Action
6	<p>Connect the M221 to the PC using a USB or Ethernet cable.</p> 
7	Set the system bit %S105 to 1.
8	<p>Verify that %SW167 is set to 0. Result: The SR2MOD01 is initialized. NOTE: As the SR2MOD01 is initialized, you can modify the Init command.</p>
<p>(1) If you use a different modem, to configure the Init command, refer to Configuring Modbus and ASCII Protocols (see <i>Modicon M221, Logic Controller, Programming Guide</i>).</p>	

To verify the configuration of your modem, use an external software tool such as Windows Hyperterminal. If you send the command `at&v0` via Windows Hyperterminal, you see the following information:



```
at&v0

Option                Selection          AT Cmd
-----                -
Comm Standard         CCITT              B
CommandCharEcho      Disabled           E
Speaker Volume        Low                L
Speaker Control       OnUntilCarrier    M
Result Codes          Enabled            Q
Dialer Type           Tone               T/P
ResultCode Form       Text              V
ExtendResultCode     Disabled           X
DialTone Detect       Disabled           X
BusyTone Detect       Disabled           X
CDC Action            Always On         &C
DTR Action            Ignore            &D
V22b Guard Tone      Disabled           &G
Flow Control          Disabled           &K
Error Control Mode    BufferMode         \N
Data Compression      Disabled           %C

Press any key to continue; ESC to quit._

Connected 00:00:39  Auto detect  19200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

For more information, refer to the Appendix ([see page 28](#)).

Animation Table Description

Animation Table: Constant_data

The telephone number of the distant modem connected to the M221 Logic Controller slave is encoded in constant words (%KW). The number encoded is an example number.

The following illustration presents the constant words contained in the animation table named **Constant_data**:

Used	Address	Symbol	Value	Force	Comment
<input checked="" type="checkbox"/>	%KW0	SLAVE_NB	1		Serial line slave address of the distant PLC
<input checked="" type="checkbox"/>	%KW1	CALL_WORD_1	AT		First twin characters command for dial. 0x4154 = "AT" in ASCII
<input checked="" type="checkbox"/>	%KW2	CALL_WORD_2	D+		Second twin characters command for dial. 0x4428 = "D+" in ASCII
<input checked="" type="checkbox"/>	%KW3	CALL_WORD_3	33		Third twin characters command for dial. 0x3333 = 33 in ASCII for France country
<input checked="" type="checkbox"/>	%KW4	CALL_WORD_4	12		Fourth twin characters command for dial. 0x3132 = 12 in ASCII
<input checked="" type="checkbox"/>	%KW5	CALL_WORD_5	34		Fifth twin characters command for dial. 0x3334 = 34 in ASCII
<input checked="" type="checkbox"/>	%KW6	CALL_WORD_6	56		Sixth twin characters command for dial. 0x5356 = 56 in ASCII
<input checked="" type="checkbox"/>	%KW7	CALL_WORD_7	78		Seventh twin characters command for dial. 0x3738 = 78 in ASCII
<input checked="" type="checkbox"/>	%KW8	CALL_WORD_8	90		Eighth twin characters command for dial. 0x3990 = 90 in ASCII
<input checked="" type="checkbox"/>	%KW9	CALL_WORD_9	12		Ninth twin characters command for dial. 0x3132 = 12 in ASCII
<input checked="" type="checkbox"/>	%KW10	CALL_WORD_10	14#0DOA		Tenth twin characters command for dial. 0x0DOA = CR + LF in ASCII (Carriage Return and Line Feed)
<input checked="" type="checkbox"/>	%KW11	CALL_CHAR_NB	20		Number to call preceded by ATD and followed by CR and LF in ASCII. 20 in our example: ATD+33123456789012CR'LF'

When the M221 is in **RUNNING** state or after a cold start, the values of the constant words are used at the first application scan. The values are transferred to memory words, which transfer the information to the SR2MOD01.

To modify the application configuration, modify the values of the constant words. Refer to Modifying Project Template (*see page 22*).

Animation Table: PLC_Sts

When you run the project template, use the animation table named **PLC_Sts** to monitor the communication initialization:

Used	Address	Value	Comment
<input type="checkbox"/>	%S105	0	Set to 1 for executing of the init command destined to the attached modem
<input type="checkbox"/>	%SW167	0	0 = Modem has well taken into account the init command ; 4 = bad response from the modem (ex. link settings are different between PLC and modem) ; 65535 = no modem connected

%S105 can be set by you or the program:

Set to 1 The M221 sends the **Init command** (*see page 15*) to the SR2MOD01.

%SW167 indicates the SR2MOD01 state:

Set to 0 The SR2MOD01 is configured and waits for the dial-up command.

Set to 4 The configurations of the M221 and the SR2MOD01 are different.

Set to 65535 The SR2MOD01 is not connected or not powered.

Animation Table: Control

When you run the project template, use the animation table named **Control** to monitor the call progress:

Used	Address	Symbol	Value	Force	Comment
<input checked="" type="checkbox"/>	%M10	CMD_CNX_MODEM	0		0 = Hangup required when %MW99 = 6 or %MW99 = persistent to 13 ; 1 = Connection required when %MW99 = 0
<input checked="" type="checkbox"/>	%M11	RETRY_CNX_MODEM			Restart connection mecanism when %MW99 = 13
<input checked="" type="checkbox"/>	%MW99	STATE_MCDEM	4		4 = Waiting connection ; 6 = Connection realized and Modbus requests in progress ; 13 = connection error
<input checked="" type="checkbox"/>	%MD1000	MDB_REQ_NB			Counter incremented on each modbus request done ; if value is fixe with %M10 = 1 and %MW99 = 6, there is a Modbus request error may be linked to a modem's disconnection
<input checked="" type="checkbox"/>	%M100	EXECUTE_MDB_REQ	1		1 = The conditions are realized to execute modbus request
<input checked="" type="checkbox"/>	%M102	RETRY_EXEC_MDB_REQ	1		1 = retry the execution of the modbus request if the conditions are realized
<input checked="" type="checkbox"/>	%MW200	DISTANT_MW10_VALUE			Value of the distant %MW10 register

%MW99 indicates the remote modem state:

Set to 0 Ready to start

Set to 4 Connection in progress

Set to 6 Connected

Set to 13 Error detected

NOTE: If %MW99 is set to 0, set %M10 to 1 to dial the remote SR2MOD01.

Communication Process

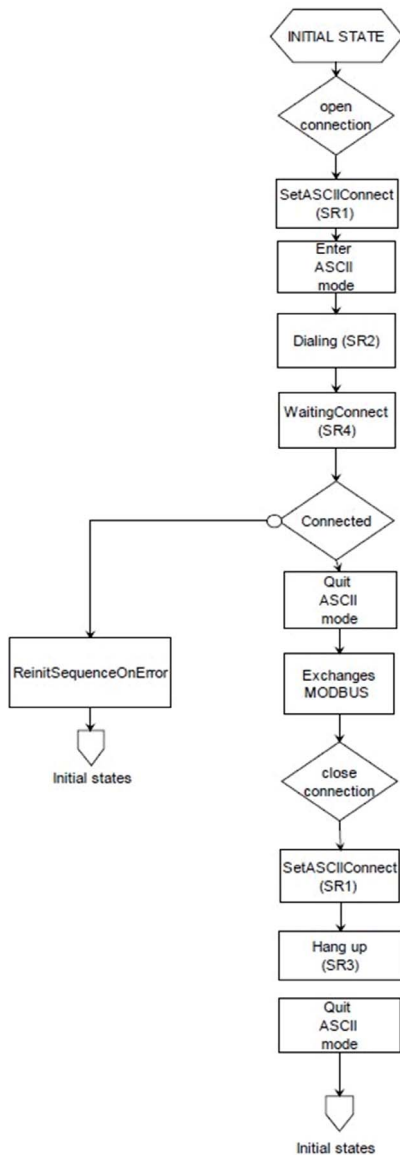
State Diagram

To start the communication, configure the communication settings using %SW103 and %SW104, then set:

- %S103 to 1
- %M10 to 1
- %MW99 to 0

This corresponds to the initial state in the diagram below.

The following diagram presents the communication process:



SR_x The subroutine used in the template

At the initial state, the communication is in Modbus mode, then commands are sent in ASCII mode. When the connection is established, the communication is in Modbus mode.

Modifying the Template Example

Modification Process

To modify the call information, use the program or the animation table named **Online_Custom**:

The screenshot displays the SIMATIC Manager interface. The top bar shows tabs for Configuration, Programming, Display, and Commissioning. The main window shows a ladder logic program with a rung labeled 'Rung0' containing a normally open contact 'Connection_Init' and a coil 'SB_FIRSTRUN' with a timer 'S13'. Below the ladder logic is the 'Online Custom' table, which lists memory words and their associated symbols and comments.

Used	Trace	Address	Symbol	Value	Force	Comment
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW0	MW_SLAVE_NB			Online custom for serial line slave address of the distant PLC
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW1	MW_CALL_WORD_1			Online custom first twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW2	MW_CALL_WORD_2			Online custom second twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW3	MW_CALL_WORD_3			Online custom third twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW4	MW_CALL_WORD_4			Online custom fourth twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW5	MW_CALL_WORD_5			Online custom fifth twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW6	MW_CALL_WORD_6			Online custom sixth twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW7	MW_CALL_WORD_7			Online custom seventh twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW8	MW_CALL_WORD_8			Online custom eighth twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW9	MW_CALL_WORD_9			Online custom ninth twin characters command for dial
<input checked="" type="checkbox"/>	<input type="checkbox"/>	%MW10	MW_CALL_WORD_10			Online custom tenth twin characters command for dial
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	%MW11	MW_CALL_CHAR_NB			Online custom number to call preceded by ATD and followed by CR and LF in ASCII

The communication between two logic controllers enables you to read and write data between these controllers.

To start the communication, modify the read and write function blocks to specify memory words (%MW) that have to be read and written.

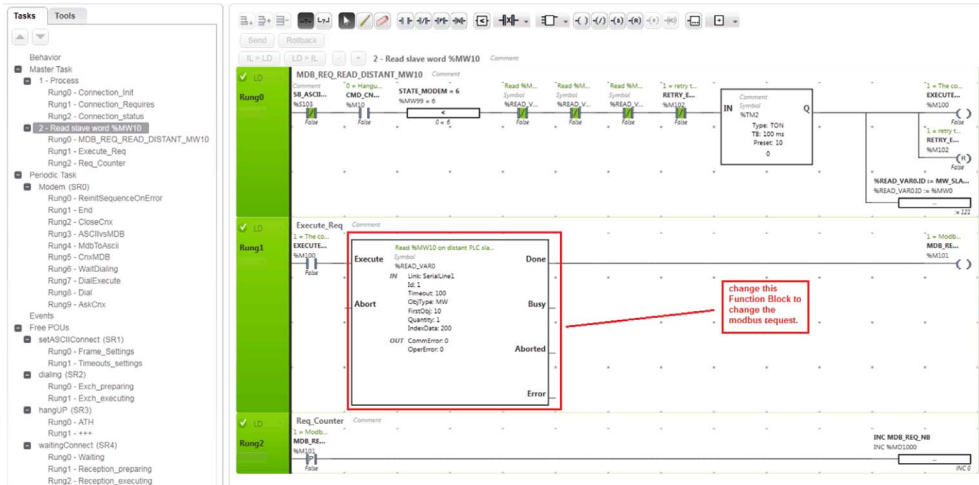
When you entered the communication data of each modem, you can start the communication.

For the purpose of this example, the memory word %MW10 of the slave M221 Logic Controller is incremented by one every second.

In the **Control** animation table, %MW200 enables you to see the %MW10 value.

For more information on the slave, refer to EcoStruxure Machine Expert - Basic Example Guide Modbus Slave on Serial Line via SR2MOD01 Modem.

In the example below, the %READ_VAR function block is programmed to read starting at %MW10 for length of one word. For your application, modify the default configuration to start the read of the slave at the intended starting word and numbers of words to read.



Appendices



Appendix A

Configuring the SR2MOD01 without the Init Command

What Is in This Chapter?

This chapter contains the following topics:

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Configuring the SR2MOD01 without the Init Command

If you do not use the **Init command** (*see page 15*) to configure the modem, use the following configuration:

E0 Disable echo commands received by DTE

Q0 Enable result codes to DTE

&C0 Ignore DCD (always ON)

&D0 Ignore DTR signals

&K0 Disable flow control

V1 Format of result code = VERBOSE

S0=1 Accept incoming call after one ring

S2 Escape code character = 43

X0 Disable error codes during call progress

&W Write current configuration

Template Values

The following table describes the default and modified values of the example:

Option	Default value	Value modified in this example	AT Cmd
Comm Standard	CCITT	–	B
CommandCharEcho	–	Disabled	E
Speaker Volume	–	Low	L
Speaker Control	OnUntilCarrier	–	M
Result Codes	Enabled	–	Q
Dialer Type	Tone	–	T/P
ResultCode Form	Text	–	V
ExtendResultCode	–	Disabled	X
DialTone Detect	–	Disabled	X
BusyTone Detect	–	Disabled	X
CDC Action	–	Always On	&C
DTR Action	–	Ignore	&D
V22b Guard Tone	Disabled	–	&G
Flow Control	–	Disabled	&K
Error Control Mode	–	BufferMode	\N
Data Compression	–	Disabled	%C
AutoAnswerRing	1	–	S0
AT Escape Char	43	–	S2
CarriageReturn Char	13	–	S3
Linefeed Char	10	–	S4
Backspace Char	8	–	S5
Blind Dial Pause	3 sec	–	S6
NoAnswer Timeout	65 sec	–	S7
Pause Time	2 sec	–	S8
Remote Config Char	37	–	S9
No Carrier Disc	2000 msec	–	S10
DTMF Dial Speed	100 msec	–	S11
Escape GuardTime	1000 msec	–	S12
Data Calling Tone	Enabled	–	S35
Line Rate	–	19200	S37

Option	Default value	Value modified in this example	AT Cmd
Handshake Speed	–	ConnectAtS37	N
Xon/Xoff Pacing	Pacing On	–	&E12/13
DSR Control	DSR High	–	&S
User Profile	Stored	–	&W
Break Control	\K5	–	\K
DTR Dialing	Off	–	\$D
Eleven Bit	Off	–	\$EB
Parity Bit	–	None	#P
Leased HS Mode	PSTN HS	–	\$LL
\$SB Setting	–	19200 bps	\$SB
Callback Security	Disabled	–	#CBS
Callback Delay	15 sec	–	#CBD
Callback Parity	None/Space	–	#CBP
Callback Inactivity	20 min	–	#CBI
Callback Retries	4	–	#CBA