TeSys

TeSys Ultra LULC033
Modbus Communication Module

User Guide

TeSys offers innovative and connected solutions for motor starters.

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www.se.com

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Safety Information

Important Information

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.

About the Book

TeSys Master Range

TeSys is an innovative motor control and management solution from the global market leader. TeSys offers connected, efficient products and solutions for switching and protection of motors and electrical loads in compliance with all major global electrical standards.

Document Scope

This guide describes the implementation, functions and operation of the LULC033 Modbus communication module.

Area of application: mainly control system applications in the Industry and Building sectors.

Validity Note

This guide applies to LULC033 Modbus communication module with firmware version 2.2 or greater.

LULC033 Modbus communication module with firmware version 2.2 is compatible with the following devices:

- LUTM controllers version 1.2 or greater
- LUCM multifunction control units version 1.10 or greater
- LUCMT multifunction control units version 2.11 or greater

Related Documents

Title of Documentation	Reference Number
LULC033 Modbus Module - Instruction Sheet	1743239
LU9GC3 Modbus Tap Module - Instruction Sheet	1638860
TeSys Ultra Communication Variables - User Guide	1744082_01A55 (FR) 1744082_02A55 (EN) 1744082_03A55 (DE) 1744082_04A55 (ES) 1744082_05A55 (IT)
LU•B/LU•S• Starters - Instruction Sheet	1629984
LUCA/LUCB/LUCC/LUCD Control Units - Instruction Sheet	AAV40503
Electromagnetic Compatibility - Practical Installation Guidelines	DEG999

You can download these technical publications and other technical information from our website at www.se.com/ww/en/download/.

Information on Non-Inclusive or Insensitive Terminology

As a responsible, inclusive company, Schneider Electric is constantly updating its communications and products that contain non-inclusive or insensitive terminology. However, despite these efforts, our content may still contain terms that are deemed inappropriate by some customers.

Hardware Implementation

What's in This Part

Installing the LULC033 Modbus Communication Module

What's in This Chapter

Safety Instructions

⚠CAUTION

HAZARDOUS OPERATION

These devices must be installed, configured and used by qualified staff only.

- Users must follow all current instructions, standards and regulations.
- Check the function settings before starting the motor.
- Do not downgrade or modify these devices.

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

⚠CAUTION

PRECAUTIONS WHEN USING COMMUNICATION VARIABLES

- Only use the serial link for transmitting data that is not critical to the application.
- There is some delay in the transmission of data relating to motor-starter states and load-current values. This data must not therefore be used in the management of safety devices and emergency stops.
- Data such as Forward, Reverse and Stop must not be used in safety and emergency-stop circuits.

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

Presentation of the LULC033 Modbus Communication Module

Receiving the Product

On opening the box containing the LULC033 Modbus communication module, you should find the following items:

- An instruction sheet providing brief pictorial information about the standard installation of the module
- An LULC033 Modbus communication module with connectors.

NOTE: Check that you have all the items described above. Make sure that the instruction sheet is included, along with the correctly inserted connectors.

Functions Offered

The communication module is used to control a motor-starter remotely, via Modbus, from an LUB••/LU2B•• TeSys Ultra starter-controller.

Using the communication module, you can:

- Read the motor-starter states
- Control the motor-starter (reversing or non-reversing)
- Adjust the protection functions
- Read the data processed in the advanced control units
- Read the state of the I/O (controller base)

NOTE: For information on the Modbus protocol, refer to the following website: www.Modbus.org.

Data Available

The available protection and control data depend on the control unit with which the Modbus communication module is used.

The Modbus communication module can be used with the following types of control unit:

- Standard (reference LUCA)
- Advanced (references LUCB/C/D)

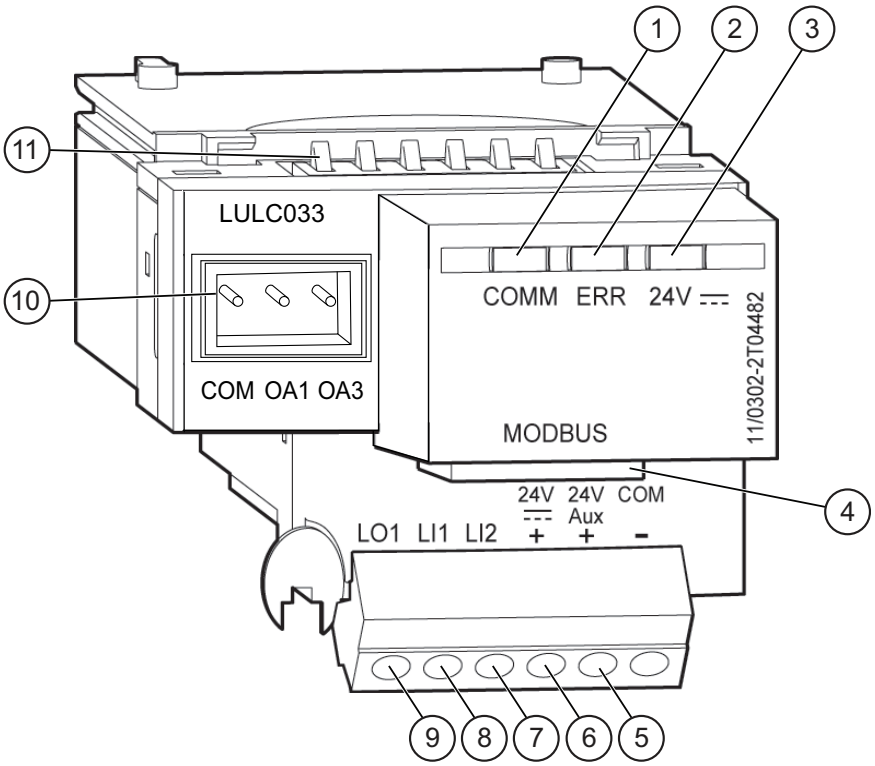
The table below can be used to check the data and commands you can access with each type of control unit:

Data - Commands	**Control unit**	
	Standard (LUCA)	**Advanced (LUCB/C/D)**
Start and stop commands	✓	✓
Status (ready, running, fault condition)	✓	✓
Warning	✓	✓
Automatic reset and remote reset via the bus		✓
Indication of the motor load		✓
Differentiation of faults		✓

Description of the Module and Installation

Diagram of the Module

Connectors and indicator lights (LEDs) on the LULC033 Modbus communication module:



1	Green **COMM** Modbus communication status LED.
2	Red **ERR** Modbus communication module fault indication LED.
3	Green **24V** ⎓ LED indicating voltage presence at outputs OA1, OA3, LO1.
4	RJ45 connector for the Modbus RS-485 link.
5	Connection of the module power supply.
6	Connection of the 24 V ⎓ power supply for outputs OA1, OA3, LO1.
7	Discrete input 2.
8	Discrete input 1.
9	Discrete output 1, assignable depending on the configuration register (685 LSB).
10	24 V ⎓ prewired coil connector for the power base. • The assignment of OA1 depends on the configuration register (686 LSB). • The assignment of OA3 depends on the configuration register (686 MSB).
11	Connector for communication with the advanced control unit.

Description of Indicator Lights (LEDs)

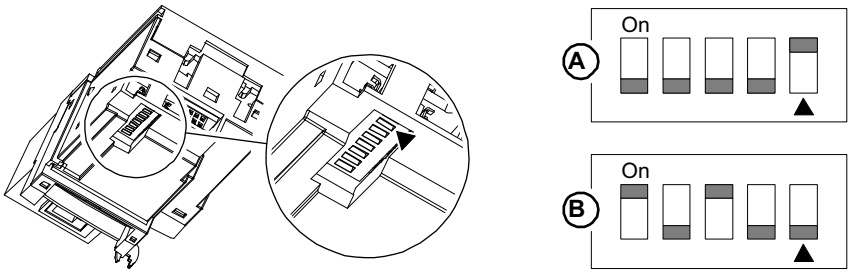
Description of the various states of the indicator lights (light-emitting diodes, LEDs) on the LULC033 Modbus communication module.

Light-emitting diodes (LEDs)			**Meaning**
Green COMM LED	**Red ERR LED**	**Green 24V ⎓ LED**	
Flashing (alternately with the **ERR** LED)	Flashing (alternately with the **COMM** LED)	On	Bus parameter initialization in progress
Flashing during communication with the Module address	Off	On	Normal operation
Off	Off	Off	Faulty: 24 Vdc voltage missing on the 24 Vdc terminal. Check the connection between the power supply and the communication module.
	On	On	Internal fault on the LULC033 Internal Faults, page 49
	Flashing	On	Loss of communication on the Modbus network

NOTE: During startup, because the default fallback mode is **forced stop**, if no communication has previously been established, the red **ERR** LED will flash after one minute (default timeout value).

Addressing Using Switches

The Modbus communication module address is defined by switches located on the underside of the module. Turn the module over to access them:



A. The module is delivered with the default address 1

B. Example of configuration with address 20

The range of accepted values is between 1 and 31.

The address coding is in binary format.

The **least significant bit** is on the right, indicated by ▲.

Address 0 is not taken into account by the module, since it is used by the Client for a broadcast request.

NOTE: Addressing is only taken into account when the communication module is powered up.

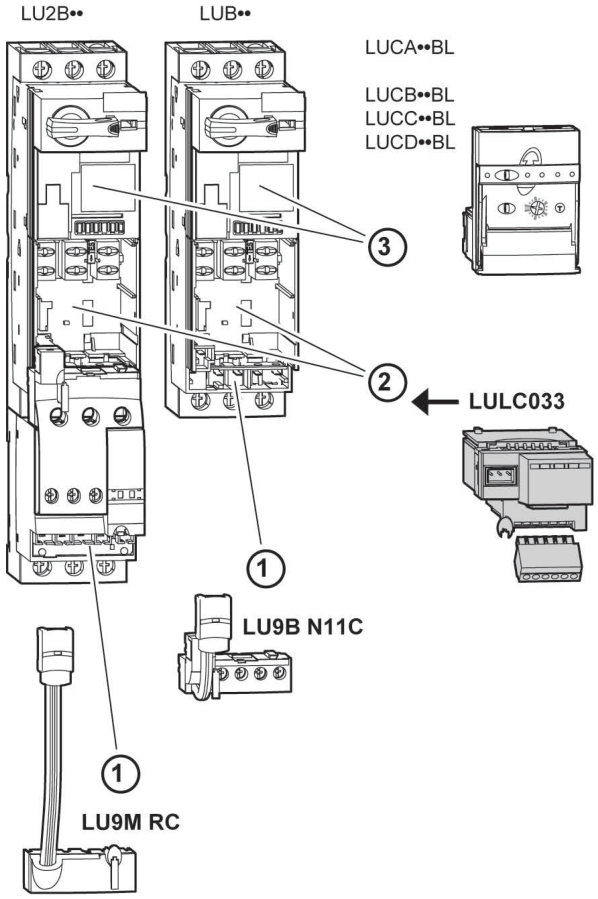
Order of Mounting on a Base

The LULC033 module is installed in a power base or a controller base (on the underside of the control unit which locks it in position).

To install the module in the power base or controller base:

Step	Action
1	Choose the prewired coil connection terminals.
2	Insert the LULC033 Modbus communication module.
3	Insert the control unit which locks the module.

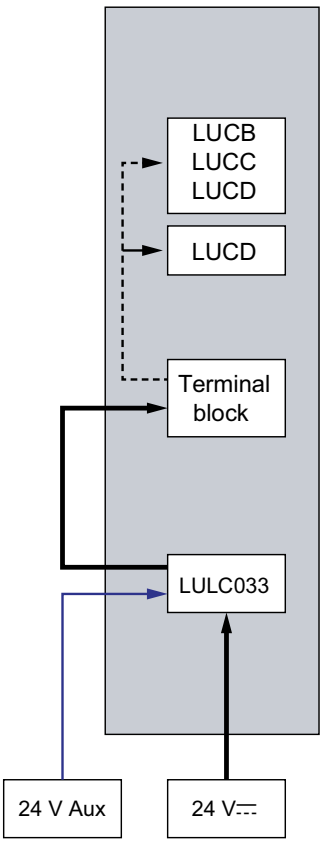
The diagram below illustrates these steps. Installation of the LULC033 Modbus communication module corresponds to step (2). The numbers indicate both the order of mounting for the components and their location.



Electrical Connection

24 V ⎓ and 24 V Aux Power Supply

Diagram for 24 V ⎓ and 24 V Aux power supplies.



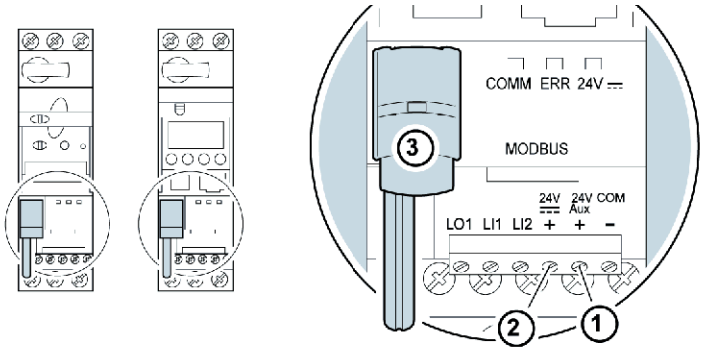
IMPORTANT: 24 V ⎓ and 24 V Aux power supplies must be dedicated to the application.

Power Supply for the LULC033 and Outputs OA1, OA3 and LO1

In order to operate, the LULC033 Modbus communication module must be powered by a 24 V ⎓ source:

- With a power base, the LULC033 must be powered by an external source.
- With a controller base, the LULC033 is powered directly.

Power Supply for LUB••/LU2B•• Power Bases



1 24 V Aux: Power-supply terminal for the LULC033 Modbus communication module.

2 24 V ==: Power-supply terminal for outputs OA1 OA3 and LO1.

3 Prewired link for connecting outputs OA1 and OA3 to terminals A1/A3/A2 on the starter.

Power Base: Terminal Power Supply

The user has two options for connecting the **power-base** terminals:

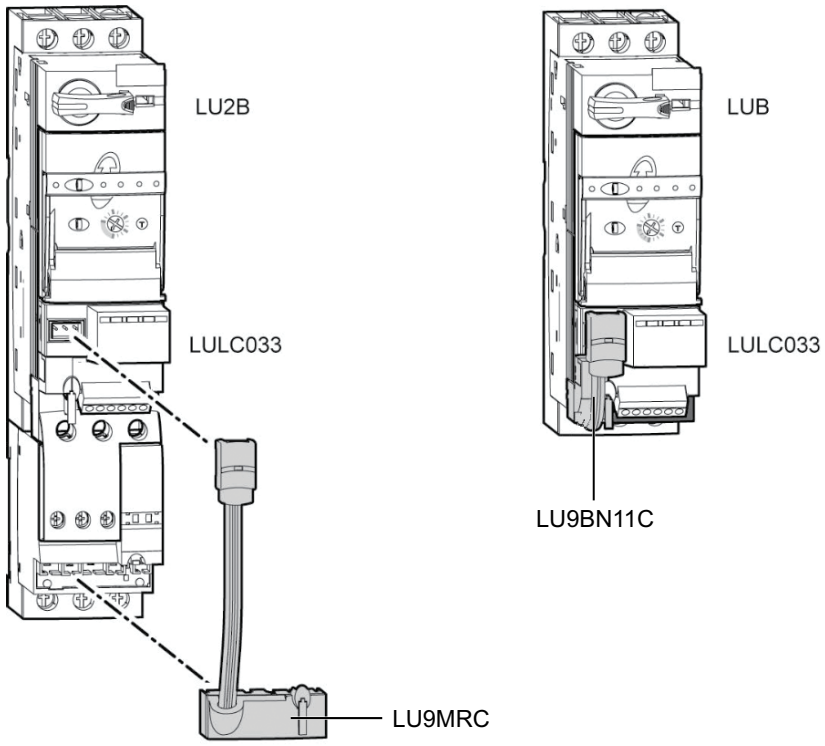
- Power supply via the LULC033 Modbus communication module with a prewired link
- Direct power supply with a wire-to-wire link

Prewired Link

Catalog numbers for the two prewired coils:

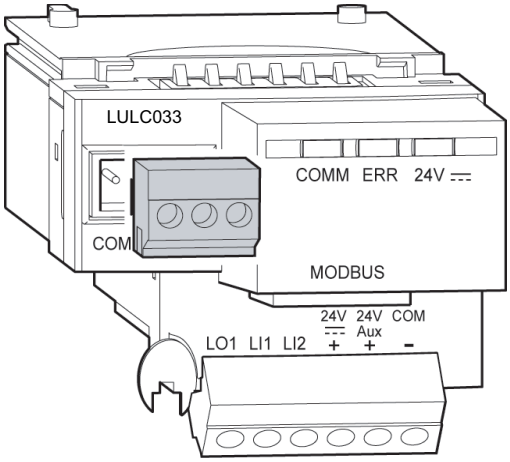
Designation	With a power base	Catalog number
Prewired coil	LUB••	LU9BN11C
	LU2B••	LU9MRC

Illustration for both types of power base:



Wire-to-Wire Link (Power Supply to Outputs OA1, OA3 and LO1)

This type of link is compulsory in the case of a reversing starter-controller created from an LU6M reversing unit, for separate assembly.



The wire-to-wire link can also be used to insert a local or external stop command, for example.

Connection Capacities of the LULC033 Terminals

The table below shows the conductor cross-sections to be used:

Connection	Type of conductor	Cross-section (min. - max.)	
1 conductor	Solid conductor	0.14 - 1 mm²	AWG 26 - AWG 18
	Stranded conductor	0.14 - 1 mm²	AWG 26 - AWG 18
	Stranded conductor with cable end: Non-insulated Insulated	 0.25 - 1 mm² 0.25 - 0.5 mm²	 AWG 24 - AWG 18 AWG 24 - AWG 20

Connection	Type of conductor	Cross-section (min. - max.)	
2 conductors (same cross-section)	2 solid conductors	0.14 - 0.5 mm^2	AWG 26 - AWG 20
	2 stranded conductors	0.14 - 0.75 mm^2	AWG 26 - AWG 20
	2 stranded conductors with cable end: Non-insulated Insulated	 0.25 - 0.34 mm^2 0.50 mm^2	 AWG 24 - AWG 22 AWG 20

Connectors	3 and 6 pts	
Increment	3.81 mm	0.15 in.
Tightening torque	0.2/0.25 N.m.	28.3/35.4 lb-in.
Flat screwdriver	2.5 mm	0.10 in.

Connection to the RS-485 Bus

General

There are several ways in which the user can connect the communication module to the RS-485 bus:

- Direct connection to the bus via a VW3A8306TF•• T-junction box
- Connection to the bus via a splitter box
- Connection to the bus via SCA type junction boxes

For Interference Protection:

Use the Schneider Electric cable with 2 pairs of shielded twisted conductors (references: TSXCSA100, TSXCSA200, TSXCSA500, VW3A8306TF••).

Keep the Modbus cable away from the power cables (at least 30 cm (12 in)).

Create crossovers of the Modbus cable and the power cables at right-angles, if necessary.

The RS-485 standard allows variants of some characteristics:

- Polarization
- Line terminator
- Number of servers
- Length of bus

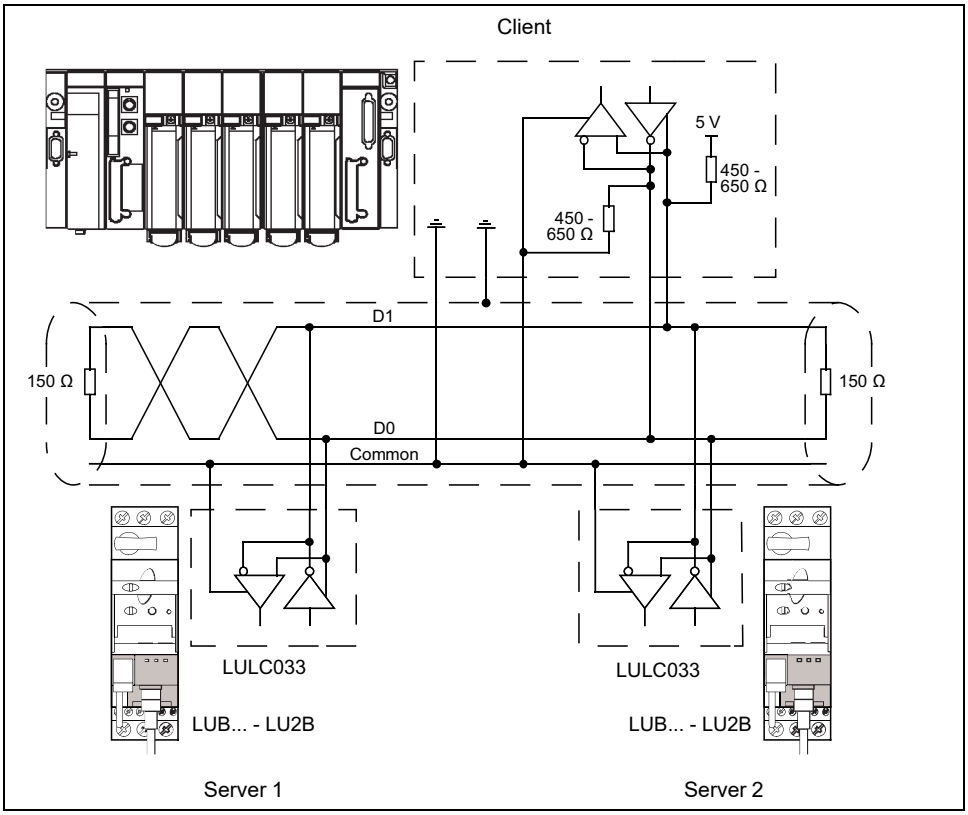
The Modbus specification, published on the Modbus.org site, defines all these characteristics precisely. All new Schneider Electric devices conform to this specification.

Connection to the Bus via a Tee

The standard diagram corresponds to the Modbus specification published on the Modbus.org site and in particular to the 2-wire multidrop serial bus diagram.

The LULC033 Modbus communication module conforms to this specification.

The simplified diagram is as follows:

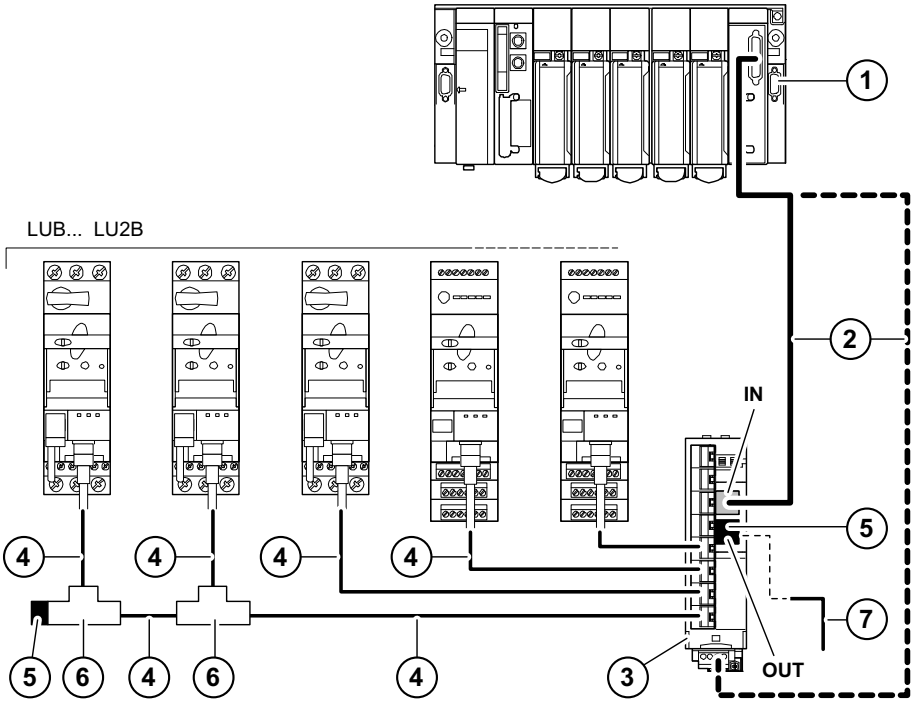


The characteristics for direct connection to the bus are as follows:

Designation	Description
Type of trunk cable	Single shielded twisted pair cable and at least a 3rd conductor
Maximum length of bus	1000 m (3280 ft) at 19200 Baud with the Schneider Electric TSXCSA•• cable
Maximum number of stations (without repeater)	32 stations, i.e., 31 servers
Maximum length of tap-offs	• 20 m (66 ft) for one tap-off • 30 m (100 ft) divided by the number of tap-offs on the multiple junction box
Bus polarization	• A 450 to 650 Ω pulldown resistor at the 5 V • A 450 to 650 Ω pulldown resistor at the Common This polarization is recommended for the client. There is no polarization at the RS-485 terminal on the communication module.
Line terminator	A 150 Ω resistor +/- 5%
Common polarity	Yes (Common), connected to the protective ground in at least one point on the bus

Connection to the Bus via a Splitter Box

The connection diagram for connection to the bus via a splitter box is as follows:



1 Client (PLC, PC or communication module)

2 Modbus cable depending on the type of client (with polarization integrated on the client side or on another part of the bus)

3 Modbus splitter box LU9GC3

4 Modbus drop cables VW3A8306R••

5 Line terminators VW3A8306R

6 Modbus T-junction boxes VW3A8306TF•• (with cable)

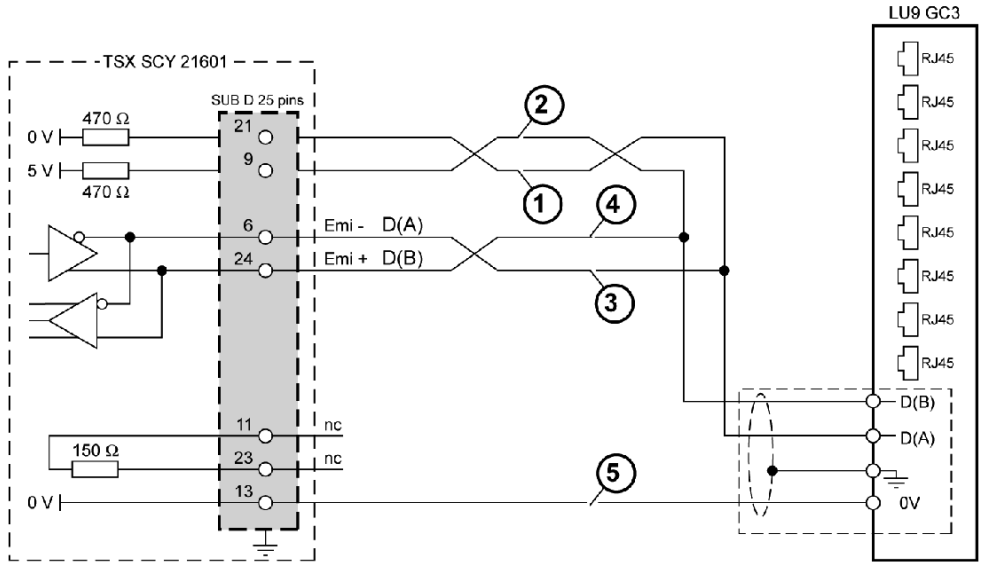
7 Modbus cable (to another splitter box) TSXCSA•00 (replaces (5)

NOTE: It is advisable to place a line terminator at each end of the bus to avoid malfunctions on the communication bus. This means that a tee should not have a free connector. It is either connected to a server or to the client, or there is a line terminator.

NOTE: It is important to connect the bus to the **IN** input (or the screw terminals on the bottom) of the splitter box. Connection to another splitter box is made via the **OUT** output.

Connection Diagrams (PLC - Splitter Box)

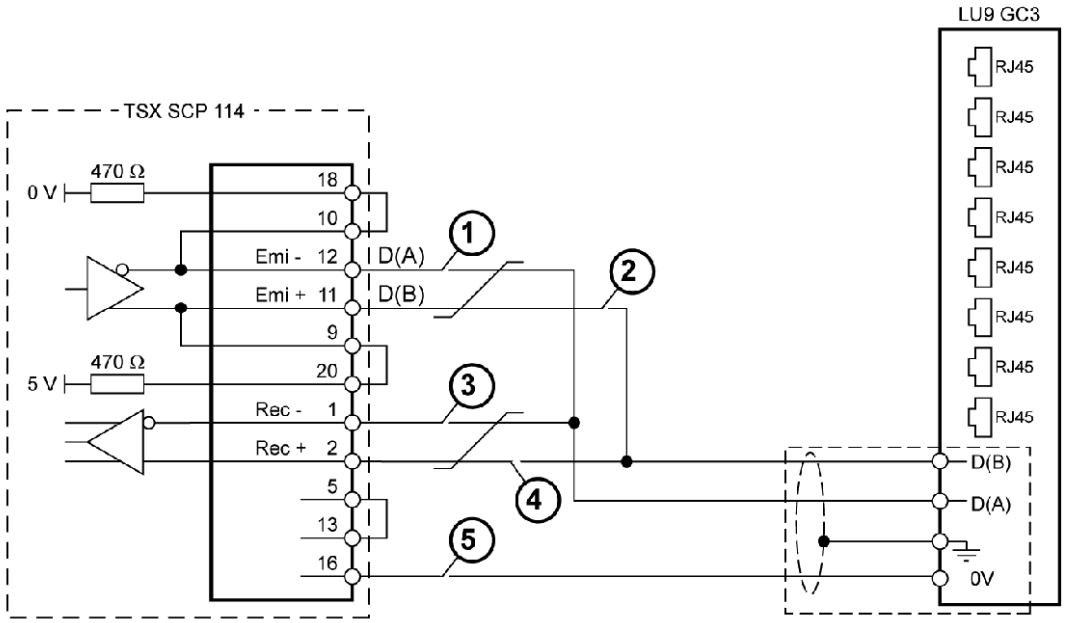
Example 1: Connection between TSXSCY21601 module (channel 0) and splitter box LU9GC3 using cable TSXSCYCM6030:



1. Green/White
2. White/Green
3. Orange/White
4. White/Orange
5. Brown/White

NOTE: Check that the 470 Ω resistors are connected to the 0 V and 5 V polarities correctly.

Example 2: Connection between PCMCIA/TSXSCP 114 card and LU9GC3 splitter box using cable TSXSCPCX4030:



1. Green/White
2. White/Green
3. White/Orange
4. Orange/White
5. Brown/White

NOTE: Check that the 470 Ω resistors are connected to the 0 V and 5 V polarities correctly.

List of connection accessories:

Designation		**Catalog number**
Modbus splitter box	10 RJ45 connectors and 1 screw terminal	LU9GC3
Modbus T-junction boxes	With 0.3 m (1 ft) integrated cable	VW3A8306TF03
	With 1 m (3 ft) integrated cable	VW3A8306TF10
Line terminators for RJ45 connector	R = 150 Ω	VW3A8306R

List of connection cables:

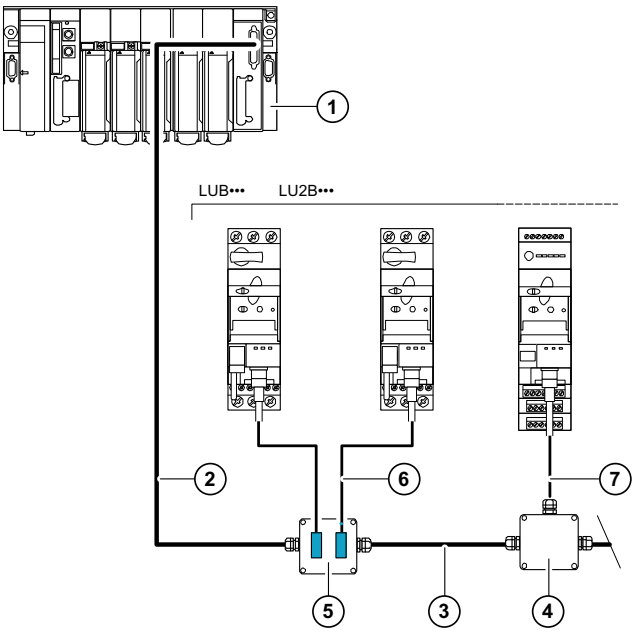
Designation	**Length**	**Connectors**	**Catalog number**
Cables for Modbus bus	3 m (10 ft)	1 RJ45 connector and 1 stripped end	VW3A8306D30
	0,3 m (1 ft) 1 m (3.3 ft) 3 m (10 ft)	2 RJ45 connectors	VW3A8306R03 VW3A8306R10 VW3A8306R30
RS-485 double shielded twisted pair cables	100 m (330 ft) 200 m (660 ft) 300 m (990 ft)	Supplied without connector	TSXCSA100 TSXCSA200 TSXCSA500

List of Modbus connection accessories for RJ45 wiring system:

Type of client	Interface with the client	Description	Catalog number
M221 or M241 or M251 or M262	RS-485 RJ45	Cable, equipped with 2 RJ45 connectors, of the following length:	
BMXP341 or BMXP342		0,3 m (1 ft)	VW3A8306R03
BMXNOM0200 or BMXNOR0200H		1 m (3.3 ft)	VW3A8306R10
		3 m (10 ft)	VW3A8306R30
Twido PLC	Mini-DIN RS-485 adaptor or interface module	3 m (10 ft) cable equipped with a mini-DIN connector and an RJ45 connector	TWDXCARJ030
	Screw terminal RS-485 adaptor or interface module	3 m (10 ft) cable equipped with an RJ45 connector and stripped at the other end	VW3A8306D30
TSX Micro PLC	Mini-DIN RS-485 terminal port	3 m (10 ft) cable equipped with a mini-DIN connector and an RJ45 connector	TWDXCARJ030
	PCMCIA card (TSXSCP114)	Stripped cable	TSXSCPCX4030
TSX Premium PLC	TSXSCY11601 or TSXSCY21601 module (25-pin SUB-D port)	Cable equipped with a 25-pin SUB-D connector and stripped at the other end (for connection to the screw terminals on the LU9GC3 splitter box)	TSXSCYCM6030
	PCMCIA card (TSXSCP114)	Stripped cable	TSXSCPCX4030
Fipio (LUFP1) or Profibus DP (LUFP7) or DeviceNet (LUFP9) gateway	RS-485 RJ45	Cable, equipped with 2 RJ45 connectors, of the following length:	
		0,3 m (1 ft)	VW3A8306R03
		1 m (3.3 ft)	VW3A8306R10
		3 m (10 ft)	VW3A8306R30
Serial port PC	PC with 9-pin male SUB-D RS 232 serial port	RS 232/RS-485 converter	TSXSCA72
		3 m (10 ft) cable equipped with an RJ45 connector and stripped at the other end (for connection to the screw terminals on the LU9GC3 splitter box)	VW3A8306D30

Connection to the Bus via SCA Junction Boxes

The connection diagram for connection to the bus via SCA junction boxes is as follows:



1 Client (PLC, PC or communication module).

2 Modbus cable depending on the type of client (with polarization integrated on the client side or on another part of the bus).

3 Modbus cable TSXCSA•00.

4 TSXSCA50 junction box (without line polarization).

5 TSXSCA62 subscriber port (without line polarization).

6 Modbus drop cable VW3A8306.

7 Modbus drop cable VW3A8306D30.

List of connection accessories:

Designation	Catalog number
Junction box 3 screw terminals and RC line terminator, connected with cable VW3A8306D30	TSXSCA50
Subscriber port 2 15-pin female SUB-D connectors, 2 screw terminals, and RC line terminator, connected with cable VW3A8306 or VW3A8306D30	TSXSCA62

List of connection cables:

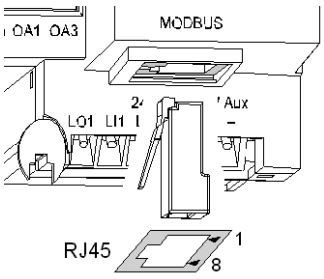
Designation	Length	Connectors	Catalog number
Cables for Modbus bus	3 m (10 ft)	1 RJ45 connector and 1 stripped end	VW3A8306D30
	5 m (16 ft)	1 RJ45 connector and 1 15-pin male SUB-D connector for TSXSCA62	VW3A8306
RS-485 double shielded twisted pair cables	100 m (330 ft)	Supplied without connector	TSXCSA100
	200 m (660 ft)		TSXCSA200
	300 m (990 ft)		TSXCSA300

List of Modbus connection accessories for junction box on screw terminals:

Type of client	Interface with the client	Description	Catalog number
M241 or M251 or M262	RS-485 RJ45	3 m (10 ft) cable equipped with an RJ45 connector and stripped at the other end	VW3A8306D30
BMXP341 or BMXP342			
BMXNOM0200 or BMXNOR0200H			
Twido PLC	Screw terminal RS-485 adaptor or interface module	Modbus cable	TSXCSA100 or TSXCSA200 or TSXCSA500
TSX Micro PLC	Mini-DIN RS-485 terminal port	Junction box	TSXPACC01
	PCMCIA card (TSXSCP114)	Cable equipped with a special connector and stripped at the other end	TSXSCPCX4030
TSX Premium PLC	TSXSCY 11601 or TSXSCY 21601 module (25-pin SUB-D port)	Cable equipped with a 25-pin SUB-D connector and stripped at the other end	TSXSCYCM6030
	PCMCIA card (TSXSCP114)	Cable equipped with a special connector and stripped at the other end	TSXSCPCX4030
Profibus DP (LA9P307) gateway	RS-485 RJ45	3 m (10 ft) cable equipped with an RJ45 connector and stripped at the other end	VW3A8306D30
Fipio (LUFP1) or Profibus DP (LUFP7) or DeviceNet (LUFP9) gateway	RS-485 RJ45	3 m (10 ft) cable equipped with an RJ45 connector and stripped at the other end	VW3A8306D30
Serial port PC	PC with 9-pin male SUB-DRS232 serial port	RS 232/RS-485 converter and Modbus cable	TSXSCA72 and TSXCSA100 or TSXCSA200 or TSXCSA500

RJ45 Connector Pinout

The communication module is connected to the Modbus network with an RJ45 connector in compliance with the following wiring:

Pin no.	Signal	
1	Do not connect	
2	Do not connect	
3	Do not connect	
4	D(B) or D1	
5	D(A) or D0	
6	Do not connect	
7	Do not connect	
8	0 V.L	

Conditions of Use and Technical Characteristics

The characteristics of the LULC033 Modbus communication module are as follows:

- Conditions of use
- Characteristics of the 24V ⎓ and 24V Aux power supply circuits
- Characteristics of the outputs (OA1, OA3 and LO1) and logic inputs (LI1 and LI2)

The communication characteristics (module Modbus port) are also described.

Conditions of Use

The conditions of use for the LULC033 Modbus communication module are as follows:

Certification	UL, CSA	
Conformity to standards	IEC/EN 60255-6, UL 508, CSA C22-2 No. 14	
European Community Directives	CE marking. Satisfies the essential requirements of the low voltage (LV) machinery and electromagnetic compatibility (EMC) directives.	
Temperature of the ambient air around the device	Storage	- 40 °C to + 85°C (-40 °F to 185 °F)
	Operation	- 25 °C to + 55 °C (-13 °F to 131 °F)

24V ⎓ Power Supply Circuit

The characteristics of the LULC033 Modbus communication module 24 V ⎓ power supply circuit are as follows:

Supply voltage	$U_{nominal}$	V	24 V ⎓
	Operating range	V	20 - 28
Maximum current drawn	-	A	1
Resistance to microbreaks	-	ms	2

24 V Aux Power Supply Circuit

The characteristics of the LULC033 Modbus communication module24 V Aux power supply circuit are as follows:

Supply voltage	$U_{nominal}$	V	24 V ⎓
	Operating range	V	20 - 28
Maximum current drawn	-	mA	30
Resistance to microbreaks	-	ms	3

Logic Outputs OA1, OA3 and LO1

The characteristics of the LULC033 Modbus communication module outputs are as follows:

Nominal output values	Voltage	V	24 V ⎓
	Current	mA	500
Output limit values	Voltage	V	20 - 28
	Current	mA	500
Coincidence factor of the 3 outputs		%	66
Output response time (register 704) (Time between the request start bit and the change in the output state)		ms	5 (LUCA/B/C/D)
Protection	Against overvoltage		Yes
	Against inversions		Yes
	Against short-circuits and overloads		Electronic circuit-breaker with automatic reset
Number of operating cycles	In millions of operating cycles		15
Maximum rate	In operating cycles per hour		3600

Logic Inputs LI1 and LI2

The characteristics of the LULC033 Modbus communication module inputs are as follows:

Nominal input values	-	Voltage	V	20 - 28 (positive logic)
	-	Current	mA	7
Input limit values	At state 1	Voltage Current	V mA	16 6
	At state 0	Voltage Current	V mA	5 2
Response time	Change to state 1		ms	10 +/- 30 %
	Change to state 0		ms	10 +/- 30 %
Type of input	-		-	Resistive
Protection	gl fuse		A	1

Communication (Modbus Port)

The technical characteristics of the LULC033 Modbus communication module Modbus port are as follows:

Characteristics	Description	Default value
Physical interface	1 multidrop RS-485 physical interface	-
Connections	RJ45 on the front panel	-
Connection pinout	As per Schneider Electric standard: pin 4: D1 (DB)	-

Characteristics	Description	Default value
	pin 5: D0 (DA) pin 8: OVL	
Protocol	Modbus RTU	-
Physical address	1 to 31 (address 0 not permitted)	1
Logical address	1 to 31 (addresses 32 to 247 not accessible)	-
Transmission speed	1200, 2400, 4800, 9600, 19200 Baud (automatic configuration up to this value)	19200 Baud
Parity	Even, Odd (1 stop bit). No parity (1 or 2 stop bits)	Even
Turnaround time	5 ms	-

Software Implementation

What's in This Part

Introduction

Once the LULC033 Modbus communication module hardware implementation phase is complete, the software implementation can begin. It focuses on configuration (the various operating modes), and the function parameters to be set (e.g., protection, current measurement, etc.).

Starting up the Module via the Registers

What's in This Chapter

Introduction

This chapter describes how to start up the LULC033 communication module by means of the Modbus registers. It provides general information, describes the data-exchange format, the product factory configuration and how it can be customized, and also the Modbus read and write requests.

General Information on Start-up via the Registers

The LULC033 Modbus communication module settings are implemented or displayed via the Modbus registers.

Access to Parameters

The module I/O parameters are set by using the Modbus RJ45 port, via the application PLC.

Data-Exchange Format

Modbus Format

Communication is based on the server Modbus RTU protocol.

The data format is as follows:

1 start bit	8 data bits	1 parity bit	1 stop bit

NOTE: The detailed format of these requests is explained on the www.Modbus.org site.

Initialization

Initialization consists of two phases:

When the auxiliary 24 V is powered up, the LULC033 Modbus communication module is initialized:

- The addressing is taken into account.
- The type of control unit is taken into account.

At the end of the initialization phase, the LULC033 Modbus communication module automatically identifies the configuration parameters (speed and parity) of the RS-485 link as soon as traffic is detected on the network.

After analysis of up to 20 frames at a speed of 19200 Baud, initialization continues (at 1200 Baud, the number of frames is higher):

- The default or configured speed is taken into account.
- The Client parity is taken into account.

Read-Write Zones

The memory zone from 0 to 19999 can be accessed by the client.

- Reading the zone of a Reserved (or non-set) register causes a correct response (value 0).
- Writing to the zone of a Reserved register causes a correct response (value 0). The write operation is not taken into account and the contents remain equal to 0.
- Writing to the zone of a Read only register causes a response with an exception code (code 03).

The memory zone 20000 is private and therefore reading/writing is not authorized. All accesses will be signaled by an exception code (code 02).

Exception Code

The presence of an exception code is indicated by the report from the PLC (refer to the Modbus client module documentation).

The Modbus exception codes supported are as follows:

Value of the exception code		Name	Comment
Hexadecimal	**Decimal**		
0x01	1	Illegal function	Unknown request code
0x02	2	Illegal data address	• Register address invalid • Access to the private memory zone (address ≥ 20000) • Writing to a read-only register The memory zone is prohibited in both read and write modes
0x03	3	Illegal data value	• Invalid value The write command is interrupted

Speed and Parity

The recognized values are as follows:

	Possible values	Factory value
Speed	1200, 2400, 4800, 9600 and 19200 Baud.	19200 Baud
Parity	Even, odd, no parity (parity bit deleted).	Even

TSX Micro or Premium Platform

Applications for Micro and Premium PLCs are designed and implemented using PL7 software.

READ_VAR or WRITE_VAR requests *(see Modbus Requests and Programming Examples)* are used to read or write respectively the value of one or more consecutive objects of the same type (bit, word), in PL7 language.

NOTE: For more details concerning Modbus communication programming within a TSX platform, refer to the PL7 online help, Communication Volume 2/ Modbus communication.

Modicon M340 or M580 Platform

Applications for Modicon PLCs are designed and implemented using EcoStruxure Control Expert software.

- For the Modicon M340 platform, use BMXNOR0200H Ethernet / Serial RTU module
- For the Modicon M580 platform, use BMENOR2200H Ethernet / Serial RTU module.

Factory Configuration

The communication module parameters are set in order to determine:

- The operating mode
- The reset mode for thermal overload faults

The parameter registers (Modbus protocol) are accessible in read/write mode. The factory-set values are as follows:

Topic	Register	Factory value	Meaning
Reset mode for thermal overload fault	602.0	1	**Manual** mode
Fallback mode for control outputs on loss of communication	682	2	**Forced stop** Power base: OA1 and OA3 at 0 Controller base: 13 and 23 at 0
Inversion of the LULC033 outputs	684	0	The state of the outputs is the image of the control bits
On power base, assignment of:			
- Output LO1	685 LSB	2	LO1 is the state of control bit 700.0
- Output OA1	686 LSB	12	OA1 is the state of control bit 704.0
- Output OA3	686 MSB	13	OA3 is the state of control bit 704.1
On controller base, assignment of:			
- Output 13	687 LSB	12	13 is the state of control bit 704.0
- Output 23	687 MSB	13	23 is the state of control bit 704.1
Recovery mode after stopping	688	0	The outputs revert to the state they were in before the power cut.
Control unit ID	690	0	The control unit is identified automatically

NOTE: For more information, refer to the *TeSys Ultra Communication Variables User Guide*, page 6.

Customizing Your Configuration

You can use the factory settings (see Factory Configuration, page 36) or customize your configuration.

The following parameters can be set:

- Control unit configuration
- Control unit ID
- Timeout duration
- Fallback mode
- Inversion of the output states
- Assignment of outputs LO1, OA1, OA3, 13 and 23
- Recovery after stopping
- Control unit forcing

⚠WARNING

UNEXPECTED OPERATION

A configuration can be loaded or edited via both Modbus ports (via the communication module). One configuration can then overwrite another, as the system does not prevent such an action. The result is not certain.

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

Control Unit Configuration (Reg 602)

Register **602** (accessible in read/write mode) is used to configure the reset mode of the control unit.

Reg•	Value	Comment
602.0	1	Resetting is manual (by default). Bits 1 and 2 are at 0.
	0	You have activated either bit 1 (remote reset) or bit 2 (automatic reset)

Control Unit Configuration (Reg 680)

The control unit is identified each time the communication module is powered up.

Timeout Duration (Reg 681)

Register **681** (accessible in read/write mode) is used to set or read the value of the timeout on loss of communication with the PLC. Following loss of communication, the timeout corresponds to the time before switching to fallback mode. Loss of communication results in a warning, which is signaled by register 460 = 109.

Reg•	Value	Range	Unit	Factory value	Comment
681	-	0 - 65535	10 ms	6000	Value of timeout The value 0 represents a time of zero.

Fallback Mode (Reg 682)

Register **682** (accessible in read/write mode) is used to configure the fallback mode in the event of loss of communication with the PLC.

Register 682 Value	Fallback Mode
0	Ignored
1	Freeze outputs
2	Stop
3	Signal comm loss warning
4	Force run forward
5	Force run reverse

⚠WARNING

AUTOMATIC RESTART OF THE MOTOR

- When communication stops, outputs OA1-OA3 take the status corresponding to the selected fallback mode (register 682), but command bits 704.0 and 704.1 are not modified.
- During the loss of communication warning (register 703 or push button on the controller), the motor will restart automatically if command bits 704.0 or 704.1 have not been reset to zero first by the PLC application.

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

Description of the different fallback modes:

Fallback Mode	Loss of Communication	Communication Recover	Loss of Communication Acknowledgement
Ignored (reg 682 = 0)	No detection of the loss of communication	No detection of the loss of communication	No acknowledgement of the loss of communication
	OA1 and OA3 keep their status	OA1 and OA3 keep their status	
Freeze outputs (reg 682 = 1)	OA1 and OA3 keep their status	OA1 and OA3 keep their status	On rising edge by bit 703.3 (do not leave set to 1)
	ERR LED blinking on the front face	ERR LED blinking on the front face	Once the acknowledgement is done, the last command stored in register 704 is enabled
	-	Every new On/Off command is stored but with no impact on OA1 and OA3	ERR LED switches off
Stop (reg 682 = 2)	OA1 and OA3 are forced to 0	OA1 and OA3 are forced to 0	On rising edge by bit 703.3 (do not leave set to 1)
	ERR LED blinking on the front face	ERR LED blinking on the front face	Once the acknowledgement is done, the last command stored in register 704 is enabled
	-	Every new On/Off command is stored but with no impact on OA1 and OA3	ERR LED switches off
Signal comm loss warning (reg 682 = 3)	OA1 and OA3 keep their status	OA1 and OA3 keep their status	On rising edge by bit 703.3 (do not leave set to 1)
	ERR LED blinking on the front face	ERR LED blinking on the front face	ERR LED switches off
	-	Every new On/Off command is considered and has an impact on OA1 and OA3	
Force run forward (reg 682 = 4)	OA1 is forced to 1 OA3 is forced to 0	OA1 is forced to 1 OA3 is forced to 0	On rising edge by bit 703.3 (do not leave set to 1)

Fallback Mode	Loss of Communication	Communication Recover	Loss of Communication Acknowledgement
	ERR LED blinking on the front face	ERR LED blinking on the front face	Once the acknowledgement is done, the last command stored in register 704 is enabled
	-	Every new On/Off command is stored but with no impact on OA1 and OA3	ERR LED switches off
Force run reverse (reg 682 = 5)	OA1 is forced to 0 OA3 is forced to 1	OA1 is forced to 0 OA3 is forced to 1	On rising edge by bit 703.3 (do not leave set to 1)
	ERR LED blinking on the front face	ERR LED blinking on the front face	Once the acknowledgement is done, the last command stored in register 704 is enabled
	-	Every new On/Off command is stored but with no impact on OA1 and OA3	ERR LED switches off

NOTE: The red ERR LED flashes to indicate a loss of communication (fault on timeout).

Inversion of Output States (Reg 684)

Depending on requirements (signaling, run, stop, etc.), it is possible to assign NO or NC behavior to outputs OA1, OA3 and LO1, by configuring register **684**.

To do this, define the output concerned in register **684**.

Power base	Bit
Invert output OA1	_.0 = 1
Invert output OA3	_.1 = 1
Invert output LO1	_.2 = 1

Modifying Output Assignments

The tables below show how the assignments of outputs LO1, OA1, OA3, 13, and 23 can be modified. To modify the assignments (factory values), write a different value (0 to 45), referring to the *TeSys Ultra Communication Variables User Guide*, page 6

⚠WARNING

UNEXPECTED OPERATION

Before modifying the assignment of an output by means of parameterization, you must note the following information. Otherwise, you run the risk of unexpected operation.

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

Register 704 is used for controlling the motor-starter. The following are associated with this register: functions for monitoring loss of communication, fallback mode (register 682), reflex functions or recovery mode after stopping (register 688). Only the outputs activated by bits 704.0 and 704.1 benefit from these functions.

In addition, command bits 704.0 and 704.1 are independent and can be activated simultaneously.

Using register 700 to activate outputs is comparable with unconditional forcing.

Setting the parameters of output LO1 (Reg 685 LSB)

Assignment/control (factory value) of output LO1 on the LULC033 Modbus communication module is as follows:

Reg•	Bit	Value	Factory value	Comment
685	0 to 7	0 to 45	2	Output LO1 = state of register 700.0

Setting the Parameters of Output OA1 (Reg 686 LSB)

Assignment/control (factory value) of output OA1 on the LULC033 Modbus communication module is as follows:

Reg•	Bit	Value	Factory value	Comment
686	0 to 7	0 to 45	12	Output OA1 = state of register 704.0

Setting the Parameters of Output OA3 (Reg 686 MSB)

Assignment/control (factory value) of output OA3 on the LULC033 Modbus communication module is as follows:

Reg•	Bit	Value	Factory value	Comment
686	8 to 15	0 to 45	13	Output OA3 = state of register 704.1

Recovery Mode (Reg 688)

If you use register 704 to control outputs OA1-OA3, writing the value 1 to register 688 allows you to lock the motor and prevent it restarting following the occurrence of certain events:

- Loss followed by restoration of 24 Vdc (outputs OA1-OA3)
- Change in position of rotary knob on power base followed by return to Ready position.

When one of these events occurs, command bits 704.0 and 704.1 (outputs OA1-OA3) are forced to 0 automatically. As long as one of these events remains pending, if values are written to register 704, the module will return exception code 02. Once these conditions have disappeared, control of the motor can be restored by sending a new run command.

⚠WARNING

AUTOMATIC RESTART OF THE MOTOR

In the case of cyclic writing to register 704 (e.g., an LUFP• gateway in its predefined configuration), this monitoring function must be used with caution. The application program must take this state into account and request that bits 704.0 or 704.1 are written to 0. Otherwise, when this event disappears, the motor will restart automatically.

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

Forcing Control Unit (Reg 690)

The control unit is identified automatically, but identification can be forced.

Value	Comment
0	Default value. The system automatically identifies the type of control unit connected (standard or advanced).
1	If the value is set to 1, this deactivates automatic identification and forces identification of a standard or advanced control unit.
2	If the value is set to 2, this deactivates automatic identification and forces identification of a multifunction control unit.

Modbus Requests and Programming Examples

Modbus Requests

The recognized Modbus requests are as follows:

Code value		Name	Comment
Hexadecimal	Decimal		
0x03	3	Read multiple registers	Read mode
0x06	6	Write single register	Write mode
0x10	16	Write multiple registers	
0x2B	43	Read register identification	Read mode for identifying the LULC033 Modbus communication module

The maximum number of registers per request is limited to 100.

NOTE: The **Broadcast** function is supported. To use it, a write operation (code 6 or 16) to address 00 is necessary.

⚠WARNING

UNEXPECTED OPERATION

- Use of this device on a Modbus network that uses the broadcast function should be considered with caution.
- This device has a large number of registers that must not be modified during normal operation.
- Unintended writing of these registers by the broadcast function may cause unexpected and unwanted product operation.
- For more information, refer to *TeSys Ultra Communication Variables User Guide*, page 6.

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

Example of a Read Operation

The example below describes a READ_VAR request, within a TSX Micro or Premium platform, in order to read the motor-starter states at address 4 (server no. 4) contained in internal word MW0:

```
If %M0 AND NOT %MW100:X0 THEN READ_VAR(ADR#3.0.4,'%MW',455,1,%MW0:1,%MW100:4) :RESET %M0;
EN_IF;
```

① ② ③ ④ ⑤ ⑥

1 Address of the module with which you wish to communicate: 3 (module address), 0 (channel), 4 (module address on the bus)

2 Type of PL7 objects to be read: MW (internal word)

3 Address of the first register to be read: 455

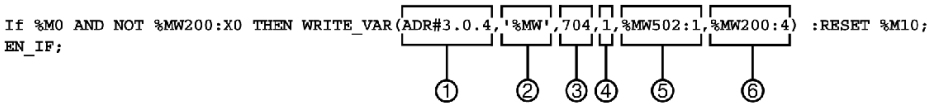
4 Number of consecutive registers to be read: 1

5 Word table containing the value of the objects read: MW0:1

6 Read report: MW100:4

Example of a Write Operation

The example below describes a WRITE_VAR request, within a TSX Micro or Premium platform, in order to control a motor-starter by sending the content of internal word MW 502:



1 Address of the module with which you wish to communicate: 3 (module address), 0 (channel), 4 (module address on the bus)

2 Type of PL7 objects to be written: MW (internal word)

3 Address of the first register to be written: 704

4 Number of consecutive registers to be written: 1

5 Word table containing the value of the objects to be sent: MW502:1

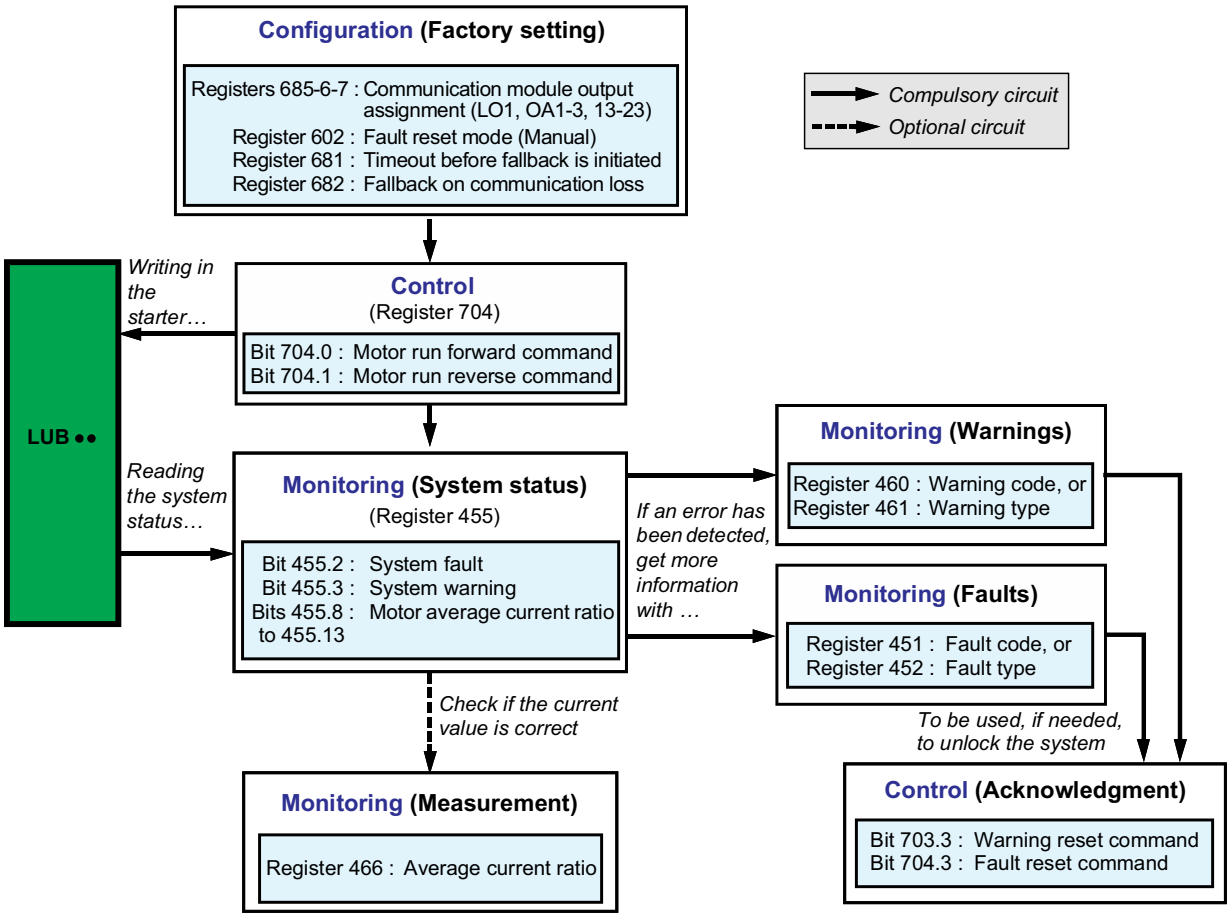
6 Write report: MW200:4

Use of the Main Registers for Simplified Management

Before implementing a motor-starter, it is useful to know which of the main registers are invoked, and in what order.

Diagram of Register Usage

The diagram below provides basic implementation information, using the following registers: configuration, control and monitoring (system state, measurements, faults and warnings, acknowledgment). Starting with the factory configuration (predefined), you will easily be able to follow or anticipate how your system behaves.



Fault and Warning Management

What's in This Chapter

Displaying Faults

The presence of a fault is signaled by various indicators:

- State of the LEDs on the LULC033 Modbus communication module

With a power base:

- State of the power base rotary knob (0 or **trip**)
- State of the output relays

With a controller base:

- State of the LEDs on the controller base
- State of the output relays

With a standard or advanced control unit:

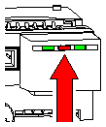
- Internal signals sent to the LULC033 Modbus communication module

  NOTE: The warning and the fault are taken into account in the relevant registers. For more information, refer to fault monitoring registers (450 to 452) and warning monitoring registers (460 to 461) in *TeSys Ultra Communication Variables User Guide*, page 6.

Application Faults

Acknowledgement of Application Faults

The possible application faults are listed below. Their reset (or acknowledgment) method can be: manual/automatic/remote.

Application faults	**Registers**		**LULC033**	**Fault acknowledgment**
	451 **Fault number**	**452** **Fault bit**	 **ERR**	
Short-circuit fault	1	_.0 = 1	Off	Manual reset
Overcurrent fault	2	_.1 = 1		
Thermal overload fault	4	_.3 = 1		According to the reset mode configured in register 602

Overload Fault with LU•B• Power Base

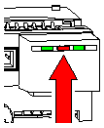
Following a thermal overload fault, use the rotary knob on the front panel for direct manual reset.

Configuration register	**Reset (acknowledgment)**	**Method**
602.0 = 1	Direct **manual**	With the rotary knob on LU•B•
	Remote **manual**	With the LU9 AP•• kit on LU•B•
602.1 = 1	**Remote**	Acknowledgment by bit 704.3 This bit is active on rising edge and must be reset to 0 by programming.
602.2 = 1	**Automatic**	Managed by the control unit

Warnings - Loss of Communication

Warning Acknowledgment

List of possible warnings.

Warnings	Registers		LULC033	Acknowledgment of a warning
	460 **Warning number**	**461** **Warning bit**	 **ERR**	
Thermal overload warning	4	_.3 = 1	Off	Automatic when the overload is less than 85%
Loss of communication with the client warning	109	_.15 = 1	Flashing	Acknowledgement by bit 703.3 This bit is active on rising edge and must be reset to 0 by programming.

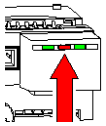
Recovery After Loss of Communication

After acknowledgment by setting bit 703.3 to 1, recovery occurs according to the states of control bits 704.0 and 704.1.

Internal Faults

Acknowledgment of Internal Faults

List of possible internal faults.

Internal faults	**Registers**		**LULC033**	**Fault acknowledgment**
	451 **Fault number**	**452** **Fault bit**	 **ERR**	
Fault on the LULC033 Modbus communication module	14	-	Off	Power down and then power up the LULC033
LULC033 Modbus communication module not installed or not supplied with power, or loss of communication with the module	15	-		
Internal fault in the LUC•• control unit	54	_.11 = 1		
Write-to-EEPROM fault	100	_.13 = 1	On	Power down and then power up the LULC033
Checksum fault in EEPROM	102	_.13 = 1	On	Rising edge on 704.3=1
EEPROM configuration fault	104	_.13 = 1	On	Rising edge on 704.3=1
Communication fault with the LULC033 module	205	_.13 = 1	On	Power down and then power up the LUTM.
No control unit	206			Power down and then power up the LUTM.

Configuration of Predefined Functions

What's in This Chapter

Description of Reflex Stop Functions

The reflex stop ensures accurate repeated position control, unhindered by the bus and PLC scan times.

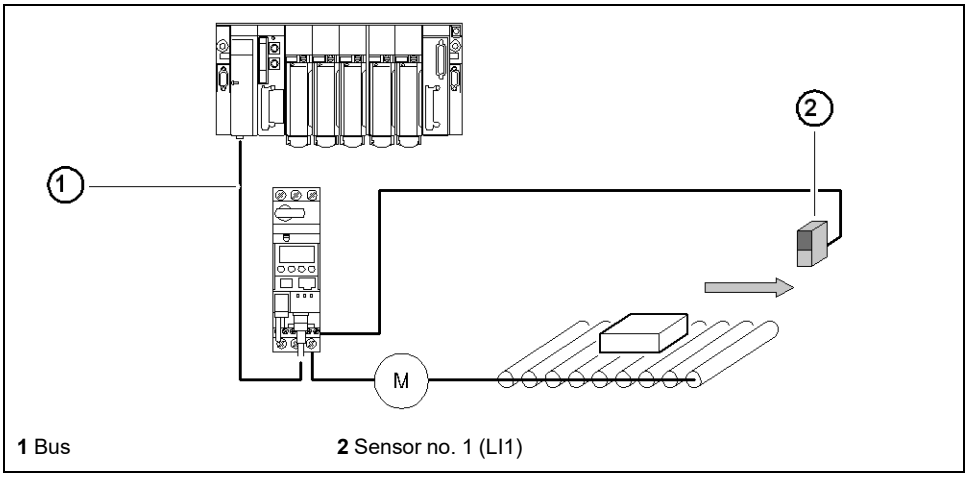
There are two types of reflex stop function:

- Reflex1: **Reflex stop 1** function
- Reflex2: **Reflex stop 2** function

Description of Reflex1

Sensor no. 1 (logic input LI1) directly controls motor stopping.

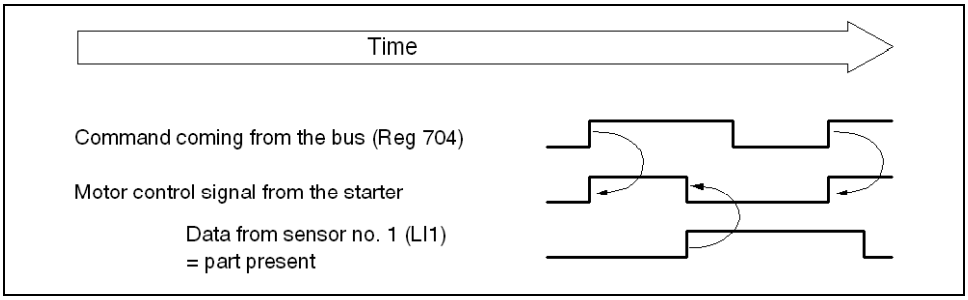
After a new run command (stop command then run command), the motor restarts even if something is still detected (LI1=1).



1 Bus **2** Sensor no. 1 (LI1)

NOTE: In the case of a reversing starter, the reflex stop works in both directions.

Data sequence

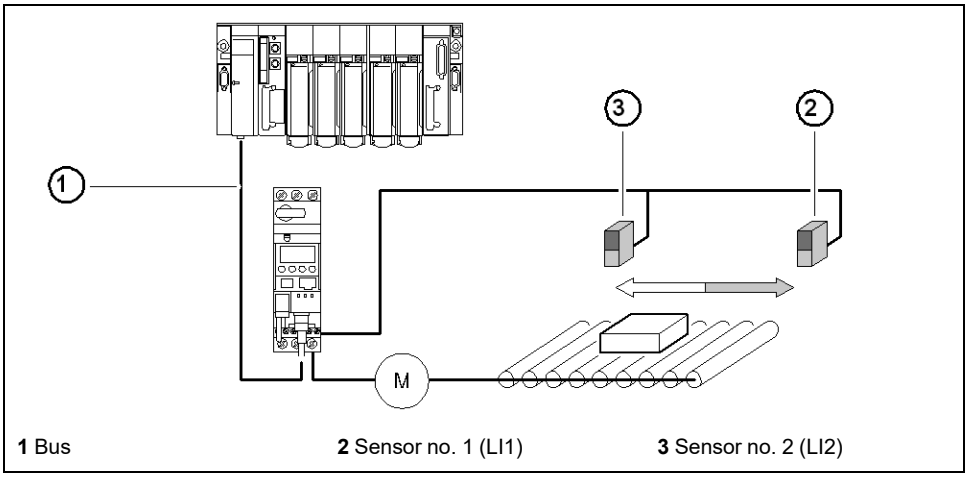


Description of Reflex2

Sensor no. 1 (logic input LI1) controls motor stopping in forward mode.

Sensor no. 2 (logic input LI2) controls motor stopping in reverse mode.

After a new run command (stop command then run command), the motor restarts even if something is still detected (LI1 or LI2 = 1).



1 Bus **2** Sensor no. 1 (LI1) **3** Sensor no. 2 (LI2)

NOTE: Sensor no. 2 (LI2) does not affect forward mode and sensor no. 1 (LI1) does not affect reverse mode.

Use of Reflex1 and Reflex2

To use a reflex stop function, it must be selected in the register of the output to be monitored.

Reflex function	Direction of motor rotation	Value of Reg•	LUB•• - LU2B•• base	
			Output LO1	Outputs OA1 OA3
Reflex1	Reflex1.Fw = forward	8	Reg685 (LSB)	Reg686 (LSB) (MSB)
	Reflex1.Rev = reverse	9		
Reflex2	Reflex2.Fw = forward	10		
	Reflex2.Rev = reverse	11		

NOTE: Before using the reflex stop functions, outputs OA1/OA3 must first be assigned to the forward/reverse directions. This selection is made in register **686**. By default, OA1 is assigned to forward and OA3 to reverse.

Reflex1.Fw

This function is active on a rising edge and not on the level.

.Fw	LI1 = 1 stops the motor, irrespective of the chosen direction of operation. After a new run command (stop command followed by a run command), even if logic input LI1 = 1, the motor restarts in the chosen direction.

NOTE: Logic input LI2 is not used.

Reflex1.Rev

This function is active on a rising edge and not on the level.

.Rev	LI1 = 1 stops the motor, irrespective of the chosen direction of operation. After a new run command (stop command followed by a run command), even if logic input LI1 = 1, the motor restarts in the chosen direction.

NOTE: Logic input LI2 is not used.

Reflex2.Fw

This function is active on a rising edge and not on the level.

.Fw	Logic input LI1 = 1 stops the motor in forward mode. Logic input LI2 = 1 stops the motor in reverse mode. After a new run command (stop command followed by a run command), even if logic input LI2 = 1, the motor restarts.

NOTE: Logic input LI2 does not affect forward mode and logic input LI1 does not affect reverse mode.

Reflex2.Rev

This function is active on a rising edge and not on the level.

.Rev	Logic input LI2 = 1 stops the motor in reverse mode. Logic input LI1 = 1 stops the motor in forward mode. After a new run command (stop command followed by a run command), even if logic input LI2 = 1, the motor restarts.

NOTE: Logic input LI2 does not affect forward mode and logic input LI1 does not affect reverse mode.

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