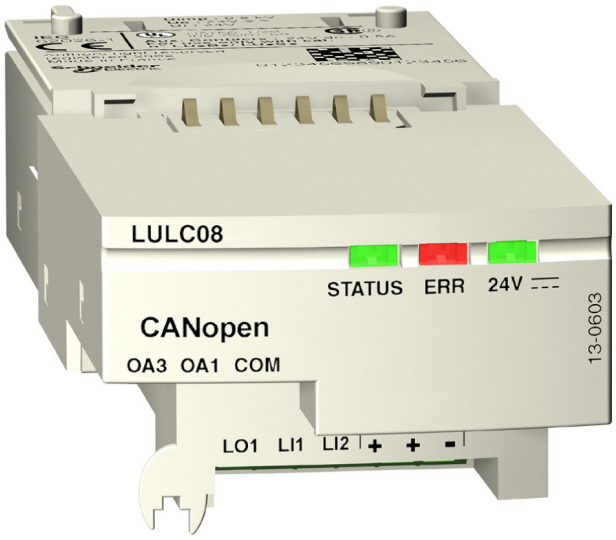
TeSys® U LULC08 CANopen Communication Module

User's Manual

03/2009



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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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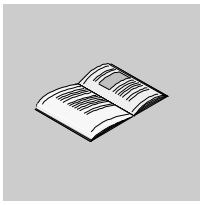

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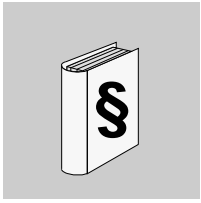
Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, 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 an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

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

⚠ CAUTION

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

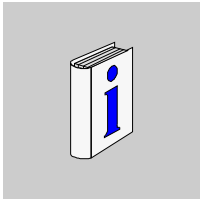
CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** 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.

About the Book



At a Glance

Document Scope

This manual describes the implementation, functionalities and operation of the TeSys U CANopen communication module (LULC08).

Field of application: mainly automation systems in industry and building areas.

Validity Note

This manual is valid for LULC08 V1.2 and later versions.

Related Documents

Title of Documentation	Reference Number
LULC08 CANopen Module - Instruction Sheet	1639545
TeSys U Communication Variables - User's Manual	1744082
LU•B/LU•S• TeSys U Starters - Instruction Sheet	1629984
LUTM• TeSys U Controller - User's Manual	1743233
LUTM• TeSys U Controller - Instruction Sheet	1743236
LUCM/LUCMT Multifunction Control Units - User's Manual	1743237
LUCM/LUCMT/LUCBT/LUCDT Control Units - Instruction Sheet	AAV40504
LUCA/LUCB/LUCC/LUCD Control Units - Instruction Sheet	AAV40503
Electromagnetic Compatibility - Practical Installation Guidelines	DEG999
CANopen Hardware Setup Manual	35010857

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User Comments

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Hardware Implementation

I

Introduction

This part describes the installation and technical characteristics of a TeSys U CANopen communication module (LULC08).

What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
1	Installation of the TeSys U CANopen Module (LULC08)	11
2	Technical Characteristics	33

Installation of the TeSys U CANopen Module (LULC08)

1

This chapter introduces the TeSys U CANopen communication module (named LULC08) and describes the different physical installation steps of the product.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Safety Instructions	12
Presentation of the LULC08 CANopen Communication Module	13
Description and Installation of the Module	14
Electrical Connection	20
Connection to the CANopen Bus	24
Types of Topologies Possible with CANopen	26
Installation of Tap Junction and Cabling Accessories	29

Safety Instructions

General Instructions

⚠ CAUTION

HAZARDOUS OPERATION

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

You 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.

⚠ DANGER

UNQUALIFIED USER

- Read and understand this bulletin and all related documents in their entirety before performing any work.
- This equipment must be installed, programmed, and serviced only by qualified personnel.
- The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

IMPROPER COMMUNICATION PORT USAGE

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 actual processing of safety devices and emergency stops.

Data such as Forward and Reverse operation and Stop must not be used in the safety and emergency stop circuits.

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

Presentation of the LULC08 CANopen Communication Module

Receiving the Product

On opening the box containing the LULC08 CANopen communication module, you should find the following items:

- An Instruction Sheet (IS), providing brief and illustrated information about the basic installation of a module.
- An LULC08 CANopen communication module equipped with connectors.

NOTE: Check that you actually 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 CANopen, from:

TeSys U starter-controller	LUB•• / LU2B••
TeSys U starter	LUS•• / LU2S••
TeSys U controller	LUTM••

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 and multifunction control units,
- read the state of the I/O.

⚠ DANGER

IMPROPER CONTROL VOLTAGE

The LULC08 CANopen communication module must only be used with 24 VDC control units (LUC•••BL).

Failure to follow these instructions will result in death or serious injury.

Data Available

The available protection and control data depends on the control unit with which the LULC08 CANopen communication module is used.

There are three types of control unit:

- Standard (referenced as LUCA)
- Advanced (referenced as LUCB/C/D, LUCBT/DT)
- Multifunction (referenced as LUCM, LUCMT)

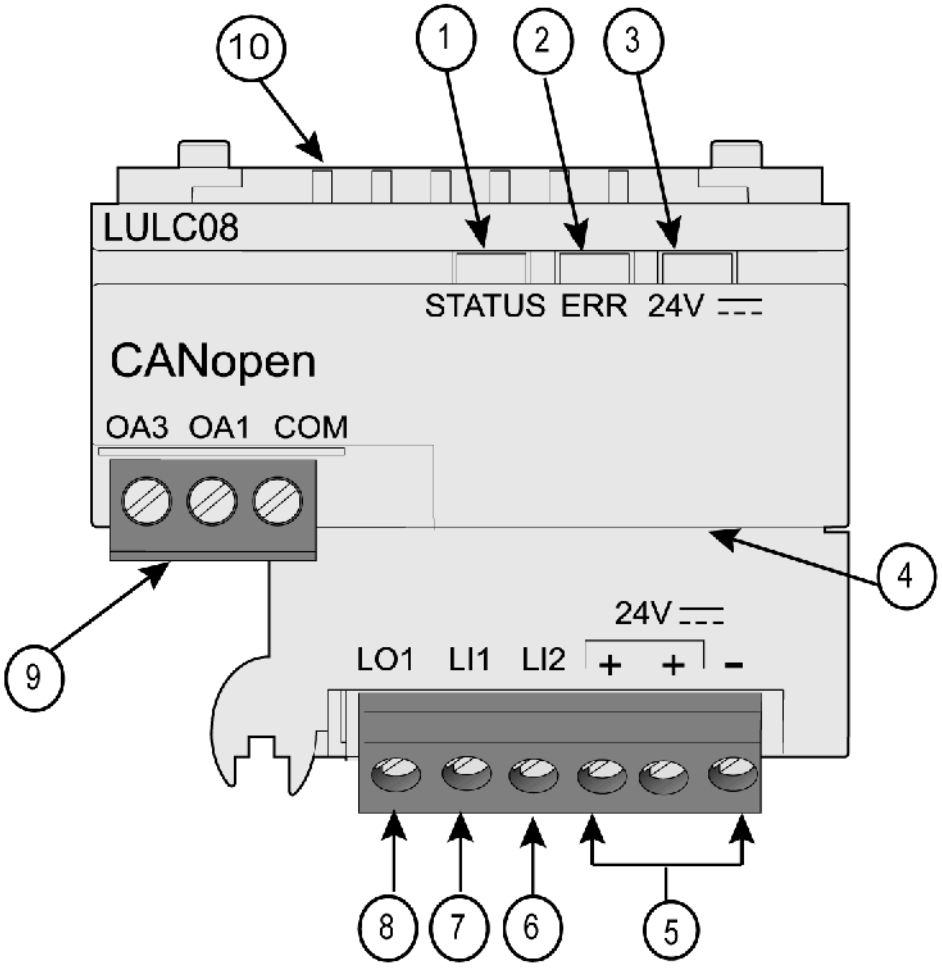
In order to select the right TeSys U configuration you need, the table below can be used to check the data and commands you have access to:

Data - Commands	**Configuration**		
	Standard (LUCA)	**Advanced (LUCB/C/D, LUCBT/DT)**	**Multifunction (LUCM/MT)**
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		√	√
Remote parameter setting and viewing of all functions			√
"Statistics" function			√
"Monitoring" function			√

Description and Installation of the Module

Front View of the Module

Connectors and LEDs of the LULC08 CANopen communication module are described hereafter:



1 2-color STATUS LED indicating CANopen module operational status.
2 Red ERR LED indicating CANopen module fault.
3 Green 24V⎓ LED indicating voltage presence at outputs OA1, OA3, LO1.
4 Sub-D 9 connector and 24V Bus (CAN external power supply)
5 Connection of the 24V ⎓ power supply for outputs OA1, OA3, LO1 (The 2 terminals marked + are internally linked).
6 Logic input 2.
7 Logic input 1.
8 Logic output 1, assignable depending on configuration reg. 685 (LSB).
9 24V⎓ wiring coil connector for the power base:
- OA1 assignment depends on configuration register 686 (LSB),
- OA3 assignment depends on configuration register 686 (MSB).

10 Connector for communication with the advanced or multifunction control unit

STATUS LED Description

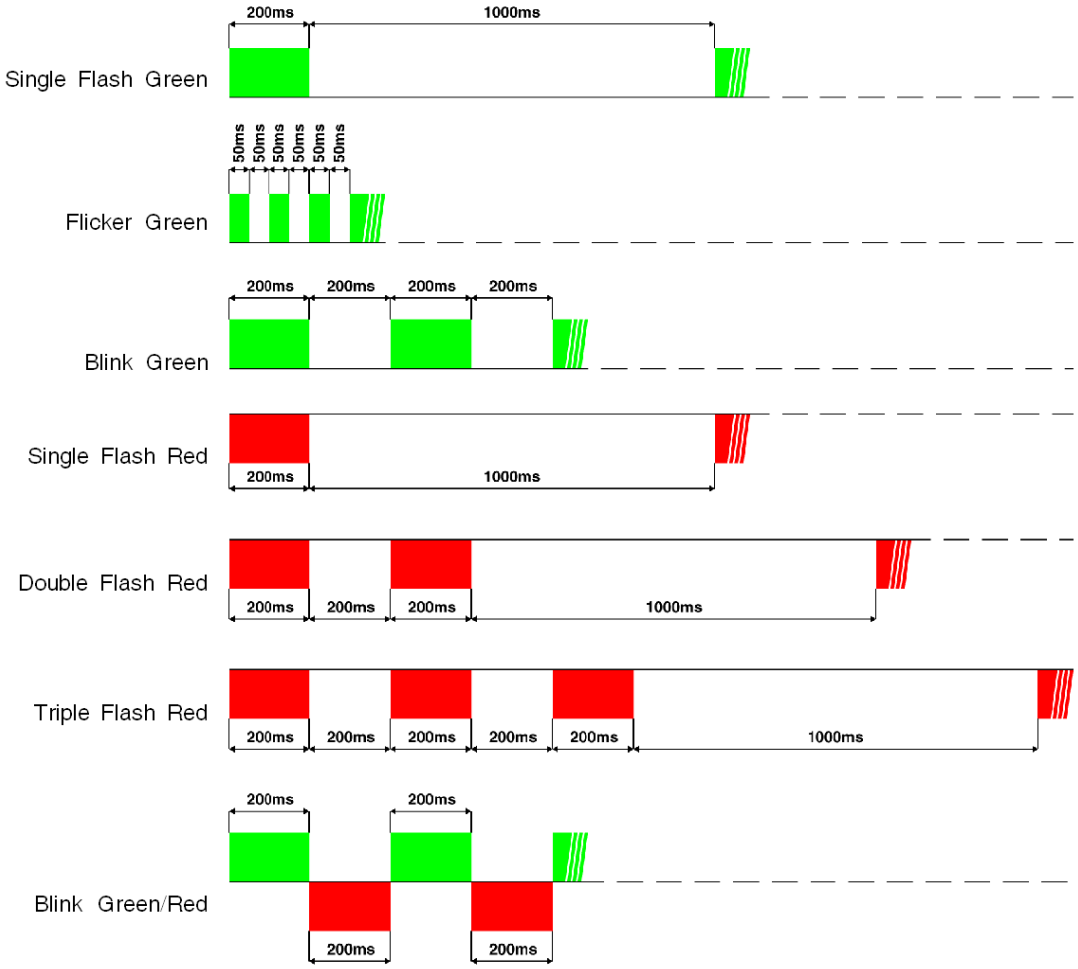
Software-controlled **STATUS** is a two-color light-emitting diode (LED), alternating between two states: a Run state (green color) and an Error state (red color).

STATUS LED colors can be flickering (every 50ms), or blinking (every 200ms), or flashing (1, 2 or 3 flashes), or steady, as described below.

2-color STATUS LED	Color display mode	Meaning	Action
Off	-	No power. No error	-
Flicker Green	The LED repeatedly flickers on for 50ms, then off for 50ms	Autobaud detection in progress	Wait for the end of auto-addressing
Blink Green	The LED repeatedly blinks on for 200ms, then off for 200ms	Pre-operational state	-
Flash Green	Single flash: The LED flashes on for 200ms, then off for 1,000ms	Stopped state	-
Green	Steady	Operational state	-
Flash Red	Single flash: The LED flashes on for 200ms, then off for 1,000ms	Warning limit reached	Cycle power, restart communication
	Double flash: The LED flashes on for 200ms, off for 200ms, on for 200ms, then off for 1,000ms	Error control event. A guard or a heartbeat event has occurred	Check network connection
	Triple flash: The LED flashes on for 200ms, off for 200ms, on for 200ms, off for 200ms, on for 200ms, then off for 1,000ms	Synchronization error. No Sync message received within the configured communication cycle timeout	Check network connection
Red	Steady	Bus off	Cycle power, restart communication
Blink Green+Red	The LED repeatedly blinks green for 200ms, then red for 200ms	A non-fatal field error has been detected	Cycle power, restart communication

STATUS LED Blink Patterns

Below is a representation of the **STATUS** LEDs, showing the different colors and flashing rates:



Error (ERR) LED

The signalling is active provided that the communication module is powered up by the Bus (CAN external power supply).

The red error (**ERR**) LED has 3 different states:

Error LED	Meaning	Action
Off	Working condition. No error	-
On	Presence of an internal fault	See *Internal Faults, page 76*
Blinking	Loss of communication. A fallback strategy is in progress	Check the cabling of your CANopen network

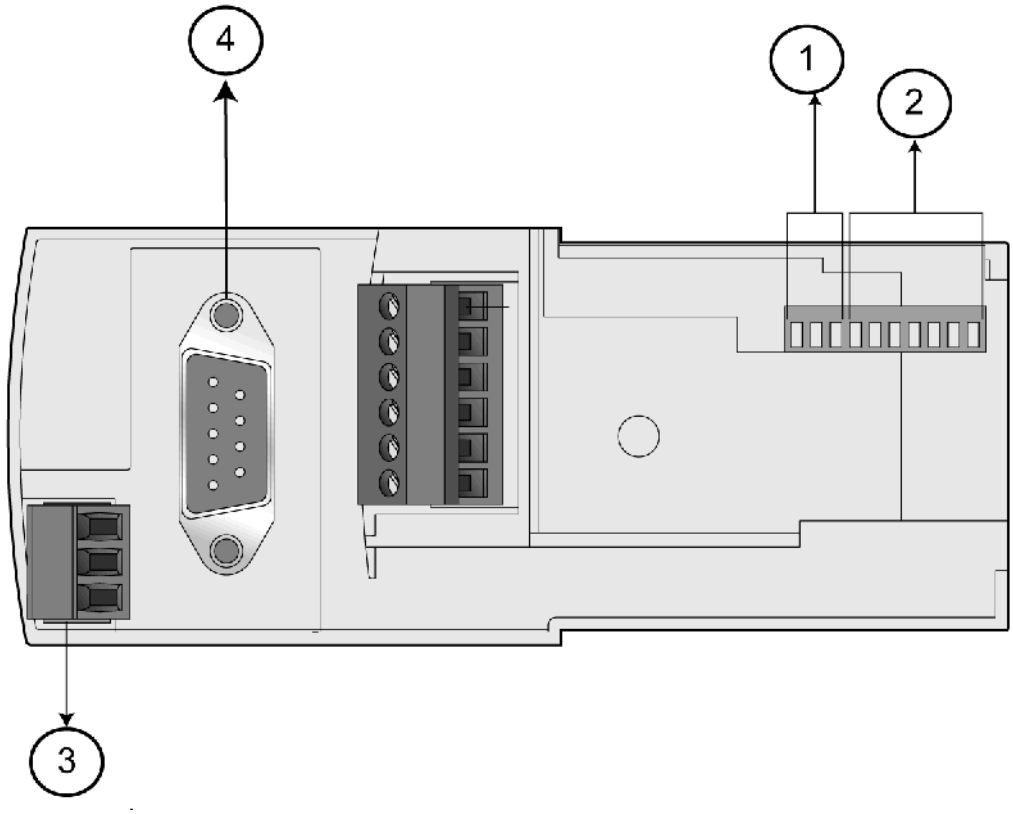
24V⎓ LED

The green 24V⎓ LED has 2 different states:

Off	Internal power or 24V⎓ power is missing.
On	LULC08 communication module is correctly powered.

Bottom View of the Module

Here is a bottom view of a LULC08 communication module:



1 Baud rate
2 Address
3 Power base connector
4 CAN bus connector

Baud Rate

The system allows you to assign a baud rate (with the following speeds: 10, 20, 50, 125, 250, 500, 800 and 1,000 kbps), using the 3 left-most switches (SW8 to SW10).

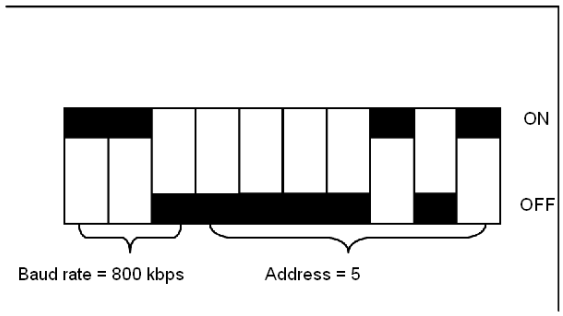
Refer to the table below:

SW10	SW9	SW8	Baud Rate
0	0	0	10 kbps
0	0	1	20 kbps
0	1	0	50 kbps
0	1	1	125 kbps
1	0	0	250 kbps (default value)
1	0	1	500 kbps
1	1	0	800 kbps
1	1	1	1,000 kbps

Address

The communication module's address on the CANopen bus is the Node-ID. According to Schneider class S20, the system allows you to assign an address from 1 to 127, using the 7 right-most switches (SW1 to SW7). Address 0 (zero) is not allowed and is considered as an invalid configuration.

Example:



(SW = Switch)

Example of possible address settings (first 6 and last 3 settings):

SW7	**SW6**	**SW5**	**SW4**	**SW3**	**SW2**	**SW1**	**Address**
0	0	0	0	0	0	0	Not valid
0	0	0	0	0	0	1	1 (default value)
0	0	0	0	0	1	0	2
0	0	0	0	0	1	1	3
0	0	0	0	1	0	0	4
0	0	0	0	1	0	1	5

...

1	1	1	1	1	0	1	125
1	1	1	1	1	1	0	126
1	1	1	1	1	1	1	127

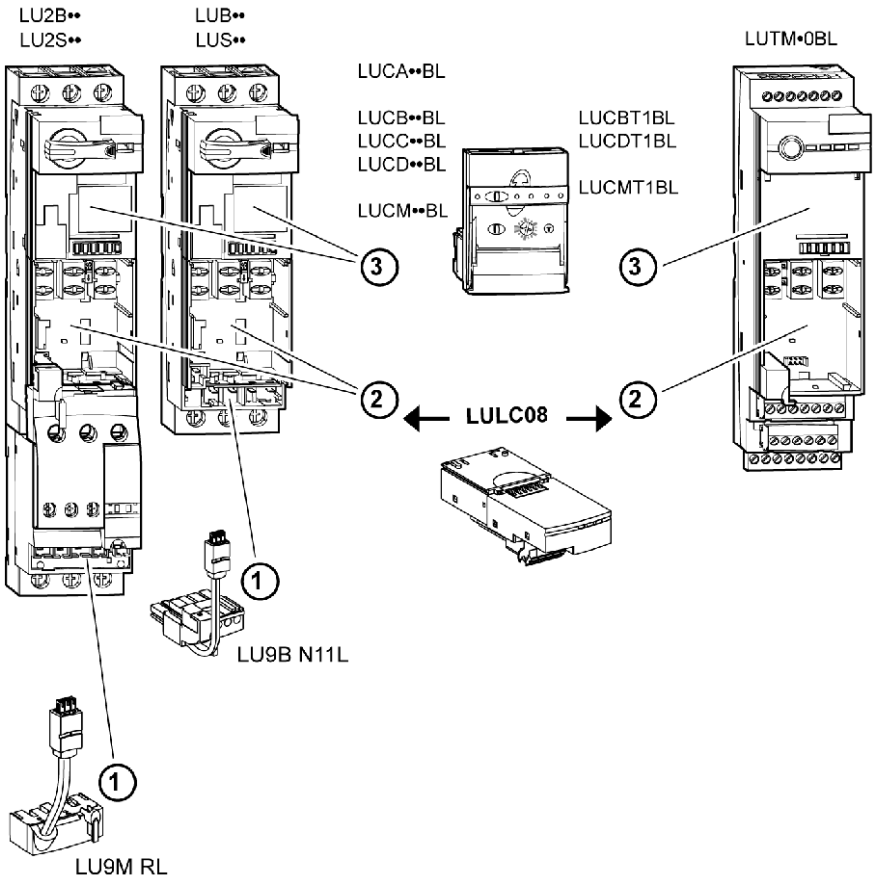
Assembly Order

The LULC08 CANopen communication module is installed in a power base or a controller base, beneath the control unit which locks it in position.

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

Step	Action
1	Choose the prewired coil connection.
2	Insert the LULC08 CANopen communication module.
3	Insert the control unit that locks the module.

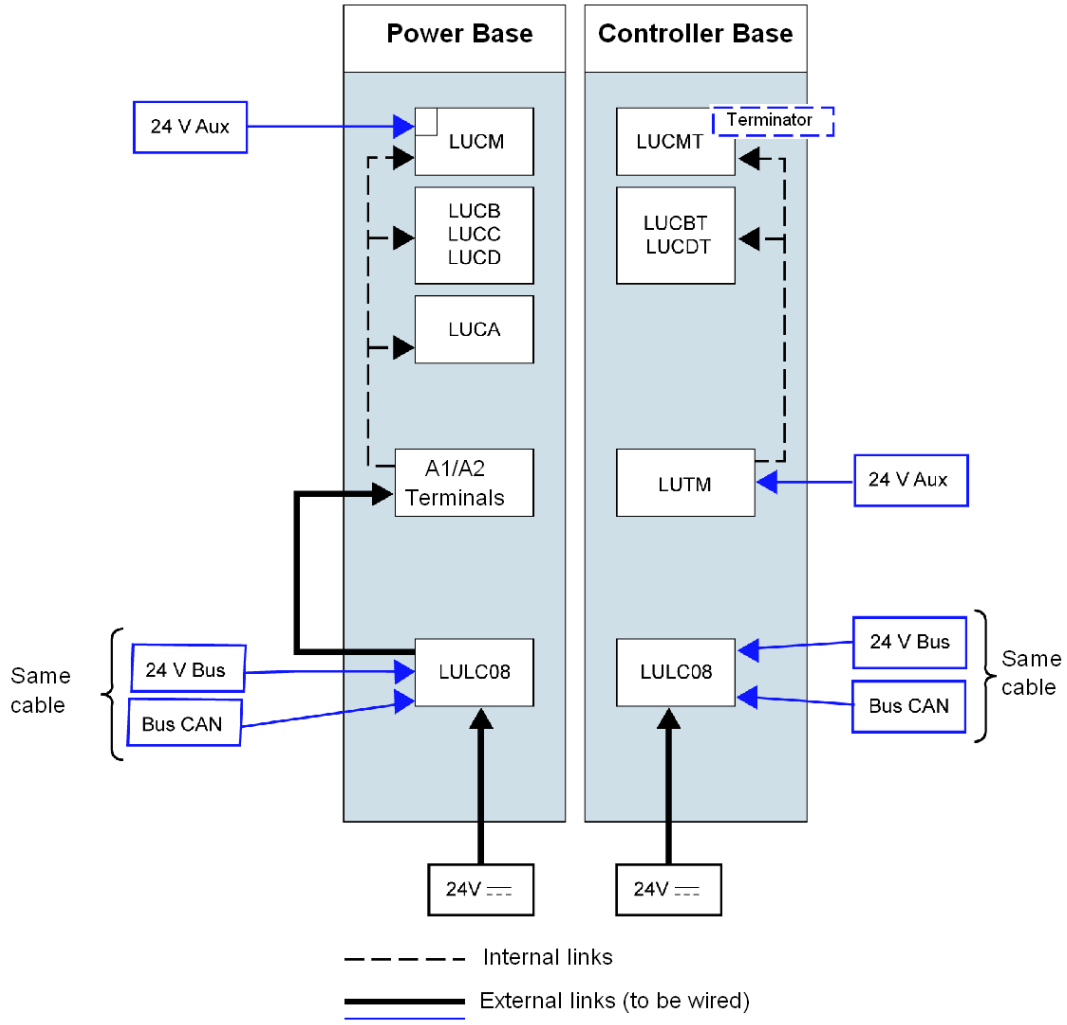
The illustration below details the steps. Installation of LULC08 CANopen communication module is (2). Numbers correspond both to components assembly order and to their positions.



Electrical Connection

24V⎓ and Internal Power Supplies

Here is a schematic of the 24V⎓ (24VDC) and internal power supplies:



24V Bus = Communication module power supply (CAN_V+ and CAN_GND)

24V ⎓ = Power supply for OA1, OA3 and LO1

24V Aux = Power supply for LUCM control unit or LUTM controller

TeSys U Behavior at Power-up with an LUCM/LUCMT

Here is a description of the system behavior at power-up of:

- a power base (LUB/LUS/LU2) with an LULC08 communication module and LUCM control unit,
- a controller base (LUTM) with an LULC08 communication module and LUCMT control unit.

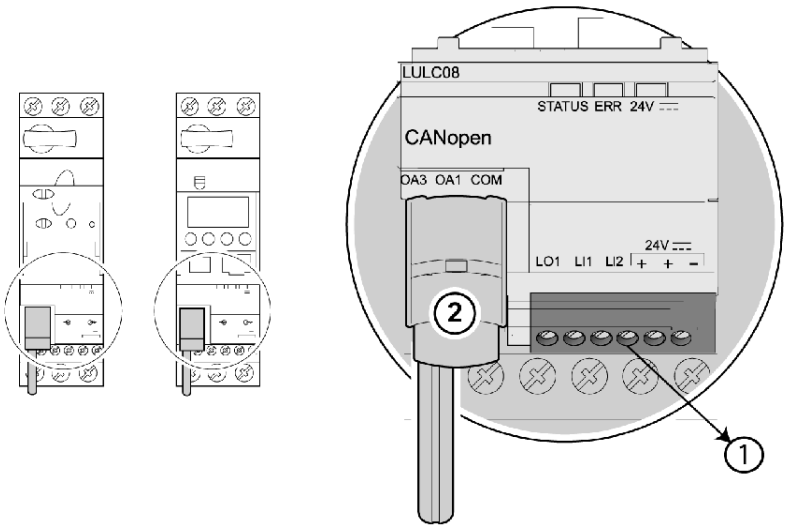
LULC08 Internal Power Supply	LUCM 24V Aux	A1/A2 Local Control	Comment
√	√		When LULC08 comm. module and LUCM multifunction control unit are powered-up simultaneously (recommended), the system is ready.
√			LULC08 is waiting for LUCM identification. The motor starter is not seen. The ERR LED is on (steady red).
	√ or √		LUCM is waiting for LULC08, which provokes an **M15** fault that must be acknowledged via the LUCM keypad or via the bus, once LULC08 has been powered-up.

LULC08 Internal Power Supply	LUCMT	Comment
√	√	When LULC08 comm. module and LUCMT multifunction control unit are powered-up simultaneously (recommended), the system is ready.
√		LULC08 is waiting for LUCMT identification. The motor starter is not seen. The ERR LED is on (steady red).
	√	LUCMT is waiting for LULC08, which provokes an **M15** fault that must be acknowledged via the LUCMT keypad, via the bus, or via the LUTM push-button, once LULC08 has been powered-up.

Power Supply for the LULC08 and Outputs OA1, OA3 and LO1

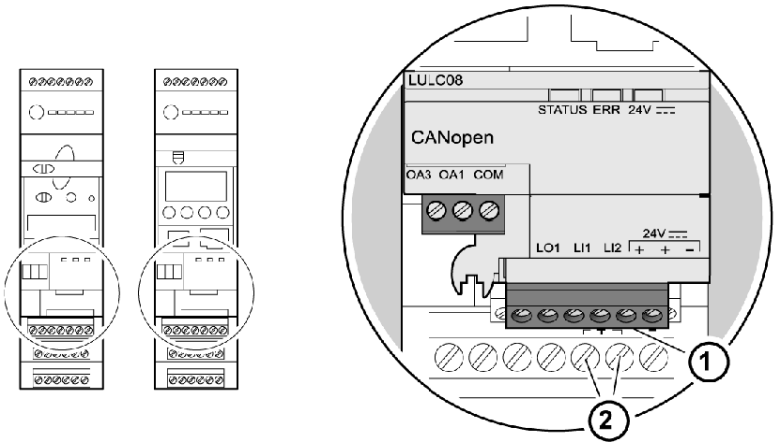
To operate, the LULC08 CANopen communication module must be powered by a 24V ⎓ power supply for output.

LUB•• / LUS•• / LU2B•• / LU2S•• Power bases power-up:



1. 24V ⎓ power supply terminal for outputs OA1, OA3 and LO1
2. Prewired coil connection for outputs OA1 and OA3 to terminals A1/A3/A2 on the starter

LUTM Controller bases power-up:



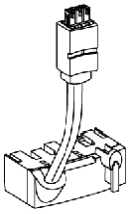
1. 24V ⎓ power supply terminal for outputs OA1, OA3 and LO1 (if required)
2. 24V Aux power supply terminals for LUTM

Power base: Terminal Power-up

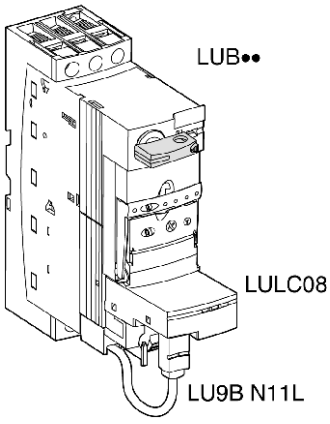
You have two options for connecting the power base terminals:
- Power supply via the LULC08 CANopen communication module with a prewired link
- Direct power supply with a wire-to-wire link.

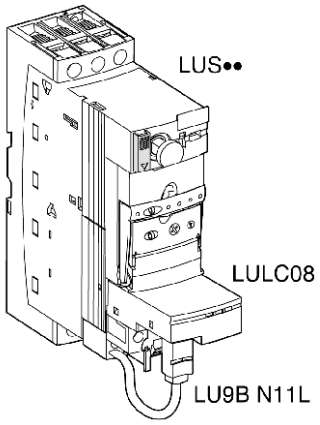
Prewired link

References of the two prewired coil connections:

Description	with a Power Base	Reference
Prewired Coil Connection 	LUB•• / LUS•• LU2B•• / LU2S••	LU9B N11L LU9M RL

Illustrations for LUB•• and LUS•• power bases:





Wire-to-wire link (supplying power to outputs OA1, OA3 and LO1)

This type of link is compulsory in the case of a reversing starter-controller created from a separate **LU6M** reverser block.

The wire-to-wire link is also used to insert, for example, a local control or an external stop control.

LULC08 Connection Cross-Sections

The following table shows the conductor cross-sections that may be used on LULC08 terminals:

Connection	Conductor type	Cross-section (min. - max.)	
1 conductor	Solid conductor	0.14 ... 1mm^2	26 ... 18 AWG
	Stranded conductor	0.14 ... 1 mm^2	26 ... 18 AWG
	Stranded conductor with cable end: - non-insulated - insulated	 0.25 ... 1 mm^2 0.25 ... 0.5 mm^2	 24 ... 18 AWG 24 ... 20 AWG
2 conductors (same cross-section)	2 solid conductors 2 stranded conductors	0.14 ... 0.5 mm^2 0.14 ... 0.75 mm^2	26 ... 20 AWG 26 ... 20 AWG
	2 stranded conductors with cable end: - non-insulated - insulated	 0.25 ... 0.34 mm^2 0.75 mm^2	 24 ... 22 AWG 20 AWG

Connectors	3 and 6 pins	
Pitch	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 CANopen Bus

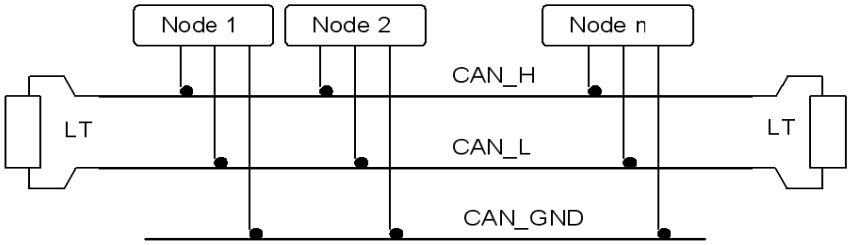
General Characteristics of a CANopen Connection

The following table provides general characteristics of a connection to the CANopen bus:

Characteristics	Description
Type of communication protocol	CiA DS-301 V4.02
Type of hardware interface	CAN 2.0 A (2.0 B passive)
Type of Device Profile	Manufacturer Specific
Baud rate	10 - 1,000 kbaud
Maximum connection distance	Depending on the baud rate *(see tables)*
Maximum number of slaves connected to 1 master	127
Connector type	Sub-D 9 points
Cable structure	2 pairs with separate shielding and a different gauge. Shielding is aluminium foil + tinned copper braid + drain. Same structure for trunk and drop cables.
EMC protection	*See the TSX DG KBL F Guide: Electromagnetic compatibility of industrial networks and fieldbuses*, and the *CANopen Hardware Setup Manual.*

Electrical Interface

The CANopen bus uses a twisted pair to transmit the differential signals and a common conductor for the return:



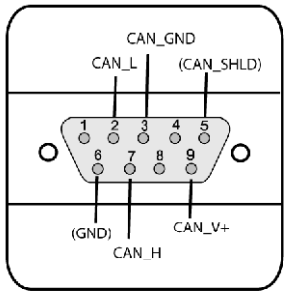
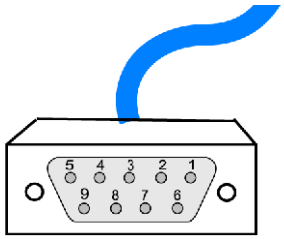
Each Schneider Electric CANopen component allows interconnection of the following signals:

Designation	Description
CAN_H	CAN_H (CAN High) bus conductor
CAN_L	CAN_L (CAN Low) bus conductor
CAN_GND	CAN bus ground
CAN_V+	Electrical supply

NOTE: In addition to the three wires noted above, Schneider Electric cables have a fourth wire for remote power supply to devices.

CANopen Sub-D 9 Connector

The following figures detail the connection of a CANopen cable to a CANopen communication module:

Male connector: module side	Female connector: cable side
	

Sub-D 9 Pinout

The pinning of the Sub-D 9 points connector is as follows:

Pin number	Signal	Description
1	Reserved	
2	CAN_L	CAN_L bus line (high dominant)
3	CAN_GND	CAN Ground
4	Reserved	
5	(CAN_SHLD)	Shielding
6	GND	Ground
7	CAN_H	CAN_H bus line (low dominant)
8	Reserved	
9	CAN_V+	CAN external power supply

Types of Topologies Possible with CANopen

General

CANopen connections are of daisy-chaining or junction type.

⚠ CAUTION
24V BUS POWER SUPPLY CONNECTION The bus connection cable between the master coupler (TSXCP110) and the first tap (TSXCATDM4) must not carry the 24V bus power supply. **Failure to follow these instructions can result in injury or equipment damage.**

Daisy-Chaining Connection

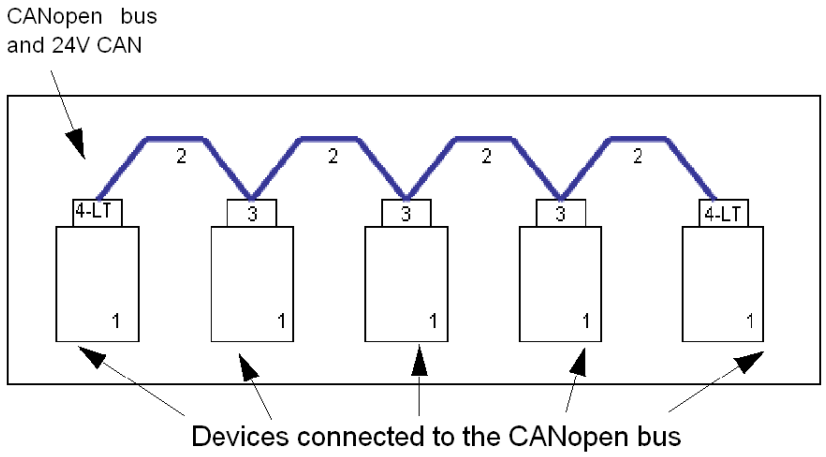
The CANopen bus in daisy-chaining mode may be created by using TSXCANC•50/100/300 cables and TSXCANKCDF• connectors.

A line terminator is built into the connectors. Each segment end connector must have an active line terminator.

This connection mode is the most economical. You can connect up to 25 products.

Example of Daisy-Chaining Connection

The diagram below illustrates a daisy-chaining connection, with the CANopen bus components:



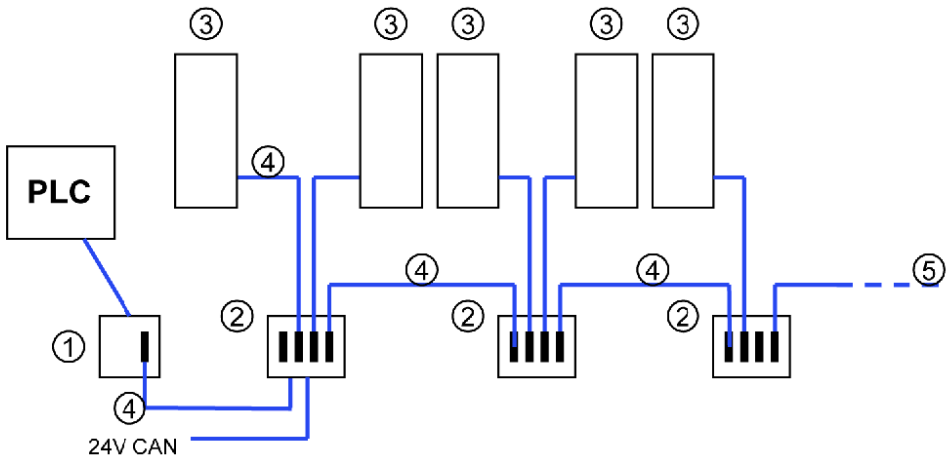
1 Device with male Sub-D 9 connector
2 TSXCANC•••• cable
3 TSXCANKCDF180T Sub-D 9 connector with line end switch in the OFF position
4 TSXCANKCDF180T Sub-D 9 connector with line end switch in the ON position (LT = Line Terminator)

Junction Connection with TSXCANTDM4

The CANopen bus in junction mode may be created by using TSXCANTDM4 taps.

This system is the fastest and the most flexible to install.

The diagram below provides an example of a bus that uses TSXCANC•DD•• drop cable.



1 TSXCP110 tap
2 TSXCANTDM4 connection devices C•••• cable
3 Device with male Sub-D 9 connector
4 TSXCANCA•• drop cable
5 Device with line terminator

⚠ CAUTION

24V BUS POWER SUPPLY CONNECTION

The bus connection cable between the master coupler tap and the first tap (TSXCATDM4) must not carry the 24V bus power supply.

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

Trunk Cable Maximum Length

The cable length is restricted by the baud rate. The table below shows the correspondence between the baud rate and the maximum bus length:

Baud rate	Maximum bus length
1 Mbps	20m (21.9yd)
800 kbps	40m (43.7yd)
500 kbps	100m (109yd)
250 kbps	250m (273yd)
125 kbps	500m (547yd)
50 kbps	1,000m (1,094yd)
20 kbps	2,500m (2,734yd)
10 kbps	5,000m (5,468yd)

In CANopen documents, the maximum length at 1 Mbps is often given as 40m. This length is calculated without taking electrical isolation as used in the Schneider Electric CANopen devices into account.

When electrical isolation is taken into account, the minimum network length calculated is 4m at 1 Mbps. In practical terms, however, 20m is the maximum length, which may be shortened by stubs or other apparatus.

Single Drop Maximum Length

The following table gives the maximum length of a single drop (CANopen drop cord), considering the baud rate:

1Mbps	800kbps	500kbps	250kbps	125kbps	50kbps	20kbps	10kbps
0.3m (0.98ft)	3m (9.84ft)	5m (16.40ft)	5m (16.40ft)	5m (16.40ft)	60m (66yd)	150m (164yd)	300m (328yd)

Multiple Drops to 1 Tap (TSXCANTDM4) Maximum Length

The following table gives the maximum cumulative length of drops connected to the same tap, considering the baud rate:

1Mbps	800kbps	500kbps	250kbps	125kbps	50kbps	20kbps	10kbps
0.6m (1.97ft)	6m (19.68ft)	10m (32.8ft)	10m (32.8ft)	10m (32.8ft)	120m (131yd)	300m (328yd)	600m (656yd)

Minimum Distance Between 2 Taps (TSXCANTDM4)

The following table gives the minimum distance between 2 drops, considering the baud rate:

1Mbps	800kbps	500kbps	250kbps	125kbps	50kbps	20kbps	10kbps
0.36m (1.18ft)	3.6m (11.80ft)	6m (19.68ft)	6m (19.68ft)	6m (19.68ft)	72m (79yd)	180m (197yd)	360m (394yd)

NOTE: The minimum distance between 2 drops corresponds to 60% of the cumulative length of drops connected to the same tap.

Multiple Drops (on the Bus) Maximum Length

The following table gives the maximum cumulative length of multiple drops connected to the CANopen bus, considering the baud rate:

1Mbps	800kbps	500kbps	250kbps	125kbps	50kbps	20kbps	10kbps
1,5m (4.92ft)	15m (49.21ft)	30m (32.8yd)	60m (66yd)	120m (131yd)	300m (328yd)	750m (820yd)	1500m (1,640yd)

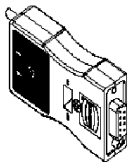
Installation of Tap Junction and Cabling Accessories

Overview

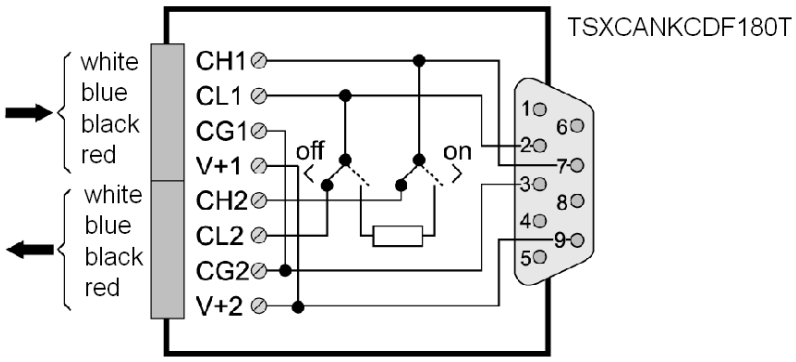
You can choose between 2 types of connections:
- 1 straight connector (TSXCANKCDF180T)
- 1 tap junction (TSXCANTDM4).

Straight Connector

TSXCANKCDF180T straight connector is as follows:

Reference	Illustration	Description
TSXCANKCDF180T		CANopen Sub-D 9pt female connector, straight. Includes a micro-switch to force the adaptation to line termination.

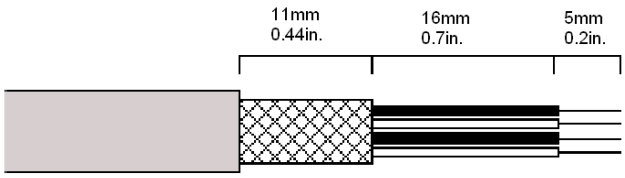
The following diagram shows the bus interface wiring inside the plugs:



Straight Connector Sub-D 9 Wiring

The table below describes the procedure for wiring the TSXCANKCDF Sub-D 9 bus interface:

Step	Action
1	Strip a section of insulation approx. 27mm (1.1in.) in length from end of the cable
2	Cut the metallic braid and the shielding films while keeping a length of 11mm (0.44in.)
3	Strip a section of 5mm (0.2in.) in length from end of each wire and mount on terminals.



CANopen Tap

The following table references the CANopen tap:

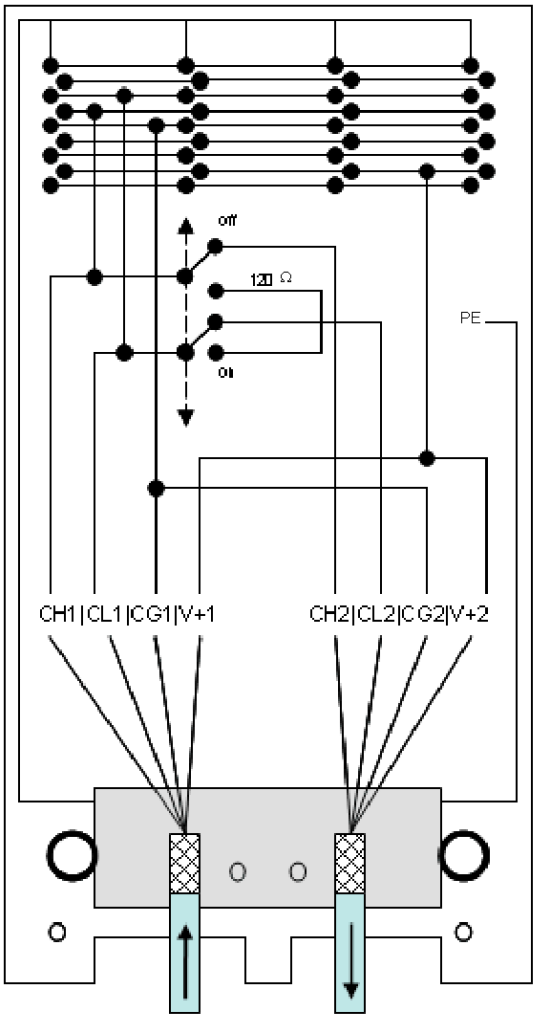
Reference	Description
TSXCANTDM4	CANopen tap equipped with 4 male Sub-D 9 ports.

The tap allows you to connect up to 4 drops to the main bus. The tap also Includes a micro-switch to force the adaptation to line termination.

Tap Junction

In this setup, the switch is normally in the OFF position. If the switch is in the ON position, the second cable is disconnected, as well as the second part of the bus.

Here is a view of the TSXCANTDM4 cable chaining:



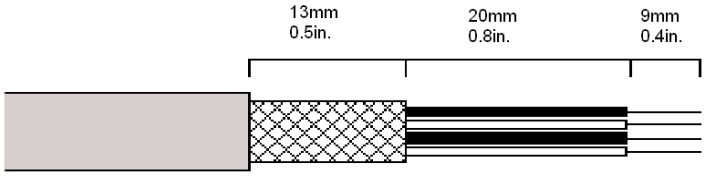
The following table shows terminal block wiring depending on the signal:

Signal	Terminal block 1	Terminal block 2	Wire color
CAN_H	CH1	CH2	White
CAN_L	CL1	CL2	Blue
CAN_GND	CG1	CG2	Black
CAN_V+	V+1	V+2	Red

Tap Junction Wiring

The table below describes the procedure for wiring the TSXCANTDM4 tap junction:

Step	Action
1	Strip a section of insulation approx. 42mm (1.7in.) in length from end of the cable
2	Cut the metallic braid and the shielding films while keeping a length of 13mm (0.5in.)
3	Strip a section of 9mm (0.4in.) in length from end of each wire and mount on terminals.



CANopen Drop Cord References

The following table references the different CANopen drop cords, that link a LULC08 Communication Module to a tap:

Reference	Cable length	Description
TSXCANCADD03	0.3m (0.98ft)	LSZH CANopen cable with one female Sub-D connector at each end. This is standard CANopen cable, EC approved. Low smoke emission, no halogen, no flame propagator.
TSXCANCBDD03		UL/IEC332-2 CANopen cable with one female Sub-D connector at each end. This is CANopen cable, UL approved.
TSXCANCADD1	1.0m (3.28ft)	LSZH CANopen cable with one female Sub-D connector at each end. This is standard CANopen cable, EC approved.
TSXCANCBDD1		UL/IEC332-2 CANopen cable with one female Sub-D connector at each end. This is CANopen cable, UL approved.
TSXCANCADD3	3.0m (9.84ft)	LSZH CANopen cable with one female Sub-D connector at each end. This is standard CANopen cable, EC approved.
TSXCANCBDD3		UL/IEC332-2 CANopen cable with one female Sub-D connector at each end. This is CANopen cable, UL approved.
TSXCANCADD5	5m (16.40ft)	LSZH CANopen cable with one female Sub-D connector at each end. This is standard CANopen cable, EC approved.
TSXCANCBDD5		UL/IEC332-2 CANopen cable with one female Sub-D connector at each end. This is CANopen cable, UL approved.

Line Termination

The line termination must be provided through termination resistors of 120 ohm +/-5% 1/4W. Resistors are located at both ends of the line. The resistors are embedded in CANopen connector CI, between CANH and CANL pins.

Connection to a PLC

To connect to a PLC (e.g., to a Modicon Premium TSX57 or Quantum 140), select your cable and connectors:

Reference	Description
TSXCANCA.. (e.g., TSXCANCA50)	CANopen trunk cable, EC approved TSXCANCA50 corresponds to 50 meters (54.68 yards) length
TSXCANCB.. (e.g., TSXCANCB100)	CANopen trunk cable, UL approved TSXCANCB100 corresponds to 100 meters (109.36 yards) length
TSXCANKCDF90T	CANopen Sub-D 9pt female connector *(see Connector table)*
TSXCANKCDF180T	
TSXCANKCDF90TP	

NOTE: Cable minimum length sold is 50 meters (54.68 yards).

Technical Characteristics

2

Operating Conditions and Technical Characteristics

Introduction

LULC08 CANopen communication module characteristics include:
- Operating conditions
- 24V ⎓ and CAN external power supply circuit characteristics
- Logic outputs (OA1, OA3 and LO1) and logic inputs (LI1 and LI2) characteristics.

Communication characteristics (module port) are also described.

Operating Conditions

LULC08 CANopen communication module service conditions are:

Certification	UL, CSA		
Conformity to standards	IEC 62026-1 Overvoltage category III Degree of pollution: 3 UL 508 and CSA C22-2 No14		
European Community Directives	CE marking. In conformity with the essential requirements of low voltage (LV) equipment and electromagnetic compatibility (EMC) directives.		
Ambient air temperature around the device	Storage	°C	- 40 ... + 85
	Operation	°C	- 25 ... + 55

Product Dimensions

Dimensions of an LULC08 CANopen communication module are:

	LULC08
HxLxD	49x46x113mm (1.9x1.8x4.4)
Weight	104g (0.23lb)

For any information about dimensions of overall TeSys U products, see *"Motor starters - open version TeSys U" Catalogue.*

24V ⎓ Power Supply

The technical characteristics of a 24V ⎓ power supply circuit, for an LULC08 CANopen communication module, include:

Supply voltage	$U_{nominal}$	V	24V ⎓
	Operating range	V	20 ... 28
Maximum current drawn		A	1.5 at +55 °C
Resistance to micro cuts		ms	3
Protection	against overvoltage		Yes
	against reverse polarity		Yes

24V CAN External Power Supply

The power supply is one of the most important devices in a network with power distribution. The following requirements shall be respected by the selected power supply:

Standard		IE61131-2:2003, PELV or SELV
Initial tolerance	V	24V +/- 3% or better (no load voltage)
Line regulation	%	+/- 3% max
Load regulation	%	+/- 3% max
Output ripple	mV	200mV p-p max
Load capacitance capability	F	7000F max
Isolation		output isolated from AC and Chassis ground
Minimum output voltage		19.2 at full load
Current limit	A	2A
Maximum current drawn	mA	50

NOTE: It is recommended to use Schneider Electric power supplies from the Phaseo product family such as e.g. : ABL-7RE2402 or ABL-7CEM24.

24V power supplies must be equipped with a surge suppressor, in order to limit the transitory spreading.

Keep the 24V cables away from the power cables, at least 30 cm (11.8 in.), and create crossovers at right-angles, if necessary.

OA1, OA3 and LO1 Logic Outputs

Output characteristics of an LULC08 CANopen communication module include:

Nominal output values	Voltage	V	24V ⎓
	Current	mA	500
Limit output values	Voltage	V	20 ... 28
	Current	mA	500
Coincidence factor of the 3 outputs		%	100
Output response time (register 704) (Time duration between the request start bit and the change in the output state)		ms	<10 (OA1, OA3, LO1)
Protection	Against short-circuits and overloads		Electronic circuit-breaker with automatic reset
Number of operating cycles	In millions		15
Maximum rate	In operating cycles per hour		3600

LI1 and LI2 Logic Inputs

Input characteristics of an LULC08 CANopen communication module include:

Nominal input values		Voltage	V	24V ⎓ (positive logic)
		Maximum voltage	V	28V ⎓
		Current	mA	7
Limit Input values	State 1	Voltage	V	16
		Current	mA	6
	State 0	Voltage	V	5
		Current	mA	2
Response time	To state 1		ms	10 +/- 30%
	To state 0		ms	10 +/- 30%
Input type				Resistive
Protection	gl fuse		A	1

Communication (CANopen Port)

Technical characteristics of CANopen port for the LULC08 communication module include:

Factory setting		
Physical interface	1	CAN
Connector		Male Sub-D 9
Pinout		According to the CANopen specification (see *CANopen Sub-D 9 Connector, page 25*)
Protocol		CAN 2.0A and CAN 2.0B (passive mode)
Address	Range	1 to 127
Transmission speed	Kbit/s	10, 20, 50, 125, 250 (default), 500, 800, 1 000

Software Implementation

II

Hardware implementation of an LULC08 CANopen communication module is being followed by its software implementation. It is focused on configuration (the different operating modes) and functions setting (e. g. protection, current measurement, ...).

Local set-up is done through:
- the LUCM/LUCMT configuration port (using Powersuite workshop software), or
- the LUCM/LUCMT keypad.

Remote set-up is done through:
- the CANopen port of the module.

What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
3	CANopen Communication Module Management	39
4	Software Setup	45
5	Managing Faults and Warnings	73
6	Configuration of Predefined Functions	79

CANopen Communication Module Management

3

Introduction to CANopen Bus

A TeSys U motor starter equipped with the LULC08 communication module is managed via the CANopen bus. The following parts describe basic CANopen features and the profile.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
CANopen Network Basics	40
CANopen Communication Profile	41

CANopen Network Basics

Introduction to CANopen Network

CANopen is a networking system based on the serial bus Controller Area Network (CAN). The CANopen Communication profile (CiA DS-301) supports both direct access to device parameters and time-critical process data communication.

CANopen device profiles (CiA DSP-40x) define standards for basic device functionality while providing ample scope for additional vendor-specific device features

CANopen reaches the full power of CAN by allowing direct peer to peer data exchange between nodes in an organized and, if necessary, deterministic manner.

CANopen Network Benefits

The network management functions specified in CANopen simplify:
- project design,
- implementation, and
- diagnosis.

They provide standard mechanisms for network start-up and error management.

CANopen supports both cyclic and event-driven communication. This makes it possible to reduce the bus load to a minimum, but still maintaining extremely short reaction times.

High communication performance can be achieved at relatively low baud rates, thus reducing EMC problems and minimizing cable costs.

CANopen is the ideal networking system for all types of automated machinery:
- supporting for data exchange at the supervisory control level, and
- accommodating the integration of very small sensors and actuators on the same physical network.

This avoids the unnecessary expense of gateways linking sensor/actuator bus systems with higher communication networks, and makes CANopen particularly attractive to original equipment manufacturers.

CANopen Communication Profile

CANopen Protocol

The CANopen protocol is based on the CAN 2.0A specification (identifier coded on 11 bits).

The CANopen TeSys U interface conforms to the CANopen specifications (DS301 V4.02).

The starter-controllers are described in EDS (Electronic Data Sheet) files that must be embedded into the configuration tools.

The LULC08 Communication Module conforms to Schneider implementation class S20.

NOTE: For more information about CANopen, visit the Can In Automation website: http://www.can-cia.de.

CANopen Message Frame

Here is the description of a standard CANopen message frame:

SOF	**COB-ID**	**RTR**	**CTRL**	**Data segment**	**CRC**	**ACK**	**EOF**
1 bit	11 bits	1 bit	5 bits	0-8 bytes	16 bits	2 bits	7 bits

SOF	Start of frame
COB-ID	CAN message identification field, composed of a Function code (4bits) and a Node D (7bits). The Function code determines the object priority. This allows communication between a Network manager and 127 stations. The Function code is determined with an Object Dictionary in the Device Profile. Broadcasting is indicated by a Node ID of zero.
RTR	Remote transmission request
CTRL	Control field (i.e. data length)
CRC	Cyclic redundancy check
ACK	Acknowledge
OEF	End of frame

CANopen Services

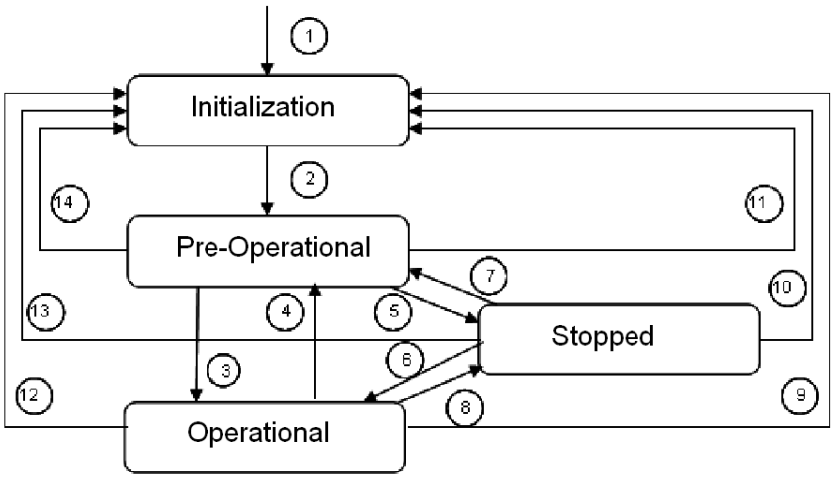
CANopen communication objects transmitted via the CAN network are described by services:

- NETWORK MANAGEMENT
  Starting the bus, parameters setting, monitoring.
- HIGH SPEED TRANSMISSION OF PROCESS DATA
  PDOs (Process Data Objects) for real time control command.
- LOW SPEED TRANSMISSION OF SERVICE DATA.
  SDOs (Service Data Objects) for configuration, setting and diagnostic.

Network Management (NMT)

The CANopen network management is node-oriented and follows a master/slave structure. It requires one device in the network, which fulfils the function of the NMT master. The other nodes are NMT slaves.

The CANopen NMT slave devices implement a state machine, described below:



(1)	At Power on, the initialization state is entered autonomously.
(2)	Once initialization is finished, the Pre-Operational state is automatically entered (it is possible to send parameters). **Note**: In the Pre-Operational state, you can write some parameters selected by configuration.
(3) (6)	Start_Remote_Node
(4) (7)	Enter_Pre-Operational_State, and apply fallback.
(5) (8)	Stop_Remote_Node
(9) (10) (11)	Reset_Node
(12) (13) (14)	Reset_Communication

Process Data Objects (PDOs)

The real time data transfer is performed by means of Process Data Object (PDO) telegrams. Process Data is time-critical data used to monitor and control the device.

The CANopen communication module features:

PDOs	Description	Status
Transmit PDO1	To monitor (data transmitted by the slave)	Pre-configured and activated
Receive PDO1	To control (data transmitted by the master)	
Transmit PDO2	To be used to exchange data (defined at configuration)	To be configured and activated
Receive PDO2		
Transmit PDO3		
Receive PDO3		
Transmit PDO4	To access (read or write) to any register by programming	Pre-configured and activated
Receive PDO4		

The RPDO (Receive PDO) and TPDO (Transmit PDO) objects can be configured to include 8 bytes of data, organized as four 16-bits registers or one 64-bits object, for example.

The RPDO objects have a write access.

You can set the PDO communication mode, depending on your needs: cyclic or acyclic, synchronous or asynchronous.

Synchronous means that the PDO transmission is related to the SYNC object, which is cyclically emitted by the CANopen master. It does not include any data. Its default value is 0x080.

Transmission mode is:

Transmission Type	PDO Transmission			
	Cyclic	Acyclic	Synchronous	Asynchronous
0 PDO sent synchronously with the SYNC object, triggered by a change of data value		√	√	
1-240 PDO sent by the communication module once every 1 to 240 receptions of the SYNC object	√		√	
255 Default communication mode value		√		√

Service Data Objects (SDOs)

Service Data Objects (SDOs) are used for device configuration. They are also used to define the type and format of information communicated via the PDOs.

SDOs let you access any object of the device Object Dictionary.

CANopen masters perform acyclic messaging through SDOs. They are also used for asynchronous, aperiodic requests. For example, an SDO can be used to read a control unit identification.

The CANopen communication module manages 1 SDO server.

Software Setup

4

Local Setup

This chapter describes the main steps of the TeSys U software setup on CANopen.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
EDS File Importation in the CANopen Configuration Software	46
Inserting TeSys U in the CANopen Network	47
Factory Configuration and Setting	53
Customizing your Configuration	54
Using PDOs	60
Using SDOs	66
PKW: Encapsulated Acyclic Accesses	67
Using of Main Registers for a Simplified Management	71

EDS File Importation in the CANopen Configuration Software

EDS Download Procedure

The different TeSys U starter-controller variants are described in EDS (Electronic Data Sheet) files.

If the TeSys U starter controllers do not show up in your CANopen configuration tool, the corresponding EDS files must be imported.

The following table describes the steps to follow to download the EDS and icon files associated to Tesys U from the www.schneider-electric.com website:

Step	Action
1	Open the Schneider Electric website: www.schneider-electric.com.
2	Click **Products and Services** and then click **Automation and Control**.
3	In the **Downloads** section of the left menu bar, click **Current offers**.
4	• In the **Choose a function** drop-down list, select **Motor Control**. • In the **Choose a range** drop-down list, select **TeSys U**. • In the **Choose a type of document** drop-down list, select **Software/Firmware**. Click **>Find**.
5	Select **Communication Module Tesys U Canopen** and download LULC08_EDS_DIB_files_V100.exe file.
6	Double-click LULC08_EDS_DIB_files_V100.exe on your hard disk. Click **Accept** in the 'Licence for software downloaded from Schneider-Electric web sites' window which opens, then browse for a destination folder and click **Install**.
7	Select the EDS file(s) corresponding to your TeSys U configuration(s):

The table below gives the associations between the 7 TeSys U variants and the associated EDS files names.

Variants names	EDS file name
TeSys U C Ad	TE_TESYSU_C_AD••••E.eds
TeSys U C Mu L	TE_TESYSU_C_MU_L••••E.eds
TeSys U C Mu R	TE_TESYSU_C_MU_R••••E.eds
TeSys U Sc Ad	TE_TESYSU_SC_AD••••E.eds
TeSys U Sc Mu L	TE_TESYSU_SC_MU_L••••E.eds
TeSys U Sc Mu R	TE_TESYSU_SC_MU_R••••E.eds
TeSys U Sc St	TE_TESYSU_SC_ST••••E.eds

- **Sc** and **C** letters stand for **S**tarter-**C**ontroller and **C**ontroller, respectively.
- **St**, **Ad** and **Mu** letters stand for **St**andard, **Ad**vanced and **Mu**ltifunction control unit, respectively.
- **R** and **L** letters stand for **R**emote and **L**ocal configuration.

Inserting TeSys U in the CANopen Network

Introduction

To insert TeSys U in the CANopen network you must select one of the seven variants described below

Selection Criteria of a TeSys U Variant

Choose TeSys U variant...	When you need...
TeSys U C Ad	a controller up to 450kW, for a 3-phase motor class 10-20, with an advanced control unit that protects against overloads and short-circuits, against phase imbalance and insulation breaks, and offers a manual or remote/automatic reset.
TeSys U C Mu R or TeSys U C Mu L	a controller up to 450kW, for a 3-phase motor class 5-30, with a multifunction control unit that protects against overloads and short-circuits, against phase imbalance and insulation breaks, has function warnings, log and monitoring functions, fault differentiation, overtorque and no-load running monitoring, and offers a manual/automatic reset.
TeSys U Sc Ad	a starter or a starter-controller up to 15kW, for a 3-phase motor class 10 or 20 or a 1-phase motor class 10, 0-12 or 0-32A rating, with an advanced control unit that protects against overloads, short-circuits, phase imbalance, and insulation breaks, and offers a manual or remote/automatic reset.
TeSys U Sc Mu R or TeSys U Sc Mu L	a starter-controller up to 15kW, for a 1 phase or a 3-phase motor class 5-30, 0-12 or 0-32A rating, with a multifunction control unit that protects against overloads and short-circuits, against phase imbalance and insulation breaks, has function warnings, log and monitoring functions, fault differentiation, overtorque and no-load running monitoring, and offers a manual/automatic reset.
TeSys U Sc St	a starter or a starter-controller up to 15kW, for a 3-phase motor class 10, 0-12 or 0-32A rating, with a standard control unit that protects against overloads, short-circuits, phase imbalance, and insulation breaks, and offers a manual reset.

Local (L) / Remote (R) configuration modes refer to Configuration register 601 (read/write with motor off), supported by Multifunction Control Unit ≥ V3.x.

If in a local configuration mode...	It means that 601.7 = 1. This mode preserves the local configuration made with the embedded HMI of the multifunction control unit. It forbids any configuration managed by PLC application through the network, thus preserving your local configuration.
If in a remote configuration mode...	It means that 601.7 = 0. This mode enables the PLC application to remotely configure the TeSys U device. **Note:** The parameters overwritten by the PLC application will be lost. This mode is useful in case of faulty device replacement.

By default, the TeSys U device equipped with a Multifunction Control Unit ≥ V3.x is in Remote configuration mode.

Setting TeSys U Parameters

Depending on the TeSys U variant, parameter settings can be managed through different channels:

	Configuration managed by CANopen configuration tool	Configuration managed through PKW (PDO n°4)	Configuration locally by embedded HMI of multifunction control unit
TeSys U C Ad V1.xx	√	√	
TeSys U C Mu L V1.xx			√
TeSys U C Mu R V1.xx	√	√	*
TeSys U Sc Ad V1.xx	√	√	
TeSys U Sc Mu L V1.xx			√
TeSys U Sc Mu R V1.xx	√	√	*
TeSys U Sc St V1.xx	√	√	

* The parameters can be set locally by embedded HMI of multifunction control unit on "TeSys U Sc Mu R V2.xx" and "TeSys U C Mu R V1.xx" variants if the PLC application does not modify any parameters through the network.

Parameters for TeSys U C Ad

The following table gives the description of parameters for TeSys U C Ad:

CANopen index	Parameter	Description
2006 : 03	602	Control configuration (thermal fault reset mode)
2007 : 21	682	Communication loss fallback strategy
2007 : 22	683	Controller Local/Remote control mode
2007 : 23	684	Inversion of output configuration
2007 : 24	685	Output LO1 configuration
2007 : 25	686	Outputs OA1 and OA3 configuration
2007 : 26	687	Outputs 13 and 23 configuration
2007 : 27	688	Recovery mode
2007 : 29	690	Disable auto-identification

Parameters for TeSys U C Mu L/R

The following table gives the description of parameters for TeSys U C Mu L/R:

CANopen index	Parameter	Description
2006 : 01	600	Define an access code to lock LUCMT keypad
2006 : 02	601	Configuration
2006 : 03	602	Control configuration
2006 : 04	603	Control unit communication on LUCMT port address
2006 : 05	604	Control unit communication on LUCMT port baud rate
2006 : 07	606	Load class
2006 : 08	607	Thermal reset time
2006 : 09	608	Thermal reset threshold
2006 : 0A	609	Thermal warning threshold
2006 : 0B	610	Ground fault trip timeout
2006 : 0C	611	Ground fault trip threshold
2006 : 0D	612	Ground fault warning threshold
2006 : 0E	613	Phase imbalance trip timeout at start-up
2006 : 0F	614	Phase imbalance trip timeout while running
2006 : 10	615	Phase imbalance trip threshold
2006 : 11	616	Phase imbalance warning threshold
2006 : 12	617	Jam trip timeout
2006 : 13	618	Jam trip threshold
2006 : 14	619	Jam warning threshold
2006 : 15	620	Undercurrent trip timeout
2006 : 16	621	Undercurrent trip threshold
2006 : 17	622	Undercurrent warning threshold
2006 : 18	623	Long start trip timeout
2006 : 19	624	Long start trip threshold
2006 : 1A	625	Long start warning threshold
2006 : 1B-1C	626-627	Reserved
2006 : 1D	628	Current transformer primary
2006 : 1E	629	Current transformer secondary
2006 : 1F	630	Current transformer external passes
2006 : 20-23	631-634	Reserved
2007 : 01	650	Display language
2007 : 02	651	Display of running items
2007 : 03	652	Full Load Amps setting (%FLA max)
2007 : 04-1E	653-679	Reserved
2007 :1F	680	Communication module identification code setting
2007 : 21	682	Communication loss fallback strategy
2007 : 22	683	Controller Local/Remote control mode
2007 : 23	684	Inversion of output configuration
2007 : 24	685	Output LO1 configuration
2007 : 25	686	Outputs OA1 and OA3 configuration
2007 : 27	687	Outputs 13 and 23 configuration
2007 : 28	688	Recovery mode
2007 : 29	690	Disable auto-identification

Parameters for TeSys U Sc Ad

The following table gives the description of parameters for TeSys U Sc Ad:

CANopen index	Parameter	Description
2006 : 03	602	Control configuration (thermal fault reset mode)
2007 : 21	682	Communication loss fallback strategy
2007 : 23	684	Inversion of output configuration
2007 : 24	685	Output LO1 configuration
2007 : 25	686	Outputs OA1 and OA3 configuration
2007 : 27	688	Recovery mode
2007 : 29	690	Disable auto-identification

Parameters for TeSys U Sc Mu L/R

The following table gives the description of parameters for TeSys U Sc Mu L/R:

CANopen index	Parameter	Description
2006 : 01	600	Define an access code to lock LUCMT keypad
2006 : 02	601	Configuration
2006 : 03	602	Control configuration
2006 : 04	603	Control unit communication on LUCMT port address
2006 : 05	604	Control unit communication on LUCMT port baud rate
2006 : 07	606	Load class
2006 : 08	607	Thermal reset time
2006 : 09	608	Thermal reset threshold
2006 : 0A	609	Thermal warning threshold
2006 : 0B	610	Ground fault trip timeout
2006 : 0C	611	Ground fault trip threshold
2006 : 0D	612	Ground fault warning threshold
2006 : 0E	613	Phase imbalance trip timeout at start-up
2006 : 0F	614	Phase imbalance trip timeout while running
2006 : 10	615	Phase imbalance trip threshold
2006 : 11	616	Phase imbalance warning threshold
2006 : 12	617	Jam trip timeout
2006 : 13	618	Jam trip threshold
2006 : 14	619	Jam warning threshold
2006 : 15	620	Undercurrent trip timeout
2006 : 16	621	Undercurrent trip threshold
2006 : 17	622	Undercurrent warning threshold
2006 : 18	623	Long start trip timeout
2006 : 19	624	Long start trip threshold
2006 : 1A	625	Long start warning threshold
2006 : 1B-23	626-634	Reserved
2007 : 01	650	Display language
2007 : 02	651	Display of running items
2007 : 03	652	Full Load Amps setting (%FLA max)
2007 : 04-1E	653-679	Reserved
2007 :1F	680	Communication module identification code setting
2007 : 21	682	Communication loss fallback strategy
2007 : 22	683	Local/Remote control
2007 : 23	684	Inversion of output configuration
2007 : 24	685	Output LO1 configuration
2007 : 25	686	Outputs OA1 and OA3 configuration
2007 : 26	687	Reserved
2007 : 27	688	Recovery mode
2007 : 29	690	Disable auto-identification

Parameters for TeSys U Sc St

The following table gives the description of parameters for TeSys U Sc St:

CANopen index	Parameter	Description
2007 : 21	682	Communication loss fallback strategy
2007 : 23	684	Inversion of output configuration
2007 : 24	685	Output LO1 configuration
2007 : 25	686	Outputs OA1 and OA3 configuration
2007 : 27	688	Recovery mode
2007 : 29	690	Disable auto-identification

Factory Configuration and Setting

Parameter Types

Setting communication module parameters allows you to determine:
- the operation mode,
- the reset mode on thermal overload fault,
- the correspondence between the communication module outputs and the LUTM controller inputs.

Default Configuration and Setting Reglsters

Configuration registers (2006:xx) and Setting registers (2007:xx) are in a read/write access. Factory default values are:

CANopen index	Register	Subject	Factory value	Meaning
2006:03	602.0	Reset mode after thermal overload fault	1	"**Manual**" mode
	602.4	Validate the communication between LUCM and LULC08	1	Forced to 0 (zero), this bit forbids any communication between LUCM multifunction control unit and LULC08 communication module.
2007:21	682	Fallback mode of control outputs on communication loss	2	**Forced stop** Power base: OA1 and OA3 to 0 Controller base: 13 and 23 to 0
2007:22	683	Local or bus operation mode with LUTM and LULC08	0	LUTM output control mode "**remote via the bus**"
2007:23	684	LULC08 outputs inversion	0	Outputs status reflects control bits
2007:24 LSB 2007:25 LSB 2007:25 MSB 2007:26 LSB 2007:26 MSB	685 LSB 686 LSB 686 MSB 687 LSB 687 MSB	Assignment of: - output LO1 - output OA1 - output OA3 (on a controller base) - output 13 - output 23	 2 12 13 12 13	 LO1 reflects control bit 700.0 OA1 reflects control bit 704.0 OA3 reflects control bit 704.1 13 reflects control bit 704.0 23 reflects control bit 704.1
2007:27	688	Recovery mode after power-off	0	The outputs recover the status they had before power-off
2007:29	690	Disable auto-identification	0	Automatic identification of control unit

NOTE: For more details, refer to *TeSys U Communication Variables User's Manual*.

Customizing your Configuration

Parameter Types

You can either use the factory settings or customize your configuration.

Parameters concerning the communication module are described below.

For other parameters concerning the Control Unit, refer to the "TeSys U communication variables User's manual."

Control Configuration

Bits 0, 1 and 2 of this register are used to configure the reset mode after thermal overload fault. Only one of these bits must be set to 1 to select the reset mode. Other bits (3 to 8) are dedicated to the configuration of the Modbus port of the multifunction control unit.

CANopen index	Bit	Description/Possible values	Advanced Control Unit	Multifunction Control Unit
2006:03	Reset mode after thermal overload fault bits 0-2 (1 bit is set to 1)			
	602.0	Manual (default value =1)	√	√
	602.1	Remote (or multifunction control unit keypad)	√	√
	602.2	Automatic	√	√
	602.3	Control Unit communication parity 0 = none (default) - 1 = even		√
	602.4	Communication control enabled/disabled 0 = disabled - 1 = enabled (default)		√
	Multifunction control unit port watchdog bits 5-8 (1 bit is set to 1)			√
	602.5	Ignored (default value =1)		√
	602.6	Warning		√
	602.7	Drop-out		√
	602.8	Trip		√
	602.9 to 602.15	Reserved		√

Communication Loss Fallback strategy

Communication loss fallback strategy parameter (register 682 or CANopen index 2007:21) is used to adjust the fallback mode in case of a communication loss 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

If communication is stopped, the outputs OA1-OA3 take the status corresponding to the selected fallback mode (register 682), but the control bits 704.0 and 704.1 are not modified.

When a loss of communication warning is acknowledged (register 703 or pushbutton on the controller), the motor will automatically restart if the control bits 704.0 or 704.1 were not previously overwritten to zero 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)
	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

Controller Local/Remote Control Mode

Controlling LUTM outputs 13 and 23 depends on the operating mode selected in register Controller Local/Remote Mode.

CANopen index	Register	Control Mode	Value	Comment	
2007:22	683	Remote	0	Outputs 13 and 23 are controlled only by the bus (default value). *Status of inputs I.1 and I.2 does not affect outputs 13 and 23.*	
		Local	1	Outputs 13 and 23 are controlled only by inputs **I.1** and **I.2**. *Controlling outputs via the bus is not taken into account.*	
		Mixed Input I.10 takes priority	2	If I.10 = 1: Local mode	Outputs 13 and 23 are controlled by inputs **I.1** and **I.2**.
				If I.10 = 0: Remote Mode	Outputs 13 and 23 are controlled only by the bus. Status of inputs **I.1** and **I.2** does not affect outputs 13 and 23.

Inversion of Outputs Configuration

Depending on your needs (signalling, run, stop, etc.), you can assign a NO or NC status to outputs OA1, OA3 and LO1, by configuring Inversion of outputs configuration register.

CANopen index	Register	Bit	Value	Comment
2007:23	684	0	0	No inversion of output OA1 (default value)
			1	Inversion of output OA1
		1	0	No inversion of output OA3 (default value)
			1	Inversion of output OA3
		2	0	No inversion of output LO1 (default value)
			1	Inversion of output LO1

Output LO1 Configuration

To change the assignment (factory setting), write another value (0 to 45), as described in Assignment of outputs LO1, OA1, OA3, 13, 23.

Assignment/control (factory setting) of LULC08 output LO1 is:

CANopen index	Register	Value	Factory setting	Comment
2007:24 - LSB	685 - LSB	0 to 45	2	Output LO1 = image of register 700.0

Output OA1 Configuration

To change the assignment (factory setting), write another value (0 to 45), as described in Assignment of outputs LO1, OA1, OA3, 13, 23.

Assignment/control (factory setting) of LULC08 output OA1 is:

CANopen index	Register	Value	Factory setting	Comment
2007:25 - LSB	686 - LSB	0 to 45	12	Output OA1 = image of register 704.0

Output OA3 Configuration

To change the assignment (factory setting), write another value (0 to 45), as described in Assignment of outputs LO1, OA1, OA3, 13, 23.

Assignment/control (factory setting) of LULC08 output OA3 is:

CANopen index	Register	Value	Factory setting	Comment
2007:25 - MSB	686 - MSB	0 to 45	13	Output OA3 = image of register 704.1

Output 13 Configuration

To change the assignment (factory setting), write another value (0 to 45), as described in Assignment of outputs LO1, OA1, OA3, 13, 23.

Assignment/control (factory setting) of LULC08 output 13 is:

CANopen index	Register	Value	Factory setting	Comment
2007:26 - LSB	687 - LSB	0 to 45	12	Output 13 = image of register 704.0

Output 23 Configuration

To change the assignment (factory setting), write another value (0 to 45), as described in Assignment of outputs LO1, OA1, OA3, 13, 23.

Assignment/control (factory setting) of LULC08 output 23 is:

CANopen index	Register	Value	Factory setting	Comment
2007:26 - MSB	687 - MSB	0 to 45	13	Output 23 = image of register 704.1

Recovery Mode After Stopping (Reg 688)

If you use register 704 to control outputs OA1-OA3, writing value 1 to register 688 locks the motor and prevents it from restarting after 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, the control bits 704.0 and 704.1 (outputs OA1-OA3) are forced to 0 automatically. 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 case of a 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.

Disable Auto- Identification

Disable auto-identification can be automatic or forced.

CANopen index	Register	Value	Comment
2007:29	690	0	Automatic identification
		1	Forced to LUCB/C/D
		2	Forced to LUCM

Assignment of Outputs LO1, OA1, OA3, 13, 23

This table describes the assigned values to configure outputs LO1, OA1, OA3, 13 and 23.

Value	Description of assigned value	LUCBT / LUCDT	LUCMT
0	The corresponding output is forced to 0 (0V)	√	√
1	The corresponding output is forced to 1 (24V)	√	√
2	State of register 700, bits 0-4: - 700.0 --> LO1 - 700.1 --> OA1 - 700.2 --> OA3 - 700.3 --> 13 - 700.4 --> 23	√	√
3	452.3 (Thermal overload fault)	√	√
4	461.3 (Thermal overload warning)	√	√
5	457.0 (System ready)	√	√
6	457.1	√	√
7	State of bit 457.2	√	√
8	The corresponding output copies the result of "Reflex stop 1: forward"	√	√
9	The corresponding output copies the result of "Reflex stop 1: reverse"	√	√
10	The corresponding output copies the result of "Reflex stop 2: forward"	√	√
11	The corresponding output copies the result of "Reflex stop 2: reverse"	√	√
12	The corresponding output copies the result of "Forward direction" (default OA1 value)	√	√
13	The corresponding output copies the result of "Reverse direction" (default OA3 value)	√	√
14	452.0 (Short-circuit fault)	√	√
15	452.1 (Overcurrent fault)	√	√
16	452.2 (Ground fault)		√
17	452.3 (Thermal overload fault)	√	√
18	452.4 (Long start fault)		√
19	452.5 (Mechanical locking (jam) fault)		√
20	452.6 (Phase imbalance fault)		√
21	452.7 (Underload fault)		√
22	452.8 (Shunt trip)		√
23	452.9 (Test trip)		√
24	452.10 (Communication loss fault on LUCMT Modbus port)		√
25	452.11 (Control unit internal fault)	√	√
26	452.12 (Module identification or internal communication fault)		√
27	452.13 (Module internal fault)	√	√
28-31	*(Reserved)*		
32	461.2 (Ground fault warning)		√
33	461.3 (Thermal overload warning)	√	√
34	461.4 (Long start warning)		√
35	461.5 (Mechanical locking (jam) warning)		√
36	461.6 (Phase imbalance warning)		√
37	461.7 (Under-current warning)		√
38-39	*(Reserved)*		
40	461.10 (Communication loss on LUCMT Modbus port)		√
41	461.11 (Internal temperature warning)		√
42	461.12 (Module identification or internal communication warning)		√
43-44	*(Reserved)*		
45	461.15 (Module warning)	√	√

Using PDOs

Introduction

PDO telegrams are used to exchange periodic I/O data between the PLC and the TeSys U starter-controller.

The TeSys U starter-controller has four PDO sets:
- PDO1 set is predefined for control and monitoring. It is activated by default.
- PDO2 set is not predefined and is free to use.It is not activated by default.
- PDO3 set is not predefined and is free to use. It is not activated by default.
- PDO4 set is predefined to access any register (read or write) by programming using PKW objects. It is activated by default.

PDO Transmission Mode

The four PDO sets support the following transmission modes:

- Cyclic synchronous (synchronization is related to SYNC object)
- Acyclic synchronous and asynchronous.

Default mode of transmission of TeSys U starter-controller is acyclic asynchronous.Data is sent at network starting, on network reconnection and in normal operation on data change.

Default mode of transmission of CANopen master is also acyclic asynchronous.Data is sent from the master at network starting, on network reconnection and in normal operation on data change.

PDO Mapping

The mapping of the four PDO sets can be modified by the user.

Transmit PDOs are able to transport the following read-only variables:	
Monitoring objects:	CANopen index 2004
Multifunction Control Unit HMI display data:	CANopen index 200B

Receive PDOs are able to transport the following read/write variables:	
Setting objects:	CANopen index 2007
Command objects:	CANopen index 2008
Multifunction Control Unit keypad command:	CANopen index 200C

The complete list of CANopen mappable objects is detailed in the TeSys U Communication variables User's manual. Mappable objects are identified by the character "M" in the first column (Protocols address) of each table.

PDO1 Set Description

The first PDO set (PDO1) is dedicated to control and monitoring. The predefined mapping is described below and can be modified by the user.

Receive PDO1 mapping description

Receive PDO1 is dedicated to command the starter-controller from the PLC. The predefined mapping is common to the 7 TeSys U variants.

	Word 1	**Word 2**	**Word 3**	**Word 4**
Register	704	703	700	Empty
CANopen Index	2008:5	2008:4	2008:1	–
Description	Control Register	Control of communication module	Output control	–

Control Register Reg 704

The following table gives a description of the Control Register

⚠ WARNING

AUTOMATIC RESTART OF THE MOTOR

The motor will automatically restart if the control bits 704.0 and 704.1 were not previously overwritten to zero by the PLC application, in case of a cyclic writing to register 704 and on the occurrence of one of the following events:

- Loss followed by restoration of the outputs power supply 24 VDC.
- Change in position of rotary knob on power base followed by return to Ready position.
- Communication break followed by restoration.

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

Word 1	CANopen Index 2008:5	Sc St	C Ad Sc Ad	C Mu L/R Sc Mu L/R
bit 0	Run forward		√	√
bit 1	Run reverse		√	√
bit 2	(Reserved)			
bit 3	Fault reset: if register 451=102 or 104, fault acknowledgment causes a return to communication module factory settings This bit is active on rising edge and must be reset to 0 by programming		√	√
bit 4	(Reserved)			
bit 5	Launch automatic thermal overload fault test This bit is active on rising edge and must be reset to 0 by programming			√
bit 6-11	(Reserved)			
bit 12	Launch trip test via communication bus This bit is active on rising edge and must be reset to 0 by programming			√
bit 13-15	(Reserved)			

NOTE: Fault reset bit must be set to 1 and reset to 0 to acknowledge a fault.

Control of Communication Module Reg 703

The following table gives a description of the Control of Communication Module

Word 2	CANopen Index 2008:4	Sc St	C Ad Sc Ad	C Mu L/R Sc Mu L/R
bit 0-2	(Reserved)			
bit 3	Reset warning (communication loss,...) This bit is active on rising edge and must be reset to 0 by programming	√	√	√
bit 4-15	(Reserved)			

NOTE: Reset warning bit must be set to 1 and reset to 0 to acknowledge a warning (loss of communication).

Output Control Reg 700

The following table gives a description of the Output Control

Word 3	CANopen Index 2008:1	Sc St	C Ad Sc Ad	C Mu L/R Sc Mu L/R
bit 0	Control of output LO1 (if 685=2)	√	√	√
bit 1	Control of output OA1 (if 686 LSB=2)	√	√	√
bit 2	Control of output OA3 (if 686 MSB=2)	√	√	√
bit 3-15	(Reserved)			

Transmit PDO1 mapping description

Transmit PDO1 is dedicated to monitor the starter-controller from the PLC. The predefined mapping depends on the TeSys U variants.

		Word 1	Word 2	Word 3	Word 4
TeSys U C Ad TeSys U C Mu L/R	Register	455	458	461	459
	CANopen Index	2004:6	2004:9	2004:C	2004:A
	Description	Status register	I/O module status register	Warning register	I/O status of controller base

		Word 1	Word 2	Word 3	Word 4
TeSys U Sc St	Register	455	458	Empty	Empty
	CANopen Index	2004:6	2004:9	–	–
	Description	Status register	I/O module status register	–	–

		Word 1	Word 2	Word 3	Word 4
TeSys U Sc Ad	Register	455	458	461	Empty
	CANopen Index	2004:6	2004:9	2004:C	–
	Description	Status register	I/O module status register	Warning register	–

		Word 1	Word 2	Word 3	Word 4
TeSys U Sc Mu L/R	Register	455	458	461	457
	CANopen Index	2004:6	2004:9	2004:C	2004:8
	Description	Status register	I/O module status register	Warning register	Mechanical and power supply status register

Status Register of starter-controller Reg 455

The following table gives a description of the Status Register of the starter-controller

Word 1	CANopen Index 2004:6	Sc St	Sc Ad	Sc Mu L/R
bit 0	Ready: LUB••/2B•• = the rotary handle is turned to 'On' position and there is no fault. LUS••/2S•• = the push-button is pressed and there is no fault.	√	√	√
bit 1	Pole status: closed	√	√	√
bit 2	All faults	√	√	√
bit 3	All warnings	√	√	√
bit 4	Tripped: LUB••/2B•• = the rotary handle is turned to 'Trip' position. LUS••/2S•• = the push-button is depressed.	√	√	√
bit 5	Fault reset authorized		√	√
bit 6	A1/A2 terminals powered up			√
bit 7	Motor running with detection of current, if greater than 10% FLA		√	√
bit 8-13	Average motor current: 32 = 100% FLA 63 = 200% FLA		√	√
bit 14	(Non significant)	√	√	√
bit 15	Start in progress: 1 = ascending current is greater than 10% FLA 0 = descending current is lower than 150% FLA		√	√

Status Register of Controller Reg 455

The following table gives a description of the Status Register of the Controller

Word 1	CANopen Index 2004:6	C Ad	C Mu L/R
bit 0	Ready: LUTM is powered-on and there is no fault with the communication module (I.7 powered-on)	√	√
bit 1	Input I.3 or I.4 powered-on	√	√
bit 2	All faults	√	√
bit 3	All warnings	√	√
bit 4	Tripped, if thermal overload fault reset mode = manual	√	√
bit 5	Fault reset authorized	√	√
bit 6	I.1 and I.2 powered-on		√
bit 7	Motor running with detection of a current, if greater than 10% FLA	√	√
bit 8-13	Average motor current: 32 = 100% FLA 63 = 200% FLA	√	√
bit 14	In local control	√	√
bit 15	Start in progress: 1 = ascending current is greater than 10% FLA 0 = descending current is lower than 150% FLA For LUCBT/DT, timeout is 10s. For LUCMT, refer to LUCM/MT User's Guide.	√	√

I/O Module Status Register Reg 458

The following table gives a description of the I/O Module Status Register

Word 2	CANopen Index 2004:9	Sc St	C Ad Sc Ad	C Mu L/R Sc Mu L/R
bit 0	OA1 status	√	√	√
bit 1	OA3 status	√	√	√
bit 2	LO1 status	√	√	√
bit 3-7	(Non significant)			
bit 8	LI1 status	√	√	√
bit 9	LI2 status	√	√	√
bit 10-15	(Non significant)			

Warning Register Reg 461

The following table gives a description of the Warning Register

Word 3	CANopen Index 2004:C	Sc St	C Ad Sc Ad	C Mu L/R Sc Mu L/R
bit 0-1	Non significant)			
bit 2	Ground fault warning			√
bit 3	Thermal warning			√
bit 4	Long start warning		√	√
bit 5	Jam warning			√
bit 6	Phase imbalance warning			√
bit 7	Under-current warning			√
bit 8-9	Non significant)			
bit 10	Communication loss on LUCMT Modbus port			√
bit 11	Internal temperature warning			√
bit 12	Module identification or internal communication warning			√
bit 13-14	Non significant)			
bit 15	Module warning	√	√	√

I/O Status of Controller Base Reg 459

The following table gives a description of the I/O Status of the Controller Base

Word 4	CANopen Index 2004:A	C Ad	C Mu L/R
bit 0	I.1 = local control of output 13	√	√
bit 1	I.2 = local control of output 23	√	√
bit 2	I.3 = contactor status on output 13	√	√
bit 3	I.4 = contactor status on output 23	√	√
bit 4	I.5 = input status (reset)	√	√
bit 5	I.6 = input status (external fault)	√	√
bit 6	I.7 = input status (system ready)	√	√
bit 7	I.8 = input status (free)	√	√
bit 8	I.9 = input status (free)	√	√
bit 9	I.10 = input status in local/remote mixed mode if 683=2, otherwise free	√	√
bit 10-11	(Non significant)		
bit 12	Output 13 status (1=O1 closed)	√	√
bit 13	Output 23 status (1=O2 closed)	√	√
bit 14	Outputs 95-96 and 97-98 status (1=95-96 closed and 97-98 opened)	√	√
bit 15	Output 05-06 status (1=05-06 closed)	√	√

Mechanical and Power Supply Status Reg 457

The following table gives a description of the Mechanical and Power Supply Status

Word 4	CANopen Index 2004:8	Sc St	C Ad Sc Ad	C Mu L/R Sc Mu L/R
bit 0	Button position ‘On’ (0=’Off’)	√	√	√
bit 1	Button position ‘Trip’ (0=’Not tripped’)	√	√	√
bit 2	Contactor state ‘On’	√	√	√
bit 3	24 VDC power supply present on outputs	√	√	√
bit 4-15	(Non significant)			

PDO2 and PDO3 Set Description

PDO2 and PDO3 sets are not predefined (PDO is empty) and not activated. The user can map inside any mappable object.

The complete list of CANopen mappable objects is detailed in the TeSys U Communication variables User's manual.

PDO4 Set Description

PDO4 set is predefined to access to any register (read or write) by programming using PKW objects. PKW stands for **P**eriodically **K**ept in Acyclic **W**ords.

They allow to acyclically read or write any TeSys U register.

- 4 words are reserved in Receive PDO4 to receive a request telegram.
- 4 words are reserved in the Transmit PDO4 to provide a response telegram.

The complete list of CANopen mappable objects is detailed in the TeSys U Communication variables User's manual.

For variants TeSys U C Mu L and TeSys U Sc Mu L which are associated with the Multifunction Control Unit ≥ V3.x configured in local mode, PKW use is restricted to read access.

Receive PDO4 mapping description

Receive PDO4 is dedicated to receive a PKW request telegram.

CANopen Index	**3000:01**				**3000:02**	
Word number	**Word 1**	**Word 2**			**Word 3**	**Word 4**
		MSB		LSB		
Description	Address Register	Toggle bit (bit 7)	Function code (bit 6 to 0)	0x00	Value to write: 1st word MSW	Value to write: 2nd word LSW

Transmit PDO4 mapping description

Transmit PDO4 is dedicated to provide a response to a PKW request telegram.

CANopen Index	**3000:03**				**3000:04**	
Word number	**Word 1**	**Word 2**			**Word 3**	**Word 4**
		MSB		LSB		
Description	Same as request	Toggle bit (bit 7)	Function code (bit 6 to 0)	0x00	Read data: 1st word MSW	Read data: 2nd word LSW

Using SDOs

Introduction

SDO telegrams are used to access aperiodically any CANopen object by request programming. The list of addressable CANopen objects relative to TeSys functionnalities is detailed in the TeSys U Communication variables User's manual. The list of addressable CANopen objects relative to communication is detailed in Appendix A.The TeSys U starter controller has four PDO sets.

PDO1 set is predefined for control and monitoring and is activated by default.

Write SDO example

Here is an example of write SDO programming for Premium PLC in structured text language.

```
(*Address of exchange manager :                    ADR#0.1.SYS
Address of variable to be written :                %MD3200
Address of CANopen slave :                         40
Value of variable to be written :                  %MW3202:1
Management table :                                 %MW3250:4 *)

(*Change FLA setting to 50 % of FLA max *)
%MD3200:= 0x00032007;(* <index> = 0x2007 ; <sub-index> = 3 *)
%MW3202:= 50;

(* Write command AND previous exchange finished *)
IF %M100 AND NOT %MW3250:X0 THEN
   %MW3253:=2;(*200ms Time-out*)
   WRITE_VAR (ADR#0.1.SYS,'SDO',%MD3200,40,%MW3202:1,%MW3250:4);
   RESET %M100;(* Reset write command *)
END_IF;
```

Read SDO example

Here is an example of read SDO programming for Premium PLC in structured text language.

```
(*Address of exchange manager :                    ADR#0.1.SYS
Address of variable to be written :                %MD3220
Address of CANopen slave :                         40
Value of variable to be written :                  %MW3222:1
Management table :                                 %MW3260:4 *)

(*Read or fault register*)
%MD3220:= 0x00032004;(* <index> = 0x2004 ; <sub-index> = 3 *)

(* Read command AND Service inactive *)
IF %M101 AND NOT %MW3260:X0 THEN
   %MW3263:=2;(*200ms Time-out*)
   READ_VAR(ADR#0.1.SYS,'SDO',%MD3220,40,%MW3222:1,%MW3260:4);
   RESET %M101;(* Reset read command *)
END_IF;
```

PKW: Encapsulated Acyclic Accesses

Overview

The PKW feature is implemented to allow acyclic read or write accesses to be encapsulated in PDO4.

This feature is enabled in the CANopen configuration tool by activating PDO4.

Read/Write Registers

With the PKW data, you can read or write any register. The 8 bytes are interpreted as a request telegram or a response telegram encapsulated in IN data and OUT data.

Modules Without PDO4 Activated

IN		OUT
0		0
1		1
2		2
3		3
4		
5		
6		
7		

Modules With PDO4 Activated

IN		OUT
0		0
1		1
2		2
3		3
4		4 PKW OUT 0
5		5 PKW OUT 1
6		6 PKW OUT 2
7		7 PKW OUT 3
8 PKW IN 0		8 PKW OUT 4
9 PKW IN 1		9 PKW OUT 5
10 PKW IN 2		10 PKW OUT 6
11 PKW IN 3		11 PKW OUT 7
12 PKW IN 4		
13 PKW IN 5		
14 PKW IN 6		
15 PKW IN 7		

PKW OUT Data

PKW OUT Data request (DeviceNet Master → LULC08) are mapped in modules supporting PKW.

To access a register, you must select 1 of the following function codes:
- R_REG_16 = 0x25 to read 1 register
- R_REG_32 = 0x26 to read 2 registers
- W_REG_16 = 0x2A to write 1 register
- W_REG_32 = 0x2B to write 2 registers.

Register numbers are given in TeSys U Communication Variables User's Manual.

Word 1	**Word 2**			**Word 3**	**Word 4**
Register address	Toggle bit (bit 15)	Function bits (bits 8 to 14)	Not used (bits 0 to 7)	Data to write	
Register number	0/1	R_REG_16 Code 0x25	0x00	_	_
		R_REG_32 Code 0x26		_	_
		W_REG_16 Code 0x2A		Data to write in register	_
		W_REG_32 Code 0x2B		Data to write in register 1	Data to write in register 2

Depending on the PLC platform used, refer to the PKW OUT description in Little and Big endian formats to know the positioning of each field inside each word.

Any changes in the function field will trigger the handling of the request (except if Function code = 0x00).

Toggle bit must change at each consecutive request. This mechanism allows the request initiator to detect that a response is ready by polling the toggle bit in response. When this bit in the OUT data becomes equal to the response emitted toggle bit in the IN data, then the response is ready.

PKW IN Data

PKW IN Data Response (LULC08 → CANopen Master) are mapped in modules supporting PKW. The LULC08 echoes the same register address and function code or eventually an error code:

Word 1	**Word 2**			**Word 3**	**Word 4**
Register address	Toggle bit (bit 15)	Function bits (bits 8 to 14)	Not used (bits 0 to 7)	Data to write	
Same register number as in request	Same as request	ERROR Code 0x4E	0x00	Error code	
		R_REG_16 Code 0x25		Data read in register	_
		R_REG_32 Code 0x26		Data read in register 1	Data read in register 2
		W_REG_16 Code 0x2A		_	_
		W_REG_32 Code 0x2B		_	_

Depending on the PLC platform used, refer to the PKW IN description in Little and Big endian formats to know the positioning of each field inside each word.

If the initiator tries to write a TeSys U object or register to an unauthorized value, or tries to access an inaccessible register, an error code is answered (Function code = toggle bit + 0x4E). The exact error code can be found in words 3 and 4. The request is not accepted and the object or register remains at the old value.

If you want to re-trigger exactly the same command, you must:
- reset the Function code to 0x00,
- wait for the response frame with the function code equal to 0x00, then
- set it again to its previous value.

This is useful for a limited master like an HMI.

Another way of re-triggering exactly the same command is to:
- invert the toggle bit in the function code byte.

The response is valid when the toggle bit of the response is equal to the toggle bit written in the answer (this is a more efficient method, but it requires higher programming capabilities).

PKW Error Codes

Case of a write error:

Error Code	Error Name	Explanation
1	FGP_ERR_REQ_STACK_FULL	external request: sends back an error frame
3	FGP_ERR_REGISTER_NOT_FOUND	register not managed (or the request needs super user access rights)
4	FGP_ERR_ANSWER_DELAYED	external request: answer postponed
7	FGP_ERR_NOT_ALL_REGISTER_FOUND	one or both registers cannot be found
8	FGP_ERR_READ_ONLY	register not authorized to be written
10	FGP_ERR_VAL_1WORD_TOOHIGH	written value not in the range of the register (word value is too high)
11	FGP_ERR_VAL_1WORD_TOOLOW	written value not in the range of the register (word value is too low)
12	FGP_ERR_VAL_2BYTES_INF_TOOHIGH	written value not in the range of the register (MSB value is too high)
13	FGP_ERR_VAL_2BYTES_INF_TOOLOW	written value not in the range of the register (MSB value is too low)
16	FGP_ERR_VAL_INVALID	written value not a valid value
20	FGP_ERR_BAD_ANSWER	external request: sends back an error frame

Case of a read error:

Error Code	Error Name	Explanation
1	FGP_ERR_REQ_STACK_FULL	external request: sends back an error frame
3	FGP_ERR_REGISTER_NOT_FOUND	register not managed (or the request needs super user access rights)
4	FGP_ERR_ANSWER_DELAYED	external request: answer postponed
7	FGP_ERR_NOT_ALL_REGISTER_FOUND	one or both registers cannot be found

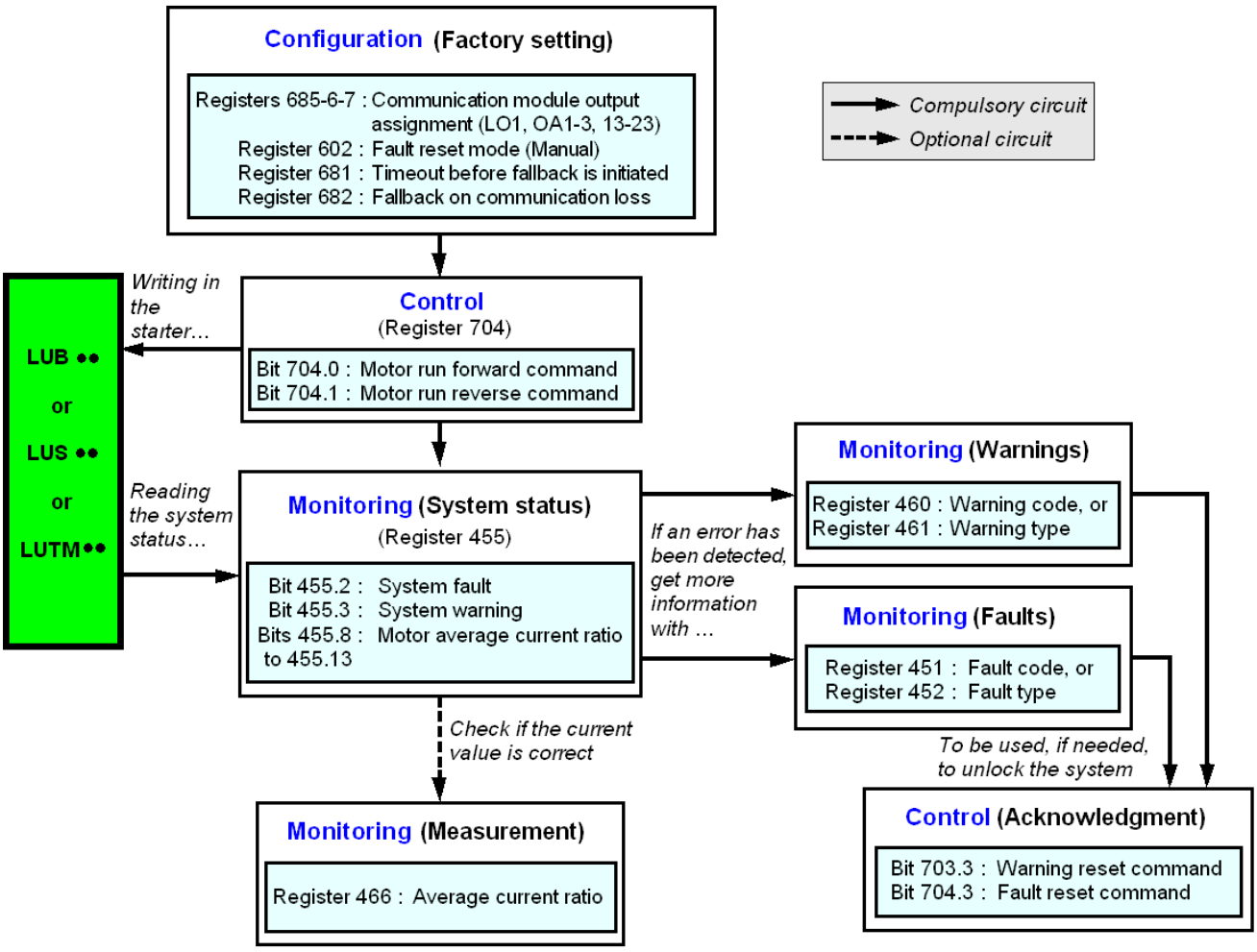
Using of Main Registers for a Simplified Management

Introduction

Before commissioning a motor starter, it is interesting to know which registers you access, and in which order.

Illustration of Registers Used

The following illustration gives you basic information about commissioning, through registers: configuration, control and monitoring (state of the system, measurements, faults and warnings, acknowledgment). Starting from the predefined factory configuration, you will be able to visualize, and even anticipate the behavior of your system.



Managing Faults and Warnings

5

Introduction

This chapter explains how to manage the different types of faults and warnings that may occur.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Viewing a Fault	74
Application Faults	75
Internal Faults	76
Warnings - Communication Loss	77

Viewing a Fault

Fault Indicators

A fault is being signalled by different indicators:

- status of LULC08 communication module's LEDs,

with a power base:

- status of rotary button on the power base (0 or "trip"),
- status of outputs,

with a controller base:

- status of the LEDs on the controller base,
- status of output relays,

with a standard or advanced control unit:

- internal signals sent to LULC08 communication module,

with a multifunction control unit:

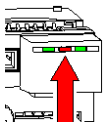
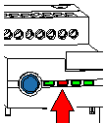
- warning,
- message(s) displayed on screen,
- internal communication with the LULC08 communication module,
- presence of an exception code (PLC report).

NOTE: Warnings and faults are being considered in specific registers. Refer to *Communication Variables User's Manual*: fault monitoring registers 450 (2004:01) to 452 (2004:03), and warning monitoring registers 460 (2004:0B) to 461 (2004:0C).

Application Faults

Application Fault Acknowledgement

Possible application faults are listed below. They can be reset (acknowledged): manually / automatically / remotely.

Application faults	Registers		LULC08	LUCM•	LUTM	Fault reset
	451 (2004:02) Fault number	452 (2004:03) Fault bit	 "ERR"	 (line 2)	 "FAULT"	
Short-circuit fault	1	_.0 = 1	off	SC	-	Manual reset
Over-current fault	2	_.1 = 1		I>>	-	
Thermal overload fault	4	_.3 = 1		overload	-	Depending on reset mode set in register 602 (2006:03)
LUCM• multifunction control unit application fault	3 and 5 set to 12	*See LUCM••BL - LUCMT1BL Multifunction Control Unit User's Manual*				

Overload Fault with LU•B•/LU•S• Power Base

After a thermal overload fault, rotary button or blue push-button on the front can be used, whatever the reset mode that was set.

Configuration register	Acknowledgement (reset)	Means
602.0 = 1	"**manual**" direct	With rotary button on LU•B• With blue push-button on LU•S•
	"**manual**" remote	With kit LU9 AP•• on LU•B• With kit LU9 •• on LU•S•
602.1 = 1	"**remote**"	Acknowledged 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 control unit

Overload Fault with LUTM Controller Base

After a thermal overload fault, blue push-button on the front or input I.5 can be used, whatever the reset mode that was set.

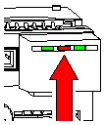
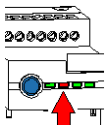
Configuration register	Acknowledgement (reset)	Means
602.0 = 1	"**manual**" local	With blue push-button on the front
	"**manual**" remote	With reset mode on front of the rack or table (via input **I.5**)
602.1 = 1	"**remote**"	Acknowledged by bit 704.3. This bit is active on rising edge and must be reset to 0 by programming
602.2 = 1	"**automatic**"	Managed by control unit

NOTE: Reset mode must be set.

Internal Faults

Internal Fault Acknowledgement

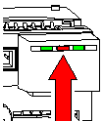
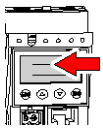
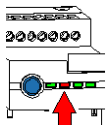
Here is the list of possible internal faults:

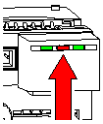
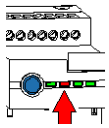
Internal faults	Registers		LULC08	LUCM•	LUTM	Fault acknowledgement
	451 (2004:02) Fault number	452 (2004:03) Fault bit	 "ERR"	 (line 2)	 "FAULT"	
LULC08 CANopen communication module fault	14	-	Off	M14	-	LULC08 and LUCM• power off then on
LULC08 CANopen communication module not installed or not powered, or communication loss with the module	15	-		M15	-	
LUC•• control unit internal fault	54	_.11 = 1		M54	-	
LUCM• multifunction control unit internal fault	51 to 53, 55 to 63	*See LUCM - LUCMT Multifunction Control Unit User's Manual*				
Write-to-EEPROM fault	100	_.13 = 1	On	M100	-	LULC08 power off then on
Communication fault with LUCM• multifunction control unit	101	_.12 = 1	On	M101	Blinking	LULC08 power off then on
Checksum-on-EEPROM fault	102	_.13 = 1	On	M102		Rising edge on 704.3=1
EEPROM configuration fault	104	_.13 = 1	On	M104		Rising edge on 704.3=1
Communication fault with LUTM controller base	105	_.13 = 1	On	M105		LULC08 power off then on
Communication fault with LULC08 module	205	_.13 = 1	On	-	See LUTM User's Manual	LUTM power off then on
No control unit	206					LUTM power off then on

Warnings - Communication Loss

Warning Acknowledgement

List of possible warnings.

Warnings	Registers		LULC08	LUCM•	LUTM	Warning acknowledgement
	460 (2004:0B) warning number	461 (2004:0C) warning bit	 "ERR"	 (line 1)	 "FAULT"	
Warning on thermal overload	4	_.3 = 1	-	Wrng overload	-	Automatic when overload is lower than 85%
Warning on communication loss with the master	109	_.15 = 1	Flashing	Comm loss	-	Acknowledgement by bit 703.3. This bit is active on rising edge and must be reset to 0 by programming
Warning on LUCM• multifunction control unit	2 and 4 to 13	*See LUCM - LUCMT Multifunction Control Unit User's Manual*				

Warnings	Registers		LULC08	LUCM•	LUTM	Warning acknowledgement
	460 (2004:0B) warning number	461 (2004:0C) warning bit	 "ERR"	 (line 2)	 "FAULT"	
LUTM external warning signalled by I.6 set to 0	201	_.15 = 1	-	-	See LUTM Controller User's Guide	Automatic with I.6 set back to 1

Recovery after Communication Loss

Following an acknowledgement by setting bit 703.3 to 1, recovery occurs depending on the status of control bits 704.0 and 704.1.

Configuration of Predefined Functions

6

Overtravel Limit Switch (Modbus Reflex Functions)

Introduction

The Overtravel Limit Switch allows you to perform precise and iterative positionings, without any interaction of bus or PLC cycle time. It is a Modbus function initiated at the LULC08 communication module level.

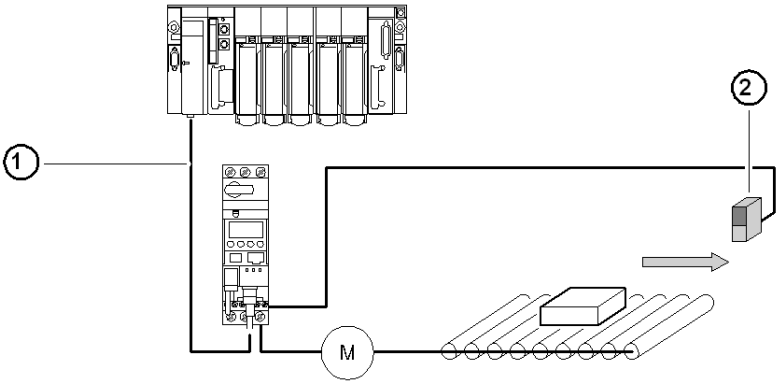
There are two types of functions:

- Reflex1: Modbus "reflex stop 1" function
- Reflex2: Modbus "reflex stop 2" function.

Description of Reflex1

Sensor 1 (logic input LI1) directly controls the motor stop.

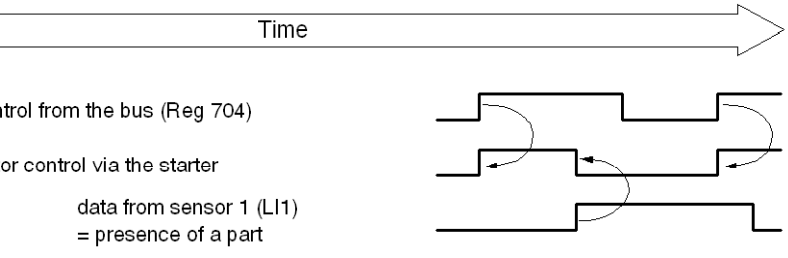
After a new running order (stop then run order), the motor restarts even with sensing (LI1=1).



1 Bus **2** Sensor 1 (LI1)

NOTE: In case of a reversing starter, reflex stop impacts both directions.

Information chaining.

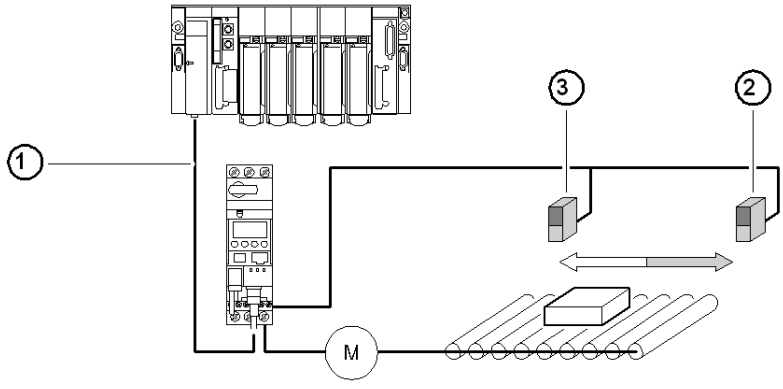


Description of Reflex2

Sensor 1 (logic input LI1) controls the motor stop when running forward.

Sensor 2 (logic input LI2) controls the motor stop when running reverse.

After a new running order (stop then run order), the motor restarts even with sensing (LI1=1 or LI2 = 1).



1 Bus **2** Sensor 1 (LI1) **3** Sensor 2 (LI2)

NOTE: Sensor 2 (LI2) does not impact the forward direction, and sensor 1 (LI1) does not impact the reverse direction.

Reflex Stop Selection

In order to use a "reflex stop" function, you have to select it from the register having an output to monitor.

Reflex function	**Motor spinning direction**	**Value of Reg•**	**LUB••/S•• - LU2B••/2S•• base**		**LUTM•• base**
			Output LO1	**Outputs OA1 OA3**	**Outputs 13 23**
Reflex1	Reflex1.Fw = forward run	8	Reg. 685 (2007:24) (LSB)	Reg. 686 (2007:25) (LSB) (MSB)	Reg. 687 (2007:26) (LSB) (MSB)
	Reflex1.Rev = reverse run	9			
Reflex2	Reflex2.Fw = forward run	10			
	Reflex2.Rev = reverse run	11			

NOTE: Before using a "reflex stop" function, you need to assign outputs OA1/OA3 to forward/reverse run. Do it in register **686** (2007:25). By default, OA1 is assigned to forward run and OA3 to reverse run.

Reflex1.Fw

This function is enabled on rising edge, not on level.

.Fw	LI1 = 1 makes the motor stop, whatever the running direction. After a new running order (a stop order followed by a run order), even though logic input LI1 = 1, the motor starts again in the chosen direction.

NOTE: Logic input LI2 is not used.

Reflex1.Rev

This function is enabled on rising edge, not on level.

.Rev	LI1 = 1 makes the motor stop, whatever the running direction. After a new running order (a stop order followed by a run order), even though logic input LI1 = 1, the motor starts again in the chosen direction.

NOTE: Logic input LI2 is not used.

Reflex2.Fw

This function is enabled on rising edge, not on level.

.Fw	Logic input LI1 = 1 makes the motor stop in forward run. Logic input LI2 = 1 makes the motor stop in reverse run. After a new running order (a stop order followed by a run order), even though logic input LI2 = 1, the motor starts again.

NOTE: Logic input LI2 does not impact the forward run and logic input LI1 does not impact the reverse run.

Reflex2.Rev

This function is enabled on rising edge, not on level.

.Rev	Logic input LI2 = 1 makes the motor stop in reverse run. Logic input LI1 = 1 makes the motor stop in forward run. After a new running order (a stop order followed by a run order), even though logic input LI2 = 1, the motor starts again.

NOTE: Logic input LI2 does not impact the forward run and logic input LI1 does not impact the reverse run.

Appendices

Object Tables

A

Objects concerning the communication profile are described in tables.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Identity	86
Receive PDO Definition	88
SDO Definition	90
Transmit PDO Definition	91

Identity

Identity Specifications

The following tables give the specifications for Identity parameters.

Index	Sub index	Access	Object Type	Data type	Default value	Description
0x1000	0x00	RO	VAR	Unsigned 32	0x00000000	**Device type:** Bits 16-23 = Device type mode Bits 00-15 = Device profile number (I/O module profile)
0x1001	0x00	RO	VAR	Unsigned 8	0x00	**Error register:** Error (1) or no error (0) Bitfield: could be detailed
0x1003	0x00	RW	ARRAY	Unsigned 8	0	**Number of errors:** No error (0) or one or more errors (>0) in object 0x1003; Only the value 0 can be written
0x1003	0x01	RO	VAR	Unsigned 32	0x00000000	**Standard Error Field 1:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Error code
0x1003	0x02	RO	VAR	Unsigned 32	0x00000000	**Standard Error Field 2:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Error code
0x1003	0x03	RO	VAR	Unsigned 32	0x00000000	**Standard Error Field 3:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Error code
0x1003	0x04	RO	VAR	Unsigned 32	0x00000000	**Standard Error Field 4:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Error code
0x1003	0x05	RO	VAR	Unsigned 32	0x00000000	**Standard Error Field 5:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Error code
0x1005	0x00	RW	VAR	Unsigned 32	0x80	**COB-ID SYNC message**
0x1006	0x00	RW	VAR	Unsigned 32	0x00	**Communication cycle period in microseconds**
0x1007	0x00	RW	VAR	Unsigned 32	0x00	**Synchronous window length in microseconds**
0x1008	0x00	Const	VAR	VISIBLE_STRING	TeSys U	**Manufacturer device name**
0x1009	0x00	Const	VAR	VISIBLE_STRING	M1.0-ES1.0	**Manufacturer hardware version**
0x100A	0x00	Const	VAR	VISIBLE_STRING	V01.01	**Manufacturer software version:** The value given here is only an example.
0x100C	0x00	RW	VAR	Unsigned 16	0x0000	**Guard time:** By default, the Node Guarding Protocol is inhibited; the unit of this object is 1 ms.
0x100D	0x00	RW	VAR	Unsigned 8	0x00	**Life time factor:** Multiplier applied to the "Guard Time" in order to obtain a "Life Time"

Index	Sub index	Access	Object Type	Data type	Default value	Description
0x1010	0x00	RO	ARRAY	Unsigned 32	5	**Store parameters**
0x1010	0x01	RW	VAR	Unsigned 32	0x00000000	Save all parameters
0x1010	0x02	RW	VAR	Unsigned 32	0x00000000	Save communication parameters
0x1010	0x03	RW	VAR	Unsigned 32	0x00000000	Save application parameters
0x1010	0x04	RW	VAR	Unsigned 32	0x00000000	Save manufacturer specific parameters: Configuration
0x1010	0x05	RW	VAR	Unsigned 32	0x00000000	Save manufacturer specific parameters: Settings
0x1011	0x00	RO	ARRAY	Unsigned 32	5	**Restore parameters**
0x1011	0x01	RW	VAR	Unsigned 32	0x00000000	Restore all parameters
0x1011	0x02	RW	VAR	Unsigned 32	0x00000000	Restore communication parameters
0x1011	0x03	RW	VAR	Unsigned 32	0x00000000	Restore application parameters
0x1011	0x04	RW	VAR	Unsigned 32	0x00000000	Restore manufacturer specific parameters: Configuration
0x1011	0x05	RW	VAR	Unsigned 32	0x00000000	Save manufacturer specific parameters: Settings
0x1014	0x00	RW	VAR	Unsigned 32	$NODEID+0x80	**COB-ID Emergency message**: COB-ID used for the EMCY service
0x1015	0x00	RW	VAR	Unsigned 16	0	**Inhibit Time EMCY (unit 0,1ms)**
0x1016	0x00	RO	ARRAY	Unsigned 8	1	**Consumer Heartbeat Time - Number of entries**
0x1016	0x01	RW	VAR	Unsigned 32	0x00000000	**Consumer Heartbeat Time:** Bits 16-23 = Node-ID of the producer Bits 00-15 = Heartbeat time (unit = 1 ms) N.B. Only one heartbeat producer can be configured here! By default, no producer is watched.
0x1017	0x00	RW	VAR	Unsigned 16	0x0000	**Producer Heartbeat Time:** The unit of this object is 1 ms. By default, the K7 sends no Heartbeat messages.
0x1018	0x00	RO	ARRAY	Unsigned 8	4	**Identity object - Number of entries**
0x1018	0x01	RO	VAR	Unsigned 32	0x0300005A	**Identity object - Vendor ID:** This value is unique for each manufacturer. ("Power Control and Protection Activity")
0x1018	0x02	RO	VAR	Unsigned 32	Sc St: 0x0011 Sc Ad: 0x0012 Sc Mu R: 0x0013 C AD: 0x0022 C Mu R: 0x0023 Sc Mu L: 0x0113 C Mu L: 0x0123	**Product code -**To determine the product family and product number
0x1018	0x03	RO	VAR	Unsigned 32	0x00010001	**Major and minor Product revision number**
0x1018	0x04	RO	VAR	Unsigned 32	0x00000000	**Serial number**
0x1020	0x00	RO	ARRAY	Unsigned 32	2	**Verify configuration**
0x1020	0x01	RW	VAR	Unsigned 32	0x00000000	Configuration date
0x1020	0x02	RW	VAR	Unsigned 32	0x00000000	Configuration time
0x1029	0x00	RO	ARRAY	Unsigned 8	1	**Error Behavior - No. of Error Classes**
0x1029	0x01	RW	VAR	Unsigned 8	0x00	**Communication error** 0:pre-operational / 1:no state change / 2:stopped

Receive PDO Definition

Receive PDO specifications

The following tables give the specifications for Receive PDO.

Index	Sub index	Access	Object Type	Data type	Default value	Description
0x1400	0x00	RO	RECORD	Unsigned 8	2	**Receive PDO1 - Number of entries**
0x1400	0x01	RW	VAR	Unsigned 32	$NODEID+0x00000200	**Receive PDO1 - COB-ID**
0x1400	0x02	RW	VAR	Unsigned 8	0xFF	**Receive PDO1 - Transmission type:** Three modes are available for this PDO: "asynchronous" (255), "synchronously cyclic" (1-240), and "synchronously acyclic" (0)
0x1401	0x00	RO	RECORD	Unsigned 8	2	**Receive PDO2 - Number of entries**
0x1401	0x01	RW	VAR	Unsigned 32	$NODEID+0x80000300	**Receive PDO2 - COB-ID**
0x1401	0x02	RW	VAR	Unsigned 8	0xFF	**Receive PDO2 - Transmission type:** Three modes are available for this PDO: "asynchronous" (255), "synchronously cyclic" (1-240), and "synchronously acyclic" (0)
0x1402	0x00	RO	RECORD	Unsigned 8	2	**Receive PDO3 - Number of entries**
0x1402	0x01	RW	VAR	Unsigned 32	$NODEID+0x00000400	**Receive PDO3 - COB-ID**
0x1402	0x02	RW	VAR	Unsigned 8	0xFF	**Receive PDO3 - Transmission type:** Three modes are available for this PDO: "asynchronous" (255), "synchronously cyclic" (1-240), and "synchronously acyclic" (0)
0x1403	0x00	RO	RECORD	Unsigned 8	2	**Receive PDO4 - Number of entries**
0x1403	0x01	RW	VAR	Unsigned 32	$NODEID+0x00000500	**Receive PDO4 - COB-ID**
0x1403	0x02	RW	VAR	Unsigned 8	0xFF	**Receive PDO4 - Transmission type:** Three modes are available for this PDO: "asynchronous" (255), "synchronously cyclic" (1-240), and "synchronously acyclic" (0)
0x1600	0x00	RW	ARRAY	Unsigned 8	3	**Receive PDO1 mapping - Number of mapped objects**
0x1600	0x01	RW	VAR	Unsigned 32	0x20080510	**Receive PDO1 mapping 1 -** mapped object: Reg [704]
0x1600	0x02	RW	VAR	Unsigned 32	0x20080410	**Receive PDO1 mapping 2 -** mapped object: Reg [703]
0x1600	0x03	RW	VAR	Unsigned 32	0x20080110	**Receive PDO1 mapping 3 -** mapped object: Reg [700]
0x1600	0x04	RW	VAR	Unsigned 32	0x00000000	**Receive PDO1 mapping 4 -** mapped object: None by default
0x1601	0x00	RW	ARRAY	Unsigned 8	0	**Receive PDO2 mapping - Number of mapped objects**
0x1601	0x01	RW	VAR	Unsigned 32	0x00000000	**Receive PDO2 mapping 1 -** mapped object: None by default
0x1601	0x02	RW	VAR	Unsigned 32	0x00000000	**Receive PDO2 mapping 2 -** mapped object: None by default

Index	Sub index	Access	Object Type	Data type	Default value	Description
0x1601	0x03	RW	VAR	Unsigned 32	0x00000000	**Receive PDO2 mapping 3 -** mapped object: None by default
0x1601	0x04	RW	VAR	Unsigned 32	0x00000000	**Receive PDO2 mapping 4 -** mapped object: None by default
0x1602	0x00	RW	ARRAY	Unsigned 8	0	**Receive PDO3 mapping - Number of mapped objects**
0x1602	0x01	RW	VAR	Unsigned 32	0x00000000	**Receive PDO3 mapping 1 -** mapped object: None by default
0x1602	0x02	RW	VAR	Unsigned 32	0x00000000	**Receive PDO3 mapping 2 -** mapped object: None by default
0x1602	0x03	RW	VAR	Unsigned 32	0x00000000	**Receive PDO3 mapping 3 -** mapped object: None by default
0x1602	0x04	RW	VAR	Unsigned 32	0x00000000	**Receive PDO3 mapping 4 -** mapped object: None by default
0x1603	0x00	RW	ARRAY	Unsigned 8	2	**Receive PDO4 mapping - Number of mapped objects**
0x1603	0x01	RW	VAR	Unsigned 32	0x30000120	**Receive PDO4 mapping 1 -** mapped object: PKW request
0x1603	0x02	RW	VAR	Unsigned 32	0x30000220	**Receive PDO4 mapping 2 -** mapped object: None by default
0x1603	0x03	RW	VAR	Unsigned 32	0x00000000	**Receive PDO4 mapping 3 -** mapped object: None by default
0x1603	0x04	RW	VAR	Unsigned 32	0x00000000	**Receive PDO4 mapping 4 -** mapped object: None by default

SDO Definition

SDO Specifications

The following table give the specifications for SDOs.

Index	Sub index	Access	Object Type	Data type	Default value	Description
0x1200	0x00	RO	RECORD	Unsigned 8	2	**Server SDO - Number of entries**
0x1200	0x01	RO	VAR	Unsigned 32	$NODEID+0x600	**Server SDO - COB-ID:** FBC -> K7 (receive)
0x1200	0x02	RO	VAR	Unsigned 32	$NODEID+0x580	**Server SDO - COB-ID:** FBC <- K7 (transmit)

Transmit PDO Definition

Transmit PDO specifications

The following tables give the specifications for Transmit PDO.

Index	Sub index	Access	Object Type	Data type	Default value	Description
0x1800	0x00	RO	RECORD	Unsigned 8	5	**Transmit PDO1 - Number of entries**
0x1800	0x01	RW	VAR	Unsigned 32	$NODEID+0x00 000180	**Transmit PDO1 - COB-ID**
0x1800	0x02	RW	VAR	Unsigned 8	0xFF	**Transmit PDO1 - Transmission type:** Three modes are available for this PDO: "asynchronous" (255), "synchronously cyclic" (1-240), and "synchronously acyclic" (0)
0x1800	0x03	RW	VAR	Unsigned 16	0	**Transmit PDO1 - Inhibit time:** Minimum time between two transmissions; unit = 0.1 ms
0x1800	0x04	RW	VAR	Unsigned 8	0	**Transmit PDO1 - Reserved**
0x1800	0x05	RW	VAR	Unsigned 16	0	**Transmit PDO1 - Event timer:** In "asynchronous" mode, this object sets a minimum rate of transmission for this PDO; unit = 0.1 ms
0x1801	0x00	RO	RECORD	Unsigned 8	5	**Transmit PDO2 - Number of entries**
0x1801	0x01	RW	VAR	Unsigned 32	$NODEID+0x80 000280	**Transmit PDO2 - COB-ID**
0x1801	0x02	RW	VAR	Unsigned 8	0xFF	**Transmit PDO2 - Transmission type:** Three modes are available for this PDO: "asynchronous" (255), "synchronously cyclic" (1-240), and "synchronously acyclic" (0)
0x1801	0x03	RW	VAR	Unsigned 16	0	**Transmit PDO2 - Inhibit time:** Minimum time between two transmissions; unit = 0.1 ms
0x1801	0x04	RW	VAR	Unsigned 8	0	**Transmit PDO2 - Reserved**
0x1801	0x05	RW	VAR	Unsigned 16	0	**Transmit PDO2 - Event timer:** In "asynchronous" mode, this object sets a minimum rate of transmission for this PDO; unit = 0.1 ms
0x1802	0x00	RO	RECORD	Unsigned 8	5	**Transmit PDO3 - Number of entries**
0x1802	0x01	RW	VAR	Unsigned 32	$NODEID+0x80 000380	**Transmit PDO3 - COB-ID**
0x1802	0x02	RW	VAR	Unsigned 8	0xFF	**Transmit PDO3 - Transmission type:** Three modes are available for this PDO: "asynchronous" (255), "synchronously cyclic" (1-240), and "synchronously acyclic" (0)
0x1802	0x03	RW	VAR	Unsigned 16	0	**Transmit PDO3 - Inhibit time:** Minimum time between two transmissions; unit = 0.1 ms
0x1802	0x04	RW	VAR	Unsigned 8	0	**Transmit PDO3 - Reserved**
0x1802	0x05	RW	VAR	Unsigned 16	0	**Transmit PDO3 - Event timer:** In "asynchronous" mode, this object sets a minimum rate of transmission for this PDO; unit = 0.1 ms
0x1803	0x00	RO	RECORD	Unsigned 8	5	**Transmit PDO4 - Number of entries**
0x1803	0x01	RW	VAR	Unsigned 32	$NODEID+0x80 000480	**Transmit PDO4 - COB-ID**

Index	Sub index	Access	Object Type	Data type	Default value	Description
0x1803	0x02	RW	VAR	Unsigned 8	0xFF	**Transmit PDO4 - Transmission type:** Three modes are available for this PDO: "asynchronous" (255), "synchronously cyclic" (1-240), and "synchronously acyclic" (0)
0x1803	0x03	RW	VAR	Unsigned 16	0	**Transmit PDO4 - Inhibit time:** Minimum time between two transmissions; unit = 0.1 ms
0x1803	0x04	RW	VAR	Unsigned 8	0	**Transmit PDO4 - Reserved**
0x1803	0x05	RW	VAR	Unsigned 16	0	**Transmit PDO4 - Event timer:** In "asynchronous" mode, this object sets a minimum rate of transmission for this PDO; unit = 0.1 ms
0x1A00	0x00	RW	ARRAY	Unsigned 8	Sc St:2 Sc Ad:3 Sc Mu:4 C Ad:4 C Mu:4	**Transmit PDO1 mapping - Number of mapped objects**
0x1A00	0x01	RW	VAR	Unsigned 32	0x20040610	**Transmit PDO1 mapping 1 -** mapped object: Reg [455]
0x1A00	0x02	RW	VAR	Unsigned 32	0x20040910	**Transmit PDO1 mapping 2 -** mapped object: Reg [458]
0x1A00	0x03	RW	VAR	Unsigned 32	Sc St: 0:0x00000000 Sc Ad: 0x20040C10 Sc Mu: 0x20040C10 C Ad: 0x20040C10 C Mu: 0x20040C10	**Transmit PDO1 mapping 3 -** mapped object: Reg [461], none on Sc St variant
0x1A00	0x04	RW	VAR	Unsigned 32	Sc St: 0x00000000 Sc Ad: 0x00000000 Sc Mu: 0x20040810 C Ad: 0x20040A10 C Mu: 0x20040A10	**Transmit PDO1 mapping 4 -** mapped object: Reg [457] on Sc Mu, Reg [459] on C Ad or C Mu, none on other variant.
0x1A01	0x00	RW	ARRAY	Unsigned 8	0	**Transmit PDO2 mapping - Number of mapped objects**
0x1A01	0x01	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO2 mapping 1 -** mapped object: None by default
0x1A01	0x02	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO2 mapping 2 -** mapped object: None by default
0x1A01	0x03	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO2 mapping 3 -** mapped object: None by default
0x1A01	0x04	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO2 mapping 4 -** mapped object: None by default

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