TeSys™ T LTMR

Motor Management Controller

CANopen Communication Guide

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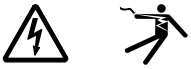
Table of Contents

Safety Information

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



The addition of either 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 personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠⚠ DANGER

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

⚠WARNING

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

⚠CAUTION

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

NOTICE

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

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Electrical equipment should be transported, stored, installed, and operated only in the environment for which it is designed.

Proposition 65 Notice

WARNING: This product can expose you to chemicals including lead and lead compounds, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

About the Book

Document Scope

This guide describes the CANopen network protocol version of the TeSys™ T LTMR motor management controller and LTME expansion module.

The purpose of this guide is to:

- Describe and explain the monitoring, protection, and control functions of the LTMR controller and LTME expansion module
- Provide the information necessary to implement and support a solution that best meets your application requirements

The guide describes the four key parts of a successful system implementation:

- Installing the LTMR controller and LTME expansion module
- Commissioning the LTMR controller by setting essential parameter values
- Using the LTMR controller and LTME expansion module, both with and without additional human-machine interface devices
- Maintaining the LTMR controller and LTME expansion module

This guide is intended for:

- Design engineers
- System integrators
- System operators
- Maintenance engineers

Validity Note

This guide is valid for LTMR CANopen controllers. Some functions are available depending on the software version of the controller.

Related Documents

Title of Documentation	Description	Reference Number
TeSys T LTMR - Motor Management Controller - User Guide	This user guide introduces the complete TeSys T range and describes the main functions of the TeSys T LTMR motor management controller and LTME expansion module.	DOCA0127EN
TeSys T LTMR - Motor Management Controller - Installation Guide	This guide describes the installation, commissioning, and maintenance of the TeSys T LTMR motor management controller and LTME expansion module.	DOCA0128EN
TeSys T LTMR - Motor Management Controller - Ethernet Communication Guide	This guide describes the Ethernet network protocol version of the TeSys T LTMR motor management controller.	DOCA0129EN
TeSys T LTMR - Motor Management Controller - Modbus Communication Guide	This guide describes the Modbus network protocol version of the TeSys T LTMR motor management controller.	DOCA0130EN
TeSys T LTMR Motor Management Controller PROFIBUS DP Communication Guide	This guide describes the PROFIBUS-DP network protocol version of the TeSys T LTMR motor management controller.	DOCA0131EN

Title of Documentation	Description	Reference Number
TeSys T LTMR - Motor Management Controller - DeviceNet Communication Guide	This guide describes the DeviceNet network protocol version of the TeSys T LTMR motor management controller.	DOCA0133EN
TeSys® T LTM CU - Control Operator Unit - User Manual	This manual describes how to install, configure, and use the TeSys T LTMCU Control Operator Unit.	1639581EN
Compact Display Units - Magelis XBT N/XBT R - User Manual	This manual describes the characteristics and presentation of the XBT N/XBT R display units.	1681029EN
TeSys T LTMR Ethernet/IP with a Third-Party PLC - Quick Start Guide	This guide provides a single reference for configuring and connecting the TeSys T and the Allen-Bradley programmable logic controller (PLC).	DOCA0119EN
TeSys T LTM R Modbus - Motor Management Controller - Quick Start Guide	This guide uses an application example to describe the different steps to quickly install, configure, and use TeSys T for Modbus network.	1639572EN
TeSys T LTM R Profibus-DP - Motor Management Controller - Quick Start Guide	This guide uses an application example to describe the different steps to quickly install, configure, and use TeSys T for PROFIBUS-DP network.	1639573EN
TeSys T LTM R CANopen - Motor Management Controller - Quick Start Guide	This guide uses an application example to describe the different steps to quickly install, configure, and use TeSys T for CANopen network.	1639574EN
TeSys T LTM R DeviceNet - Motor Management Controller - Quick Start Guide	This guide uses an application example to describe the different steps to quickly install, configure, and use TeSys T for DeviceNet network.	1639575EN
Electromagnetic Compatibility - Practical Installation Guidelines	This guide provides an insight to the electromagnetic compatibility.	DEG999EN
TeSys T LTM R•• - Instruction Sheet	This document describes the mounting and connection of the TeSys T LTMR motor management controller.	AAV7709901
TeSys T LTM E•• - Instruction Sheet	This document describes the mounting and connection of the TeSys T LTME expansion module.	AAV7950501
Magelis Compact Terminals XBT N/R/RT - Instruction Sheet	This document describes the mounting and connection of the Magelis XBT-N display units.	1681014
TeSys T LTM CU• - Instruction Sheet	This document describes the mounting and connection of the TeSys T LTMCU control unit	AAV6665701
TeSys T DTM for FDT Container - Online Help	This online help describes the TeSys T DTM and the custom logic editor embedded in the TeSys T DTM which allows the customization of the control functions of the TeSys T motor management system.	1672614EN
TCSMCNAM3M002P USB to RS485 Converter - Quick Reference Guide	This instruction guide describes the configuration cable between computer and TeSys T: USB to RS485	BBV28000
Electrical Installation Guide (Wiki version)	The aim of the Electrical Installation Guide (and now Wiki) is to help electrical designers and contractors to design electrical installations according to standards such as the IEC60364 or other relevant standards.	www.electrical-installation.org

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Introducing the TeSys T Motor Management System

Overview

This chapter introduces the TeSys T motor management system and its companion devices.

Presentation of the TeSys T Motor Management System

Aim of the Product

The TeSys T motor management system offers protection, control, and monitoring capabilities for single-phase and three-phase AC induction motors.

The system is flexible, modular, and can be configured to meet the requirements of applications in industry. The system is designed to meet the needs for integrated protection systems with open communications and a global architecture.

Highly accurate sensors and solid-state full motor protection provide better utilization of the motor. Complete monitoring functions enable analysis of motor operating conditions and faster responses to prevent system downtime.

The system offers diagnostic and statistics functions and configurable alarms and trips, allowing better prediction of component maintenance, and provides data to continuously improve the entire system.

For more details on the product, refer to the TeSys T LTMR Motor Management Controller User Guide.

Wiring of the CANopen Network

Overview

This chapter describes how to connect the LTMR controller to a CANopen network with a SUB-D 9 or an open-style connector.

It presents an example of CANopen network topology and list cable specifications.

⚠WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for critical functions, provide a means to achieve an acceptable state during and after a path interruption. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of anticipated transmission delays or interruptions of the link.(1)
- Each implementation of an LTMR controller must be individually and thoroughly tested for proper operation before being placed into service.

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

(1) For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control*.

CANopen Network Characteristics

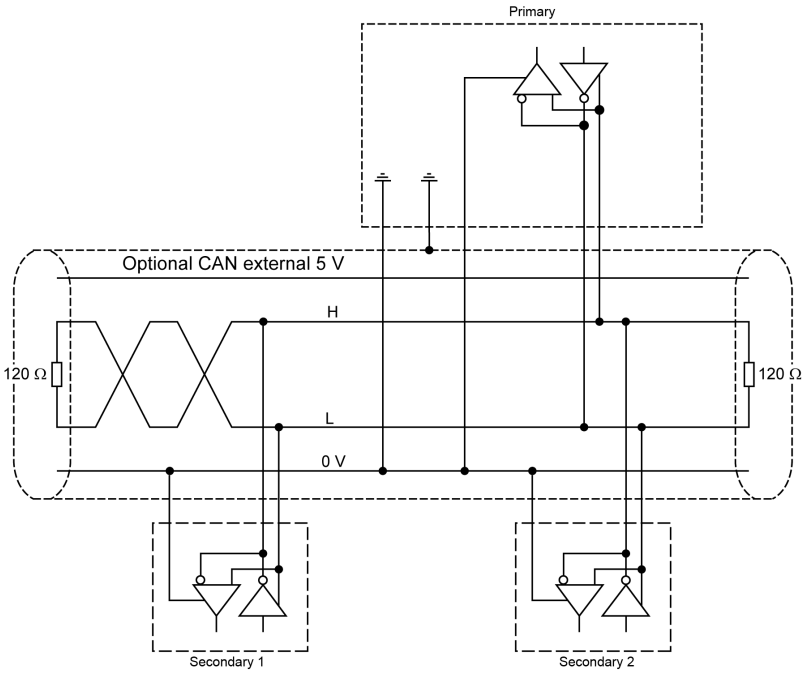
Overview

The LTMR CANopen controller complies with the standard CANopen specification.

The *CANopen Hardware Setup Manual* provides basic information on CANopen networks as used by Schneider Electric. It also describes the CANopen infrastructure components provided by Schneider Electric for setting up a CANopen network.

CANopen Network Standard Diagram

The simplified diagram is as follows:



Characteristics of a CANopen Connection

The CANopen standard allows variants of some characteristics:

- Line terminator
- Number of secondaries
- Bus length

Characteristics	Value
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
Maximum number of secondaries connected to 1 client	127
Maximum number of secondaries per derivation	30
Cable structure	Two pairs with separate shielding and differing gauges. Shielding is aluminum foil + tinned copper braid + drain. Same structure for trunk and drop cables.
Baud rate	• 10...1000 kBaud. • Autobaud functionality available.
Connector type	SUB-D 9-pin and open-style, pull-apart terminal block
Line terminator	A 120 Ω resistor ±5% at both ends of the bus

Use of Repeaters

A CANopen network bus can be segmented with repeaters for many reasons:

- Maximum length of the sum of derivations reached
- Need to connect more than 30 secondaries on the bus
- Need to isolate the derivation
- Need for derivation
- Need for removable connection to equipment

For more information about the topology with a repeater, refer to the *CANopen Hardware Setup Manual*.

Trunk Cable Maximum Length

The baud rate restricts the cable length as shown in the following table:

Baud Rate	Maximum Bus Length
1 MBaud	20 m (65.62 ft)
800 kBaud	40 m (131.23 ft)
500 kBaud	100 m (328 ft)
250 kBaud	250 m (820 ft)
125 kBaud	500 m (1,640 ft)
50 kBaud	1,000 m (3,280 ft)
20 kBaud	2,500 m (8,202 ft)
10 kBaud	5,000 m (16,404 ft)

In CANopen documents, the maximum length at 1 MBaud is often given as 40 m (131.23 ft). This length does not take into account electrical isolation as used in the Schneider Electric CANopen devices.

Taking into account electrical isolation, the minimum network length is 4 m (13.12 ft) at 1 MBaud, and the maximum length is 20 m (65.62 ft), which can be shortened by stubs or other apparatus.

1 Derivation Maximum Length

The following table gives the maximum length of 1 derivation (CANopen drop cable) depending on the baud rate:

1 MBaud	800 kBaud	500 kBaud	250 kBaud	125 kBaud	50 kBaud	20 kBaud	10 kBaud
0.3 m (0.98 ft)	3 m (9.84 ft)	5 m (16.40 ft)	5 m (16.40 ft)	5 m (16.40 ft)	60 m (196.85 ft)	150 m (492 ft)	300 m (984 ft)

All Derivations (on the Bus) Maximum Length

The following table gives the maximum cumulative length of all derivations connected to the CANopen bus depending on the baud rate:

1 MBaud	800 kBaud	500 kBaud	250 kBaud	125 kBaud	50 kBaud	20 kBaud	10 kBaud
1.5 m (4.92 ft)	15 m (49.21 ft)	30 m (98.42 ft)	60 m (196.85 ft)	120 m (393 ft)	300 m (984 ft)	750 m (2,460 ft)	1500 m (4,921 ft)

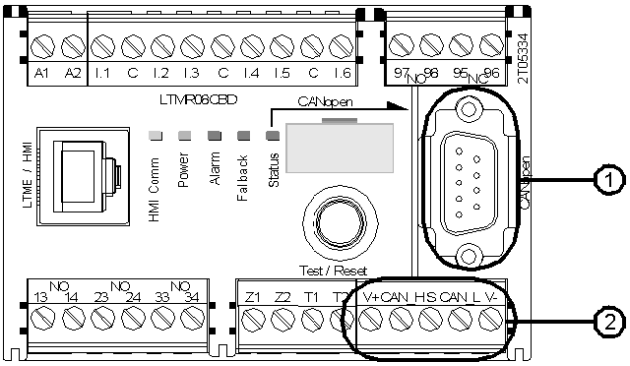
CANopen Communication Port Wiring Terminal Characteristics

Physical Interface and Connectors

The front face of the LTMR controller is equipped with two connector types for CANopen communication:

1. A plug-type, shielded SUB-D 9 connector
2. An open-style, pull-apart, terminal block

The figure shows the LTMR front face with the CANopen connectors:



Both connectors are electrically identical. They follow the CANopen interoperability standards.

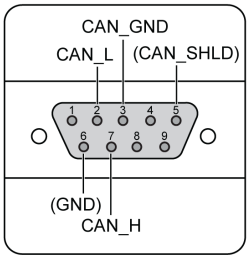
NOTE: The product must be connected through only one port. The use of the SUB-D 9 connector is recommended.

Pin V+ of the open-style, pull apart terminal block is not connected inside the controller.

The CANopen communication drivers are powered internally.

SUB-D 9 Connector Pinout

The LTMR controller is connected to the CANopen network with a plug-type, SUB-D 9-pin connector in compliance with the following wiring:



The pinout of the SUB-D 9 connector is as follows:

Pin No.	Signal	Description
1	Reserved	–
2	CAN_L	CAN_L bus line (high dominant)
3	CAN_GND	CAN Ground
4	Reserved	–
5	(S)	Optional shielding
6	Reserved	–
7	CAN_H	CAN_H bus line (low dominant)
8	Reserved	–
9	V+	Not connected

Open-Style Terminal Block

The LTMR controller has the following CANopen network plug-in terminals and pin assignments.

Pin	Signal	Description
1	V+	Not connected
2	CAN_L	CAN_L bus line (high dominant)
3	S	Shield
4	CAN_H	CAN_H bus line (low dominant)
5	V-	Ground

Open-Style Terminal Block Characteristics

Connector	5 pins
Pitch	5.08 mm (0.2 in.)
Tightening torque	0.5...0.6 N•m (5 lb-in)
Flat screwdriver	3 mm (0.10 in.)

Wiring of the CANopen Network

Overview

The recommended way to connect an LTMR controller to a CANopen network on the bus is the connection via the shielded SUB-D 9 connector.

This section describes the connection of LTMR controllers installed in withdrawable drawers.

CANopen Wiring Rules

The following wiring rules must be respected in order to reduce disturbance due to EMC on the behavior of the LTMR controller:

- Keep a distance as large as possible between the communication cable and the power or control cables (minimum 30 cm or 11.8 in.).
- Cross over the CANopen cables and the power cables at right angles, if necessary.
- Install the communication cables as close as possible to the grounded plate.
- Do not bend or damage the cables. The minimum bending radius is 10 times the cable diameter.
- Avoid sharp angles of paths or passage of the cable.
- Use the recommended cables only.
- A CANopen cable must be shielded:
  - The cable shield must be connected to a protective ground.
  - The connection of the cable shield to the protective ground must be as short as possible.
  - Connect together all the shields, if necessary.
  - Perform the grounding of the shield with a collar.
- When the LTMR controller is installed in a withdrawable drawer:
  - Connect together all the shield contacts of the withdrawable drawer part of the auxiliary connector to the ground of the withdrawable drawer to create an electromagnetic barrier. Refer to the *Okken Communications Cabling & Wiring Guide* (available on request).
  - Do not connect the cable shield at the fixed part of the auxiliary connector.
- Place a line terminator at each end of the bus to avoid malfunctions on the communication bus. A line terminator is generally already integrated in the client.
- Wire the bus between each connector directly, without intermediate terminal blocks.
- The common polarity (0V) must be connected directly to protective ground, preferably at one point only for the entire bus. In general, this point is chosen either on the client device or on the polarization device.

For more information, refer to the *Electrical Installation Guide* (available in English only), chapter *ElectroMagnetic Compatibility (EMC)*.

NOTICE
COMMUNICATION MALFUNCTION Respect all the wiring and grounding rules in order to avoid communication malfunctions due to EMC disturbance. **Failure to follow these instructions can result in equipment damage.**

LTMR Controllers Installed in a Blokset or Okken Motor Control Switchboard

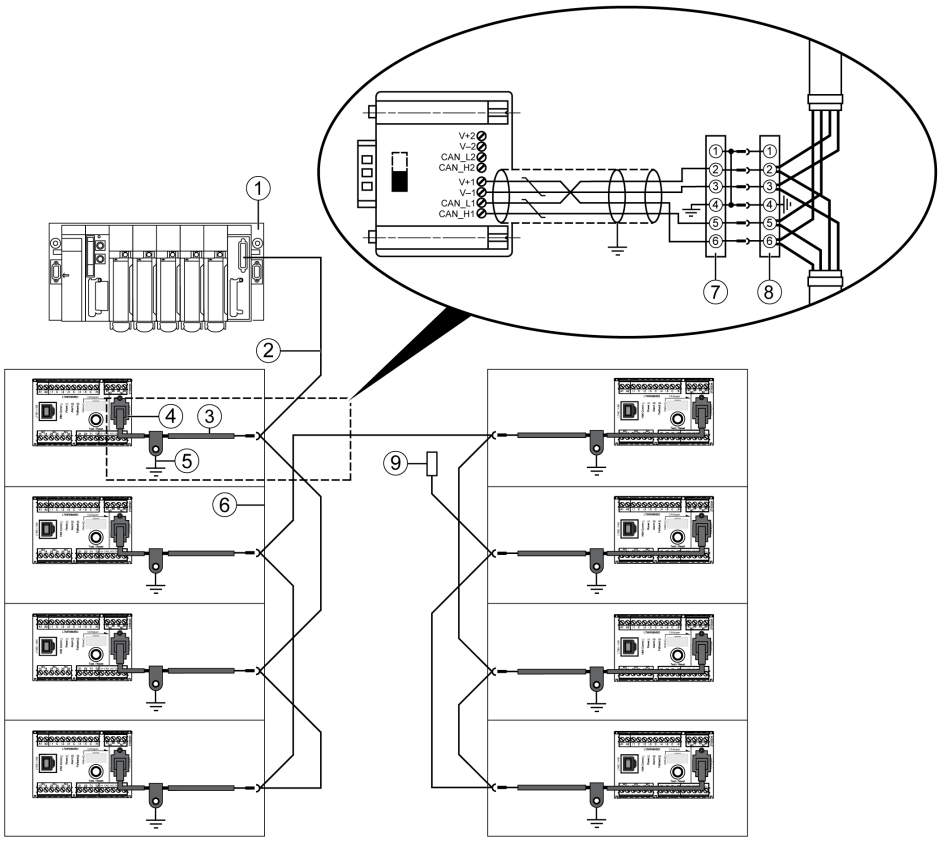
The installation of LTMR controllers in withdrawable drawers of a switchboard presents constraints specific to the type of switchboard:

- For installation of LTMR controllers in an Okken switchboard, refer to the *Okken Communications Cabling & Wiring Guide* (available on request).

- For installation of LTMR controllers in a Blokset switchboard, refer to the *Blokset Communications Cabling & Wiring Guide* (available on request).
- For installation of LTMR controllers in other types of switchboard, follow the specific EMC instructions described in this guide and refer to the relative instructions specific to your type of switchboard.

LTMR Controllers Installed in Withdrawable Drawers

The wiring diagram for connection of LTMR controllers installed in withdrawable drawers to the CANopen bus via the SUB-D 9 connector and hardwired cables is as follows:



1 Client (PLC, PC, or communication module) with line terminator

2 CANopen shielded cable TSX CAN ••••

3 CANopen shielded cable TSX CAN C••••

4 SUB-D 9 socket-type connector TSX CAN KCDF90T•

5 Grounding of the CANopen cable shield

6 Withdrawable drawer

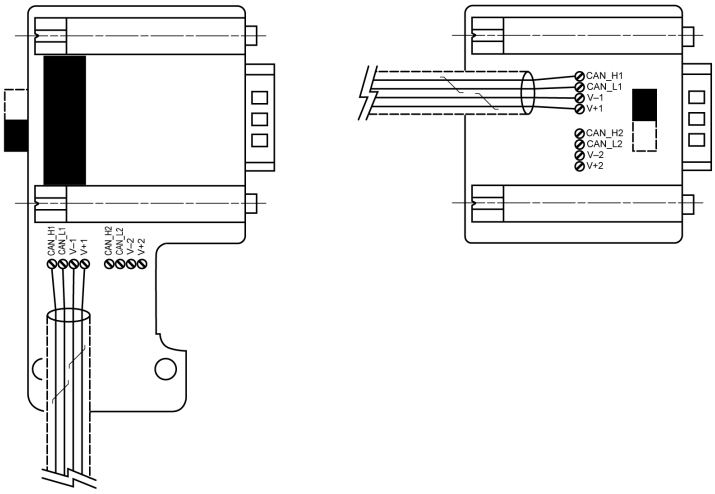
7 Withdrawable drawer part of the auxiliary connector

8 Fixed part of the auxiliary connector

9 Line terminator VW3 A8 306 DR (120 Ω)

Socket-type SUB-D 9 Connector

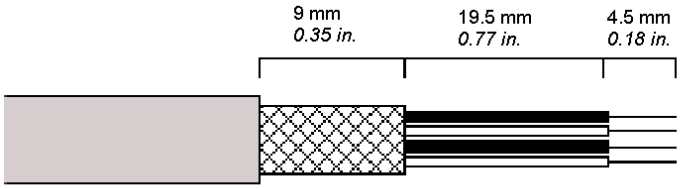
The following figures detail the connection of a CANopen cable:



SUB-D 9 Connector Wiring

The table below describes the procedure for wiring the SUB-D 9 connector bus interface:

Step	Action
1	Strip a length of 33 mm (1.3 in.) from the end of the cable.
2	Cut a length of 24 mm (0.95 in.) from the metallic braid and the shielding films, leaving a length of 9 mm (0.35 in.)
3	Strip a section of 4.5 mm (0.18 in.) in length from end of each wire and mount on terminals.



Connection to a PLC

To connect to a PLC select the cable and connectors:

Reference	Description
TSX CAN CA•• (e.g., TSX CAN CA50)	CANopen trunk cable, EC approved TSX CAN CA50 corresponds to 50 m (164 ft) length
TSX CAN CB•• (e.g., TSX CAN CB100)	CANopen trunk cable, UL approved TSX CAN CB100 corresponds to 100 m (328 ft) length
TSX CAN KCDF90T	90º CANopen SUB-D 9-pin socket-type connector
TSX CAN KCDF90TP	90º lead CANopen SUB-D 9-pin socket-type connector
TSX CAN KCDF180T	180º CANopen SUB-D 9-pin socket-type connector

NOTE: Minimum cable length sold is 50 m (328 ft).

Using the CANopen Communication Network

Overview

This chapter describes how to use the LTMR controller via the network port using the CANopen protocol.

⚠WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for critical functions, provide a means to achieve an acceptable state during and after a path interruption. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of anticipated transmission delays or interruptions of the link.(1)
- Each implementation of an LTMR controller must be individually and thoroughly tested for proper operation before being placed into service.

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

(1) For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control".

⚠WARNING

UNEXPECTED RESTART OF THE MOTOR

Check that the PLC application software:

- Considers the change from local to remote control,
- Manages appropriately the motor control commands during those changes.

When switching to the Network control channels, depending on the communication protocol configuration, the LTMR controller can take into account the latest known state of the motor control commands issued from the PLC and restart automatically the motor.

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

CANopen Protocol Principle

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.

The CANopen device profile for LTMR controllers is a manufacturer-specific profile. It defines standards for basic device functionality while providing ample scope for additional vendor-specific device features.

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

CANopen Protocol

The CANopen protocol is based on the CAN 2.B passive specification (identifier coded on 11 bits).

The LTMR CANopen controller interface conforms to the CANopen specifications (DS301 V4.02).

The controllers are described in EDS (electronic data sheet) files that must be embedded into the configuration tools.

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

CANopen Message Frame

Below 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 (4 bits) and a Module ID (7 bits). 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 Module 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

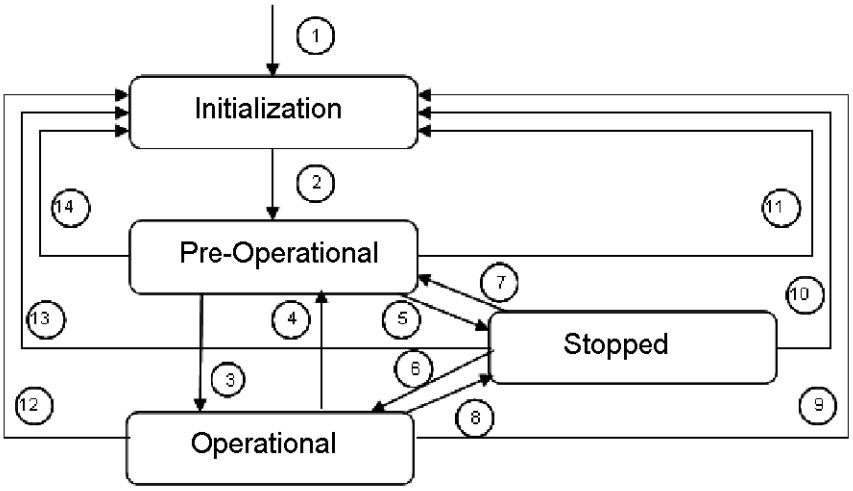
CANopen communication objects transmitted via the CAN network are described by services:

- 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 diagnostics.

Network Management (NMT)

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

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



(1)	At power-up, the device enters the initialization state.
(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 controller communication module features:

PDOs	Description	Status
Transmit PDO1	To monitor (data transmitted by the server)	Pre-configured and activated
Received PDO1	To control (data transmitted by the client)	
Transmit PDO2	To exchange data (defined at configuration)	To be configured and activated
Received PDO2		
Transmit PDO3		
Received PDO3		

PDOs	Description	Status
Transmit PDO4	To access (read or write) to any register by programming	Pre-configured and activated
Received PDO4		

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

The RPDO objects have write access.

Depending on the application, set the PDO communication mode to asynchronous, cyclic, or acyclic synchronous.

In synchronous mode, the PDO transmission is related to the SYNC object, which is cyclically emitted by the CANopen client. It does not include any data. Its factory setting 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 Factory setting of communication mode		√		√

For more information on PDOs, refer to Using PDOs, page 26.

Service Data Objects (SDOs)

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

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

CANopen clients 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 one SDO server, which receives two COB-IDs:

- One for requests (telegrams issued by the client to the CANopen LTMR)
- One for responses (telegrams sent back to the client by the CANopen LTMR)

For more information on SDOs, refer to Using SDOs, page 31.

Configuration of the LTMR CANopen Network Port

Communication Parameters

Use the TeSys T DTM or the HMI to configure the CANopen communication parameters:

- Network port address setting
- Network port baud rate setting
- Configuration channel setting

Setting the Node-ID

The Node-ID is the address of the module on the CANopen bus. With CANopen class S20, you can assign an address from 1 to 127.

You must set the Node-ID before any communication can begin. Use the TeSys T DTM or the HMI to configure the communication parameter Network Port Address Setting.

NOTE: A return to factory settings command sets the Node-ID to the invalid value 0.

Setting the Baud Rate

Set the baud rate to one of the following speeds:

- 10 kBaud
- 20 kBaud
- 50 kBaud
- 250 kBaud
- 500 kBaud
- 800 kBaud
- 1000 kBaud

To set the baud rate, use the TeSys T DTM or the HMI to configure the communication parameter Network Port Baud Rate Setting.

The parameter has the following possible settings:

Network Port Baud Rate Setting	Baud Rate
0	10 kBaud
1	20 kBaud
2	50 kBaud
3	125 kBaud
4	250 kBaud
5	500 kBaud
6	800 kBaud
7	1000 kBaud
8	Autobaud
9	Factory setting (250 kBaud)

The factory setting for the Network Port Baud Rate Setting parameter is 250 kBaud. Using Autobaud, the LTMR Controller adapts its baud rate to that of the client.

NOTE: The Autobaud functionality can only be used if at least one client and one server are already communicating on the network.

Setting the Configuration Channel

The LTMR configuration can be managed:

- Locally through the HMI port using the TeSys T DTM or the HMI
- Remotely through the network.

To manage the configuration locally, the Config via Network Port Enable parameter must be disabled to prevent an overwrite of the configuration through the network.

To manage the configuration remotely, the Config via Network Port Enable parameter must be enabled (factory setting).

Importing the EDS File into the CANopen Configuration Software

EDS File

The different LTMR controller variants are described in EDS (electronic data sheet) files.

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

The EDS and icon files associated with the LTMR can be downloaded from www.se.com website (**Products and Services > Automation and Control > Product offers > Motor Control > TeSys T > Downloads > Software/Firmware > EDS&GSD**). EDS files and icons are grouped in a single compressed Zip file that you must unzip to a single directory on your hard disk drive.

The following table gives the associations between the four LTMR variants and the associated EDS files names.

Variants	Description	EDS File Name
TeSys T MMC L	Motor Management Controller, local configuration mode	TE_TESYST_MMC_L••••E.eds
TeSys T MMC L EV40	Motor Management Controller, LTMEV40, local configuration mode	TE_TESYST_MMC_L_EV40••••E.eds
TeSys T MMC R	Motor Management Controller, remote configuration mode	TE_TESYST_MMC_R••••E.eds
TeSys T MMC R EV40	Motor Management Controller, LTMEV40, remote configuration mode	TE_TESYST_MMC_R_EV40••••E.eds

Selection Criteria for TeSys T LTMR Controller Variants

There are four EDS files corresponding to the four possible configurations of the TeSys T Motor Management Controller system:

Choose...	When You Want to Use...
TeSys T MMC L	A TeSys T Motor Management Controller system without an expansion module, configurable via the HMI port. This variant enables you to preserve your local configuration.
TeSys T MMC L EV40	A TeSys T Motor Management Controller system with expansion module, configurable via the HMI port. This variant enables you to preserve your local configuration.
TeSys T MMC R	A TeSys T Motor Management Controller system without expansion module configurable via the network.
TeSys T MMC R EV40	A TeSys T Motor Management Controller system with expansion module configurable via the network.

In local configuration mode, the parameter Config via Network Port Enable must be disabled. This mode preserves the local configuration made using the Magelis XBT or TeSys T DTM through the HMI port and prevents PLC configuration via the network.

In remote configuration mode, the parameter Config via Network Port Enable must be enabled. This enables the PLC to remotely configure the LTMR controller.

NOTE: In remote mode, the parameters overwritten by the PLC will be lost. This mode is useful when replacing inoperable devices.

The Config via Network Port Enable parameter is set by default.

Using PDOs

Introduction

PDO telegrams are used to exchange periodic I/O data between the PLC and the LTMR Controller.

The LTMR 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 available to use. It is not activated by default.
- PDO3 set is not predefined and is available 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.

The four PDO sets support the following transmission modes:

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

The factory setting mode of transmission of LTMR Controller is acyclic synchronous. Data is sent at network startup, on network reconnection and during normal operation of data exchange.

The factory setting mode of transmission of CANopen is acyclic asynchronous. Data is sent from the client at network startup, on network reconnection and during normal operation of data exchange.

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

Transmit PDOs can transport the following read-only variables:

Monitoring objects	CANopen index 2004

Receive PDOs can transport the following read/write variables:

Setting objects:	CANopen index 2007
Command objects:	CANopen index 2008

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 commanding the Controller from the PLC. This table describes the predefined mapping.

COB-ID		Word 1	Word 2	Word 3	Word 4
0x200 + Node-ID	Register	704	706	700	Empty
	CANopen Index	2008:5	2008:7	2008:1	–
	Description	Control Register	Analog output 1 command	Boolean output command register	–

Transmit PDO1 Mapping Description

Transmit PDO1 is dedicated to monitoring the Controller from the PLC. This table describes the predefined mapping.

COB-ID		Word 1	Word 2	Word 3	Word 4
0x180 + Node-ID	Register	455	456	457	458
	CANopen Index	2004:6	2004:7	2004:8	2004:9
	Description	System status register 1	System status register 2	Boolean inputs status	Boolean outputs status

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.

PDO4 Set Description

PDO4 set is predefined to access to any register (read or write) by programming using PKW objects, which enable acyclical read or write access to any TeSys T register.

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

For TeSys T MMC L and TeSys T MMC L EV40, PKW use is restricted to read access.

Receive PDO4 Mapping Description

Receive PDO4 is dedicated to receiving PKW request telegrams.

CANopen Index	3000:01				3000:02	
Word number	Word 1	Word 2			Word 3	Word 4
		MSB		LSB		
Description	Address Register	Toggle bit (bit 15)	Function code (bit 8 to 14)	0x00 or Address register	Value to write: 1st word MSW	Value to write: 2nd word LSW

Transmit PDO4 Mapping Description

Transmit PDO4 is dedicated to providing responses to PKW request telegrams.

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 15)	Function code (bit 8 to 14)	0x00 or Address register	Read data: 1st word MSW	Read data: 2nd word LSW

NOTE: In the tables above:

- MSB = Most Significant Byte
- LSB = Least Significant Byte
- MSW = Most Significant Word
- LSW = Least Significant Word

PKW Objects

Overview

The CANopen Controller supports PKW (**P**eriodically **K**ept in acyclic **W**ords). The PKW feature consists of 4 manufacturer-specific objects: 0x3000:0x01 to 0x3000:0x04.

These objects enable a CANopen client to read or write any register using PDOs. They are mapped, by default, in Transmit and Receive PDO4.

You can choose to address a register by its number or by CANopen Index and sub-index, depending on the function code.

PKW OUT Data Register Number Addressing

PKW OUT Data request (**CANopen Client > LTMR**) is mapped by default in Receive PDO4.

To access a register using number addressing, you must select one 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.

0x3000:0x01				0x3000:0x02	
Word 1	**Word 2**			**Word 3**	**Word 4**
	MSB		**LSB**		
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

PKW OUT Data CANopen Addressing

To access a register using CANopen addressing, you must select one of the following function codes:

- R_CO_16 = 0x35 to read 1 register
- R_CO_32 = 0x36 to read 2 registers
- W_CO_16 = 0x3A to write 1 register
- W_CO_32 = 0x3B to write 2 registers.

0x3000:0x01				0x3000:0x02	
Word 1	**Word 2**			**Word 3**	**Word 4**
	MSB		**LSB**		
Register address	Toggle bit (bit 15)	Function bits (bits 8 to 14)	Register address	Data to write	
CANopen index	0/1	R_CO_16 Code 0x35	CANopen sub-index	_	_
		R_CO_32 Code 0x36		_	_
		W_CO_16 Code 0x3A		Data to write in register	_
		W_CO_32 Code 0x3B		Data to write in register 1	Data to write in register 2

Any changes in the function code will trigger the handling of the request (unless function code [b8...b14] = 0x00).

NOTE: The highest bit of function code (bit 15) is a toggle bit. It is changed for each consecutive request.

This mechanism enables the request initiator to detect that a response is ready by polling bit 15 of the function code in object 30000x:03. When this bit in the OUT project becomes equal to the response emitted toggle bit in the IN data (when starting the request), then the response is ready.

PKW IN Data Register Number Addressing

PKW IN Data Response (**LTMR > CANopen Client**) is mapped by default in Transmit PDO4. The LTMR echoes the same register address and function code or eventually a detected error code:

0x3000:0x03				**0x3000:0x04**	
Word 1	**Word 2**			**Word 3**	**Word 4**
	MSB		**LSB**		
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	DETECTED ERROR Code 0x4E	0x00	Detected 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		_	_

PKW IN Data CANopen Addressing

The LTMR echoes the same register address and function code or eventually a detected error code:

0x3000:0x03				**0x3000:0x04**	
Word 1	**Word 2**			**Word 3**	**Word 4**
	MSB		**LSB**		
Register address	Toggle bit (bit 15)	Function bits (bits 8 to 14)	Register address	Data to write	
Same CANopen index as in request	Same as request	DETECTED ERROR Code 0x4E	CANopen sub-index	Detected error code	
		R_REG_16 Code 0x55		Data read in register	_
		R_REG_32 Code 0x36		Data read in register 1	Data read in register 2
		W_REG_16 Code 0x3A		_	_
		W_REG_32 Code 0x3B		_	_

If the initiator tries to write a TeSys T object or register to an unauthorized value, or tries to access an inaccessible register, a detected error code is returned (function code = toggle bit + 0x4E). The exact code can be found in words 3 and 4.

These codes are the same as SDO Abort codes , page 32.

The request is not accepted and the object/register remains at the original value.

To re-trigger exactly the same command:

1. Reset the function code to 0x00,
2. Wait for the response frame with the function code equal to 0x00,
3. Reset it to its previous value.

This is useful for a limited client 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).

Using SDOs

Introduction

SDO telegrams are used to aperiodically access any CANopen object by request programming. The SDO service consists of a request telegram and a response telegram.

Request SDO Telegram

Request information from the client to the LTMR Controller:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x600 + Node-ID	Request code	Object index		Object sub-index	Request data			
		LSB	MSB		Bits 7-0	Bits 15-8	Bits 23-16	Bits 31-24

Response SDO Telegram

Request information from the client to the LTMR Controller:

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x580 + Node-ID	Response code	Object index		Object sub-index	Response data			
		LSB	MSB		Bits 7-0	Bits 15-8	Bits 23-16	Bits 31-24

Request and Response Codes

Depending on the request code and the response code, the contents of the request data and response data may vary. The following table shows the request data for each of the different request codes:

Response Code	Command Description	Byte 4	Byte 5	Byte 6	Byte 7
0x23	Write 4-byte data	Bits 7-0	Bits 15-8	Bits 23-16	Bits 31-24
0x2B	Write 2-byte data	Bits 7-0	Bits 15-8	0x00	0x00
0x2F	Write 1-byte data	Bits 7-0	0x00	0x00	0x00
0x40	Read data	0x00	0x00	0x00	0x00
0x80	Abort the current SDO command[1] [1]	Bits 7-0	Bits 15-8	Bits 23-16	Bits 31-24

The following table shows the response data for each of the different response codes:

Request Code	Command Description	Byte 4	Byte 5	Byte 6	Byte 7
0x23	Read data: 4-byte data	Bits 7-0	Bits 15-8	Bits 23-16	Bits 31-24
0x2B	Read data: 2-byte data	Bits 7-0	Bits 15-8	0x00	0x00
0x2F	Read data: 1-byte data	Bits 7-0	0x00	0x00	0x00
0x40	Write a 1/2/4-byte data response	0x00	0x00	0x00	0x00
0x80	Detected error response: abort code returned[2]	0x00	0x00	0x00	0x00

SDO Abort Codes

The following abort codes are supported:

Abort Code	Description
0x 0503 0000	Segmented transfer: the toggle bit has not been alternated
0x 0504 0000	The SDO protocol timed out
0x 0504 0001	The request code is not valid or is unknown
0x 0601 0000	An access trip has occurred during access to the parameter (for example, a write request on a read-only parameter)
0x 0601 0001	Tried to perform a read request on a parameter with write-only access rights
0x 0601 0002	Tried to perform a write request on a parameter with read-only access rights
0x 0602 0000	The index sent in the request refers to an object that does not exist in the object dictionary
0x 0604 0041	PDO object mapping: the parameter cannot be mapped to the PDO; this detected error occurs when writing to the 0x1600, 0x1A00, 0x1605, and 0x1A05 parameters (PDO mappings)
0x 0604 0042	PDO object mapping: the number or length of the parameters to be mapped would exceed the maximum PDO length.
0x 0609 0011	The sub-index sent in the request does not exist
0x 0609 0030	Value range of parameter exceeded (only for write access)
0x 0609 0031	Value of parameter written too high
0x 0609 0032	Value of parameter written too low
0x 0609 0036	The parameter maximum value is less than its minimum value
0x 0800 0000	A general detected error occurred

1. If you use the SDO service to read multi-byte data, such as the manufacturer device name (parameter 0x1008 : 0x00), a segmented transfer will be initiated between the client and the controller. The 0x80 request code is designed to stop this kind of transfer.
2. The response data (bytes 4 to 7) corresponds to a 32-bit abort code. A list of all supported abort codes are given in the section SDO Abort Codes, page 32

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 FLC setting to 50 % of FLC 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 of fault register 1*)
%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;
```

Communication Profile Parameters

Overview

The CANopen Communication profile contains the following communication-specific parameters for the CANopen network:

- Device type
- Diagnostic
- CANopen communication objects description
- SDO

- Received PDO
- Transmit PDO

These parameters are used to configure and communicate with the LTMR controller. They are described in detail in the following pages.

Device Type

The following tables give the specifications for Device type parameter:

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	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)

Diagnostic

The following tables give the specifications for Diagnostic parameters:

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
0x1001	0x00	RO	VAR	Unsigned 8	0x00	**Detected error register:** Detected error (1) or no detected error (0) Bitfield: could be detailed
0x1003	0x00	RW	ARRAY	Unsigned 8	0	**Number of detected errors:** No detected error (0) or one or more detected errors (>0) in object 0x1003; Only the value 0 can be written
0x1003	0x01	RO	VAR	Unsigned 32	0x00000000	**Standard Detected Error Field 1:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Detected error code
0x1003	0x02	RO	VAR	Unsigned 32	0x00000000	**Standard Detected Error Field 2:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Detected error code
0x1003	0x03	RO	VAR	Unsigned 32	0x00000000	**Standard Detected Error Field 3:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Detected error code
0x1003	0x04	RO	VAR	Unsigned 32	0x00000000	**Standard Detected Error Field 4:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Detected error code
0x1003	0x05	RO	VAR	Unsigned 32	0x00000000	**Standard Detected Error Field 5:** Bits 16-23 = Additional information (all 0s) Bits 00-15 = Detected error code

CANopen Communication Objects Description

The following tables give the specifications for CANopen Communication Objects parameters:

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
0x1004	0x00	RO	ARRAY	Unsigned 32	0x00040004	**Number of PDOs supported**
0x1004	0x01	RO	VAR	Unsigned 32	0x00000000	**Number of synchronous PDOs** Bits 16-31 = Number of received PDOs supported Bits 00-15 = Number of transmit PDOs supported
0x1004	0x01	RO	VAR	Unsigned 32	0x00000000	**Number of asynchronous PDOs** Bits 16-31 = Number of received PDOs supported Bits 00-15 = Number of transmit PDOs supported
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	LTM	**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 for this object is 1 ms.
0x100D	0x00	RW	VAR	Unsigned 8	0x00	**Life time factor:** Multiplier applied to the "Guard Time" to obtain a "Life Time"
0x1014	0x00	RW	VAR	Unsigned 32	$NODEID+ 0x80	**COB-ID Emergency message**: COB-ID used for the EMCY service
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) Note: 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 controller 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	See table below	**Product code -**To determine the product family and product number
0x1018	0x03	RO	VAR	Unsigned 32	0x00010001	**Major and minor Product revision number**

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
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	**Detected Error Behavior - No. of Detected Error Classes**
0x1029	0x01	RW	VAR	Unsigned 8	0x00	**Detected communication error** 0:pre-operational / 1:no state change / 2: stopped

Register 0x1018 : 0x02 is the product code. This register is used by configuration tools to identity the product on the network. Possible values are:

Object 1018sub2	With/without Expansion Module	Configuration Mode
0x 0000 0030	Without	Remote mode
0x 0000 0031	With	
0x 0000 0130	Without	Local mode
0x 0000 0131	With	

SDO Definition

SDO Specifications

The following table gives the specifications for SDOs.

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	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)

Receive PDO Definition

Receive PDO specifications

The following tables give the specifications for Receive PDO.

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	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**

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
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 +0x80000400	**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)

.

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
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 [706]
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
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

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
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

Transmit PDO Definition

Transmit PDO Specifications

The following tables give the specifications for Transmit PDO.

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
0x1800	0x00	RO	RECORD	Unsigned 8	5	**Transmit PDO1 - Number of entries**
0x1800	0x01	RW	VAR	Unsigned 32	$NODEID +0x00000180	**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 +0x80000280	**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

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
						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 +0x80000380	**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 +0x00000480	**Transmit PDO4 - COB-ID**
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

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
0x1A00	0x00	RW	ARRAY	Unsigned 8	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	0x20040710	**Transmit PDO1 mapping 2 -** mapped object: Reg [456]
0x1A00	0x03	RW	VAR	Unsigned 32	0x20040810	**Transmit PDO1 mapping 3 -** mapped object: Reg [457]
0x1A00	0x04	RW	VAR	Unsigned 32	0x20040A10	**Transmit PDO1 mapping 4 -** mapped object: Reg [459]
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
0x1A02	0x00	RW	ARRAY	Unsigned 8	0	**Transmit PDO3 mapping - Number of mapped objects**

Index	Sub Index	Access	Object Type	Data Type	Factory Setting	Description
0x1A02	0x01	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO3 mapping 1 -** mapped object: None by default
0x1A02	0x02	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO3 mapping 2 -** mapped object: None by default
0x1A02	0x03	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO3 mapping 3 -** mapped object: None by default
0x1A02	0x04	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO3 mapping 4 -** mapped object: None by default
0x1A03	0x00	RW	ARRAY	Unsigned 8	2	**Transmit PDO4 mapping - Number of mapped objects**
0x1A03	0x01	RW	VAR	Unsigned 32	0x30000320	**Transmit PDO4 mapping 1 -** mapped object: None by default
0x1A03	0x02	RW	VAR	Unsigned 32	0x30000420	**Transmit PDO4 mapping 2 -** mapped object: None by default
0x1A03	0x03	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO4 mapping 3 -** mapped object: None by default
0x1A03	0x04	RW	VAR	Unsigned 32	0x00000000	**Transmit PDO4 mapping 4 -** mapped object: None by default

Register Map - Organization of Communication Variables

Introduction

Communication variables are listed in tables according to the group (such as identification, statistics, or monitoring). to which they belong. They are associated with an LTMR controller, which may or may not have an LTME expansion module attached.

Communication Variable Groups

Communication variables are grouped according to the following criteria:

Variable Groups	Registers	CANopen Addresses
Identification variables	00 to 99	2000 : 32 to 2000 : 61
Statistics variables	100 to 449	2001 : 01 to 2003 : 82
Monitoring variables	450 to 539	2004 : 01 to 2004 : 46
Configuration variables	540 to 699	2005 : 01 to 2007 : 32
Command variables	700 to 799	2008 : 01 to 2008 : 64
Custom Logic variables	1200 to 1399	200C : 01 to 200D : 64

Table Structure

Communication variables are listed in 5-column tables:

Column 1	Column 2	Column 3	Column 4	Column 5
Register (in decimal format)	CANopen address (index : sub-index)	Variable type , page 41	Variable name and access via Read-only or Read/Write requests	Note: code for additional information

Note

The Note column gives a code for additional information.

Variables without a code are available for all hardware configurations, and without functional restrictions.

The code can be:

- numerical (1 to 9), for specific hardware combinations
- alphabetical (A to Z), for specific system behaviors.

If the Note is...	Then the Variable is...
1	available for the LTMR + LTMEV40 combination
2	always available but with a value equal to 0 if no LTMEV40 is connected
3-9	Not used
If the Note is...	**Then...**
A	the variable can be written only when the motor is OFF
B	the variable can be written only in configuration mode
C	the variable can be written only with no trip
D-Z	the variable is available for future exceptions

Unused Addresses

Unused addresses fall into three categories:

- **Not significant**, in Read only tables, means that you should ignore the value read, whether equal to 0 or not.
- **Reserved**, in Read/Write tables, means that you must write 0 in these variables.
- **Forbidden**, means that read or write requests are rejected, that these addresses are not accessible.

Data Formats

Overview

The data format of a communication variable can be integer, Word, or Word[n], as described below. For more information about a variable size and format, refer to the Data Types, page 43.

Integer (Int, UInt, DInt, IDInt)

Integers fall into the following categories:

- **Int**: signed integer using one register (16 bits)
- **UInt**: unsigned integer using one register (16 bits)
- **DInt**: signed double integer using 2 registers (32 bits)
- **UDInt**: unsigned double integer using 2 registers (32 bits)

For all integer-type variables, the variable name is completed with its unit or format, if necessary.

Example:

Address 474, **UInt**, Frequency (x 0.01 Hz).

Word

Word: Set of 16 bits, where each bit or group of bits represents command, monitoring or configuration data.

Example:

Address 455, **Word**, System Status Register 1.

bit 0	System ready
bit 1	System ON
bit 2	System trip
bit 3	System alarm
bit 4	System tripped
bit 5	Trip reset authorized
bit 6	*(Not significant)*
bit 7	Motor running
bits 8-13	Motor average current ratio
bit 14	In remote
bit 15	Motor starting (in progress)

Word[n]

Word[n]: Data encoded on contiguous registers.

Examples:

Addresses 64 to 69, **Word[6]**, Controller Commercial Reference (DT_CommercialReference, page 43).

Addresses 655 to 658, **Word[4]**, (DT_DateTime, page 44).

Data Types

Overview

Data types are specific variable formats which are used to complement the description of internal formats (for instance, in case of a structure or of an enumeration). The generic format of data types is DT_xxx.

List of Data Types

Here is the list of the most commonly used data types:

- DT_ACInputSetting
- DT_CommercialReference
- DT_DateTime
- DT_ExtBaudRate
- DT_ExtParity
- DT_FaultCode
- DT_FirmwareVersion
- DT_Language5
- DT_OutputFallbackStrategy
- DT_PhaseNumber
- DT_ResetMode
- DT_WarningCode

These data types are described in the following tables.

DT_ACInputSetting

DT_ACInputSetting format is an **enumeration** that improves AC input detection:

Value	Description
0	None (factory setting)
1	< 170 V 50 Hz
2	< 170 V 60 Hz
3	> 170 V 50 Hz
4	> 170 V 60 Hz

DT_CommercialReference

DT_CommercialReference format is **Word[6]** and indicates a Commercial Reference:

Register	MSB	LSB
Register N	character 1	Character 2
Register N+1	character 3	Character 4
Register N+2	character 5	Character 6

Register	MSB	LSB
Register N+3	character 7	Character 8
Register N+4	character 9	Character 10
Register N+5	character 11	Character 12

Example:

Addresses 64 to 69, **Word[6]**, Controller Commercial Reference.

If Controller Commercial Reference = LTMR:

Register	MSB	LSB
64	L	T
65	M	(space)
66	R	
67		
68		
69		

DT_DateTime

DT_DateTime format is **Word[4]** and indicates Date and Time:

Register	Bits 12-15	Bits 8-11	Bits 4-7	Bits 0-3
Register N	S	S	0	0
Register N+1	H	H	m	m
Register N+2	M	M	D	D
Register N+3	Y	Y	Y	Y

Where:

- S = second
  The format is two BCD digits.
  The value range is [00-59] in BCD.
- 0 = unused
- H = hour
  The format is two BCD digits.
  The value range is [00-23] in BCD.
- m = minute
  The format is two BCD digits.
  The value range is [00-59] in BCD.
- M = month
  The format is two BCD digits.
  The value range is [01-12] in BCD.

- D = day

  The format is two BCD digits.

  The value range is (in BCD):

  [01-31] for months 01, 03, 05, 07, 08, 10, 12

  [01-30] for months 04, 06, 09, 11

  [01-29] for month 02 in a leap year

  [01-28] for month 02 in a non-leap year.
- Y = year

  The format is four Binary Coded Decimal (BCD) digits.

  The value range is [2006-2099] in BCD.

Data entry format and value range are:

Data Entry Format	**DT#YYYY-MM-DD-HH:mm:ss**	
Minimum value	DT#2006-01-01:00:00:00	January 1, 2006
Maximum value	DT#2099-12-31-23:59:59	December 31, 2099
Note: If you give values outside the limits, the system will return a detected error.		

Example:

Addresses 655 to 658, **Word[4]**, Date and Time setting.

If date is September 4, 2008 at 7 a.m., 50 minutes and 32 seconds:

Register	**15 12**	**11 8**	**7 4**	**3 0**
655	3	2	0	0
656	0	7	5	0
657	0	9	0	4
658	2	0	0	8

With data entry format: DT#2008-09-04-07:50:32.

DT_ExtBaudRate

DT_ExtbaudRate depends on the bus used:

DT_ModbusExtBaudRate format is an **enumeration** of possible baud rates with Modbus network:

Value	**Description**
1200	1200 Baud
2400	2400 Baud
4800	4800 Baud
9600	9600 Baud
19200	19,200 Baud
65535	Autodetection (factory setting)

DT_ProfibusExtBaudRate format is an **enumeration** of possible baud rates with PROFIBUS DP network:

Value	Description
65535	Autobaud (factory setting)

DT_DeviceNetExtBaudRate format is an **enumeration** of possible baud rates with DeviceNet network:

Value	Description
0	125 kBaud
1	250 kBaud
2	500 kBaud
3	Autobaud (factory setting)

DT_CANopenExtBaudRate format is an **enumeration** of possible baud rates with CANopen network:

Value	Description
0	10 kBaud
1	20 kBaud
2	50 kBaud
3	125 kBaud
4	250 kBaud (factory setting)
5	500 kBaud
6	800 kBaud
7	1000 kBaud
8	Autobaud
9	Factory setting

DT_ExtParity

DT_ExtParity depends on the bus used:

DT_ModbusExtParity format is an **enumeration** of possible parities with Modbus network:

Value	Description
0	None
1	Even
2	Odd

DT_FaultCode

DT_FaultCode format is an **enumeration** of trip codes:

Trip Code	Description
0	No detected error
3	Ground current
4	Thermal overload
5	Long start

Trip Code	Description
6	Jam
7	Current phase imbalance
8	Undercurrent
10	Test
11	HMI port detected error
12	HMI port communication loss
13	Network port internal detected error
16	External trip
18	ON-OFF diagnostic
19	Wiring diagnostic
20	Overcurrent
21	Current phase loss
22	Current phase reversal
23	Motor temp sensor
24	Voltage phase imbalance
25	Voltage phase loss
26	Voltage phase reversal
27	Undervoltage
28	Overvoltage
29	Underpower
30	Overpower
31	Under power factor
32	Over power factor
33	LTME configuration
34	Temperature sensor short-circuit
35	Temperature sensor open-circuit
36	CT reversal
37	Out of boundary CT ratio
46	Start check
47	Run checkback
48	Stop check
49	Stop checkback
51	Controller internal temperature detected error
55	Controller internal detected error (Stack overflow)
56	Controller internal detected error (RAM detected error)
57	Controller internal detected error (RAM checksum detected error)
58	Controller internal detected error (Hardware watchdog trip)
60	L2 current detected in single-phase mode
64	Non-volatile memory detected error
65	Expansion module communication detected error

Trip Code	Description
66	Stuck reset button
67	Logic function detected error
100-104	Network port internal detected error
109	Network port comm detected error
111	Fast device replacement trip
555	Network port configuration detected error

DT_FirmwareVersion

DT_FirmwareVersion format is an **XY000 array** that describes a firmware revision:

- X = major revision
- Y = minor revision.

Example:

Address 76, **UInt**, Controller firmware version.

DT_Language5

DT_Language5 format is an **enumeration** used for language display:

Language Code	Description
1	English (factory setting)
2	Français
4	Español
8	Deutsch
16	Italiano

Example:

Address 650, **Word**, HMI language.

DT_OutputFallbackStrategy

DT_OutputFallbackStrategy format is an **enumeration** of motor output states when loosing communication.

Value	Description	Motor Modes
0	Hold LO1 LO2	For all modes
1	Run	For 2-step mode only
2	LO1, LO2 Off	For all modes
3	LO1, LO2 On	Only for overload, independent and custom operating modes
4	LO1 On	For all modes except 2-step
5	LO2 On	For all modes except 2-step

DT_PhaseNumber

DT_PhaseNumber format is an **enumeration**, with only 1 bit activated:

Value	Description
1	1 phase
2	3 phases

DT_ResetMode

DT_ResetMode format is an **enumeration** of possible modes for thermal trip reset:

Value	Description
1	Manual or HMI
2	Remote by network
4	Automatic

DT_WarningCode

DT_WarningCode format is an **enumeration** of alarm codes:

Alarm Code	Description
0	No alarm
3	Ground current
4	Thermal overload
5	Long start
6	Jam
7	Current phase imbalance
8	Undercurrent
10	HMI port
11	LTMR internal temperature
18	Diagnostic
19	Wiring
20	Overcurrent
21	Current phase loss
23	Motor temp sensor
24	Voltage phase imbalance
25	Voltage phase loss
27	Undervoltage
28	Overvoltage
29	Underpower
30	Overpower
31	Under power factor

Alarm Code	Description
32	Over power factor
33	LTME configuration
46	Start check
47	Run checkback
48	Stop check
49	Stop checkback
109	Network port comm loss
555	Network port configuration

Identification Variables

Identification Variables

Identification variables are described in the following table:

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
0-34	2000 : 03 - 2000 : 28		*(Not significant)*	
35-40	2000 : 23 - 2000 : 29	Word[6]	Expansion commercial reference , page 43	1
41-45	2000 :2A - 2000 : 2E	Word[5]	Expansion serial number	1
46	2000 : 2F	UInt	Expansion ID code	1
47	2000 : 30	UInt	Expansion firmware version , page 48	1
48	2000 : 31	UInt	Expansion compatibility code	1
49-60	2000 : 32 - 2000 : 3D		*(Not significant)*	
61	2000 : 3E	UInt	Network port ID code	
62	2000 : 3F	UInt	Network port firmware version , page 48	
63	2000 : 40	UInt	Network port compatibility code	
64-69	2000 : 41 - 2000 : 46	Word[6]	Controller commercial reference , page 43	
70-74	2000 : 47 - 2000 : 4B	Word[5]	Controller serial number	
75	2000 : 4C	UInt	Controller ID code	
76	2000 : 4D	UInt	Controller firmware version , page 48	
77	2000 : 4E	UInt	Controller compatibility code	
78	2000 : 4F	UInt	Current scale ratio (0.1 %)	
79	2000 : 50	UInt	Current sensor max	
80	2000 : 51		*(Not significant)*	
81	2000 : 52	UInt	Current range max (x 0.1 A)	
82-94	2000 : 53 - 2000 : 58		*(Not significant)*	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
95	2000 : 60	UInt	Load CT ratio (x 0.1 A)	
96	2000 : 61	UInt	Full load current max (maximum FLC range, *FLC = Full Load Current*) (x 0.1 A)	
97-99	2000 : 62 - 2000 : 64	UInt	*(Forbidden)*	

Statistics Variables

Statistics Overview

Statistics variables are grouped according to the following criteria. Trip statistics are described in a main table and in an extension table.

Statistics Variable Groups	Register	CANopen Addresses
Global statistics	100 to 121	2001 : 01 to 2001 : 16
LTM monitoring statistics	122 to 149	2001 : 17 to 2001 : 32
Last trip statistics	150 to 179	2002 : 01 to 2002 : 1E
and extension	300 to 309	2003 : 01 to 2003 : 0A
Trip n-1 statistics	180 to 209	2002 : 1F to 2002 : 3C
and extension	330 to 339	2003 : 1F to 2003 : 28
Trip n-2 statistics	210 to 239	2002 : 3D to 2002 : 5A
and extension	360 to 369	2003 : 3D to 2003 : 46
Trip n-3 statistics	240 to 269	2002 : 5B to 2002 : 78
and extension	390 to 399	2003 : 5B to 2003 : 64
Trip n-4 statistics	270 to 299	2002 : 79 to 2002 : 96
and extension	420 to 429	2003 : 79 to 2003 : 82

Global Statistics

The global statistics are described in the following table:

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
100-101	2001 : 01 - 2001 : 02		*(Not significant)*	
102	2001 : 03	UInt	Ground current trips count	
103	2001 : 04	UInt	Thermal overload trips count	
104	2001 : 05	UInt	Long start trips count	
105	2001 : 06	UInt	Jam trips count	
106	2001 : 07	UInt	Current phase imbalance trips count	
107	2001 : 08	UInt	Undercurrent trips count	
109	2001 : 0A	UInt	HMI port trips count	
110	2001 : 0B	UInt	Controller internal trips count	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
111	2001 : 0C	UInt	Internal port trips count	
112	2001 : 0D		(*Not significant*)	
113	2001 : 0E	UInt	Network port config trips count	
114	2001 : 0F	UInt	Network port trips count	
115	2001 : 10	UInt	Auto-resets count	
116	2001 : 11	UInt	Thermal overload alarms count	
117-118	2001 : 12 - 2001 : 13	UDInt	Motor starts count	
119-120	2001 : 14 - 2001 : 15	UDInt	Operating time (s)	
121	2001 : 16	Int	Controller internal temperature max (°C)	

LTM Monitoring Statistics

The LTM monitoring statistics are described in the following table:

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
122	2001 : 17	UInt	Trips count	
123	2001 : 18	UInt	Alarms count	
124-125	2001 : 19 - 2001 : 1A	UDInt	Motor LO1 closings count	
126-127	2001 : 1B - 2001 : 1C	UDInt	Motor LO2 closings count	
128	2001 : 1D	UInt	Diagnostic trips count	
129	2001 : 1E		*(Reserved)*	
130	2001 : 1F	UInt	Overcurrent trips count	
131	2001 : 20	UInt	Current phase loss trips count	
132	2001 : 21	UInt	Motor temperature sensor trips count	
133	2001 : 22	UInt	Voltage phase imbalance trips count	1
134	2001 : 23	UInt	Voltage phase loss trips count	1
135	2001 : 24	UInt	Wiring trips count	1
136	2001 : 25	UInt	Undervoltage trips count	1
137	2001 : 26	UInt	Overvoltage trips count	1
138	2001 : 27	UInt	Underpower trips count	1
139	2001 : 28	UInt	Overpower trips count	1
140	2001 : 29	UInt	Under power factor trips count	1
141	2001 : 2A	UInt	Over power factor trips count	1
142	2001 : 2B	UInt	Load sheddings count	1
143-144	2001 : 2C - 2001 : 2D	UDInt	Active power consumption (kWh)	1
145-146	2001 : 2E - 2001 : 2F	UDInt	Reactive power consumption (kVARh)	1
147	2001 : 30	UInt	Auto restart immediate count	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
148	2001 : 31	UInt	Auto restart delayed count	
149	2001 : 32	UInt	Auto restart manual count	

Last Trip (n-0) Statistics

The last trip statistics are completed by variables at addresses 300 to 309.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
150	2002 : 01	UInt	trip code n-0	
151	2002 : 02	UInt	Motor full load current ratio n-0 (% FLC max)	
152	2002 : 03	UInt	Thermal capacity level n-0 (% trip level)	
153	2002 : 04	UInt	Average current ratio n-0 (% FLC)	
154	2002 : 05	UInt	L1 current ratio n-0 (% FLC)	
155	2002 : 06	UInt	L2 current ratio n-0 (% FLC)	
156	2002 : 07	UInt	L3 current ratio n-0 (% FLC)	
157	2002 : 08	UInt	Ground current ratio n-0 (x 0.1 % FLC min)	
158	2002 : 09	UInt	Full load current max n-0 (x 0.1 A)	
159	2002 : 0A	UInt	Current phase imbalance n-0 (%)	
160	2002 : 0B	UInt	Frequency n-0 (x 0.1 Hz)	2
161	2002 : 0C	UInt	Motor temperature sensor n-0 (x 0.1 Ω)	
162-165	2002 : 0D - 2002 : 10	Word[4]	Date and time n-0 , page 44	
166	2002 : 11	UInt	Average voltage n-0 (V)	1
167	2002 : 12	UInt	L3-L1 voltage n-0 (V)	1
168	2002 : 13	UInt	L1-L2 voltage n-0 (V)	1
169	2002 : 14	UInt	L2-L3 voltage n-0 (V)	1
170	2002 : 15	UInt	Voltage phase imbalance n-0 (%)	1
171	2002 : 16	UInt	Active power n-0 (x 0.1 kWh)	1
172	2002 : 17	UInt	Power factor n-0 (x 0.01)	1
173-179	2002 : 18 - 2002 : 1E		*(Not significant)*	

N-1 Trip Statistics

The n-1 trip statistics are completed by variables at addresses 330 to 339.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
180	2002 : 1F	UInt	Trip code n-1	
181	2002 : 20	UInt	Motor full load current ratio n-1 (% FLC max)	
182	2002 : 21	UInt	Thermal capacity level n-1 (% trip level)	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
183	2002 : 22	UInt	Average current ratio n-1 (% FLC)	
184	2002 : 23	UInt	L1 current ratio n-1 (% FLC)	
185	2002 : 24	UInt	L2 current ratio n-1 (% FLC)	
186	2002 : 25	UInt	L3 current ratio n-1 (% FLC)	
187	2002 : 26	UInt	Ground current ratio n-1 (x 0.1 % FLC min)	
188	2002 : 27	UInt	Full load current max n-1 (x 0.1 A)	
189	2002 : 28	UInt	Current phase imbalance n-1 (%)	
190	2002 : 29	UInt	Frequency n-1 (x 0.1 Hz)	2
191	2002 : 2A	UInt	Motor temperature sensor n-1 (x 0.1 Ω)	
192-195	2002 : 2B - 2002 : 2E	Word[4]	Date and time n-1 , page 44	
196	2002 : 2F	UInt	Average voltage n-1 (V)	1
197	2002 : 30	UInt	L3-L1 voltage n-1 (V)	1
198	2002 : 31	UInt	L1-L2 voltage n-1 (V)	1
199	2002 : 32	UInt	L2-L3 voltage n-1 (V)	1
200	2002 : 33	UInt	Voltage phase imbalance n-1 (%)	1
201	2002 : 34	UInt	Active power n-1 (x 0.1 kWh)	1
202	2002 : 35	UInt	Power factor n-1 (x 0.01)	1
203-209	2002 : 36 - 2002 : 3C		*(Not significant)*	

N-2 Trip Statistics

The n-2 trip statistics are completed by variables at addresses 360 to 369.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
210	2002 : 3D	UInt	Trip code n-2	
211	2002 : 3E	UInt	Motor full load current ratio n-2 (% FLC max)	
212	2002 : 3F	UInt	Thermal capacity level n-2 (% trip level)	
213	2002 : 40	UInt	Average current ratio n-2 (% FLC)	
214	2002 : 41	UInt	L1 current ratio n-2 (% FLC)	
215	2002 : 42	UInt	L2 current ratio n-2 (% FLC)	
216	2002 : 43	UInt	L3 current ratio n-2 (% FLC)	
217	2002 : 44	UInt	Ground current ratio n-2 (x 0.1 % FLC min)	
218	2002 : 45	UInt	Full load current max n-2 (x 0.1 A)	
219	2002 : 46	UInt	Current phase imbalance n-2 (%)	
220	2002 : 47	UInt	Frequency n-2 (x 0.1 Hz)	2
221	2002 : 48	UInt	Motor temperature sensor n-2 (x 0.1 Ω)	
222-225	2002 : 49 - 2002 : 4C	Word[4]	Date and time n-2 , page 44	
226	2002 : 4D	UInt	Average voltage n-2 (V)	1

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
227	2002 : 4E	UInt	L3-L1 voltage n-2 (V)	1
228	2002 : 4F	UInt	L1-L2 voltage n-2 (V)	1
229	2002 : 50	UInt	L2-L3 voltage n-2 (V)	1
230	2002 : 51	UInt	Voltage phase imbalance n-2 (%)	1
231	2002 : 52	UInt	Active power n-2 (x 0.1 kWh)	1
232	2002 : 53	UInt	Power factor n-2 (x 0.01)	1
233-239	2002 : 54 - 2002 : 5A		*(Not significant)*	

N-3 Trip Statistics

The n-3 trip statistics are completed by variables at addresses 390 to 399.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
240	2002 : 5B	UInt	Trip code n-3	
241	2002 : 5C	UInt	Motor full load current ratio n-3 (% FLC max)	
242	2002 : 5D	UInt	Thermal capacity level n-3 (% trip level)	
243	2002 : 5E	UInt	Average current ratio n-3 (% FLC)	
244	2002 : 5F	UInt	L1 current ratio n-3 (% FLC)	
245	2002 : 60	UInt	L2 current ratio n-3 (% FLC)	
246	2002 : 61	UInt	L3 current ratio n-3 (% FLC)	
247	2002 : 62	UInt	Ground current ratio n-3 (x 0.1 % FLC min)	
248	2002 : 63	UInt	Full load current max n-3 (0.1 A)	
249	2002 : 64	UInt	Current phase imbalance n-3 (%)	
250	2002 : 65	UInt	Frequency n-3 (x 0.1 Hz)	2
251	2002 : 66	UInt	Motor temperature sensor n-3 (x 0.1 Ω)	
252-255	2002 : 67 - 2002 : 6A	Word[4]	Date and time n-3 , page 44	
256	2002 : 6B	UInt	Average voltage n-3 (V)	1
257	2002 : 6C	UInt	L3-L1 voltage n-3 (V)	1
258	2002 : 6D	UInt	L1-L2 voltage n-3 (V)	1
259	2002 : 6E	UInt	L2-L3 voltage n-3 (V)	1
260	2002 : 6F	UInt	Voltage phase imbalance n-3 (%)	1
261	2002 : 70	UInt	Active power n-3 (x 0.1 kWh)	1
262	2002 : 71	UInt	Power factor n-3 (x 0.01)	1
263-269	2002 : 72 - 2002 : 78		*(Not significant)*	

N-4 Trip Statistics

The n-4 trip statistics are completed by variables at addresses 420 to 429.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
270	2002 : 79	UInt	Trip code n-4	
271	2002 : 7A	UInt	Motor full load current ratio n-4 (% FLC max)	
272	2002 : 7B	UInt	Thermal capacity level n-4 (% trip level)	
273	2002 : 7C	UInt	Average current ratio n-4 (% FLC)	
274	2002 : 7D	UInt	L1 current ratio n-4 (% FLC)	
275	2002 : 7E	UInt	L2 current ratio n-4 (% FLC))	
276	2002 : 7F	UInt	L3 current ratio n-4 (% FLC)	
277	2002 : 80	UInt	Ground current ratio n-4 (x 0.1 % FLC min)	
278	2002 : 81	UInt	Full load current max n-4 (x 0.1 A)	
279	2002 : 82	UInt	Current phase imbalance n-4 (%)	
280	2002 : 83	UInt	Frequency n-4 (x 0.1 Hz)	2
281	2002 : 84	UInt	Motor temperature sensor n-4 (x 0.1 Ω)	
282-285	2002 : 85 - 2002 : 88	Word[4]	Date and time n-4 , page 44	
286	2002 : 89	UInt	Average voltage n-4 (V)	1
287	2002 : 8A	UInt	L3-L1 voltage n-4 (V)	1
288	2002 : 8B	UInt	L1-L2 voltage n-4 (V)	1
289	2002 : 8C	UInt	L2-L3 voltage n-4 (V)	1
290	2002 : 8D	UInt	Voltage phase imbalance n-4 (x 1%)	1
291	2002 : 8E	UInt	Active power n-4 (x 0.1 kWh)	1
292	2002 : 8F	UInt	Power factor n-4 (x 0.01)	1
293-299	2002 : 90 - 2002 : 96		*(Not significant)*	

Last Trip (n-0) Statistics Extension

The last trip main statistics are listed at addresses 150-179.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
300-301	2003 : 01 - 2003 : 02	UDInt	Average current n-0 (x 0.01 A)	
302-303	2003 : 03 - 2003 : 04	UDInt	L1 current n-0 (x 0.01 A)	
304-305	2003 : 05 - 2003 : 06	UDInt	L2 current n-0 (x 0.01 A)	
306-307	2003 : 07 - 2003 : 08	UDInt	L3 current n-0 (x 0.01 A)	
308-309	2003 : 09 - 2003 : 0A	UDInt	Ground current n-0 (mA)	
310	2003 : 0B	UInt	Motor temperature sensor degree n-0 (°C)	

N-1 Trip Statistics Extension

The n-1 trip main statistics are listed at addresses 180-209.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
330-331	2003 : 1F - 2003 : 20	UDInt	Average current n-1 (x 0.01 A)	
332-333	2003 : 21 - 2003 : 22	UDInt	L1 current n-1 (x 0.01 A)	
334-335	2003 : 23 - 2003 : 24	UDInt	L2 current n-1 (x 0.01 A)	
336-337	2003 : 25 - 2003 : 26	UDInt	L3 current n-1 (x 0.01 A)	
338-339	2003 : 27 - 2003 : 28	UDInt	Ground current n-1 (mA)	
340	2003 : 29	UInt	Motor temperature sensor degree n-1 (°C)	

N-2 Trip Statistics Extension

The n-2 trip main statistics are listed at addresses 210-239.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
360-361	2003 : 3D - 2003 : 3E	UDInt	Average current n-2 (x 0.01 A)	
362-363	2003 : 3F - 2003 : 40	UDInt	L1 current n-2 (x 0.01 A)	
364-365	2003 : 41 - 2003 : 42	UDInt	L2 current n-2 (x 0.01 A)	
366-367	2003 : 43 - 2003 : 44	UDInt	L3 current n-2 (x 0.01 A)	
368-369	2003 : 45 - 2003 : 46	UDInt	Ground current n-2 (mA)	
370	2003 : 47	UInt	Motor temperature sensor degree n-2 (°C)	

N-3 Trip Statistics Extension

The n-3 trip main statistics are listed at addresses 240-269.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
390-391	2003 : 5B - 2003 : 5C	UDInt	Average current n-3 (x 0.01 A)	
392-393	2003 : 5D - 2003 : 5E	UDInt	L1 current n-3 (x 0.01 A)	
394-395	2003 : 5F - 2003 : 60	UDInt	L2 current n-3 (x 0.01 A)	
396-397	2003 : 61 - 2003 : 62	UDInt	L3 current n-3 (x 0.01 A)	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
398-399	2003 : 63 - 2003 : 64	UDInt	Ground current n-3 (mA)	
400	2003 : 65	UInt	Motor temperature sensor degree n-3 (°C)	

N-4 Trip Statistics Extension

The n-4 trip main statistics are listed at addresses 270-299.

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
420-421	2003 : 79 - 2003 : 7A	UDInt	Average current n-4 (x 0.01 A)	
422-423	2003 : 7B9 - 2003 : 7C	UDInt	L1 current n-4 (x 0.01 A)	
424-425	2003 : 7D - 2003 : 7E	UDInt	L2 current n-4 (x 0.01 A)	
426-427	2003 : 7F - 2003 : 80	UDInt	L3 current n-4 (x 0.01 A)	
428-429	2003 : 81 - 2003 : 82	UDInt	Ground current n-4 (mA)	
430	2003 : 83	UInt	Motor temperature sensor degree n-4 (°C)	

Monitoring Variables

Monitoring Variables

Monitoring variables are described in the following table:

Monitoring Variable Groups	Modbus Addresses	CANopen Addresses
Monitoring of trips	450 to 454	2004 : 01 to 2004 : 05
Monitoring of status	455 to 459	2004 : 06 to 2004 : 0A
Monitoring of alarms	460 to 464	2004 : 0B to 2004 : 0F
Monitoring of measurements	465 to 539	2004 : 10 to 2004 : 5A

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
450	2004 : 01	UInt	Minimum wait time (s)	
451	2004 : 02	UInt	Trip code (code of the last trip, or of the trip that takes priority) , page 46	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
452	2004 : 03	Word	Trip register 1	
			bits 0-1 (Reserved)	
			bit 2 Ground current trip	
			bit 3 Thermal overload trip	
			bit 4 Long start trip	
			bit 5 Jam trip	
			bit 6 Current phase imbalance trip	
			bit 7 Undercurrent trip	
			bit 8 (Reserved)	
			bit 9 Test trip	
			bit 10 HMI port trip	
			bit 11 Controller internal trip	
			bit 12 Internal port trip	
			bit 13 (Not significant)	
			bit 14 Network port config trip	
			bit 15 Network port trip	
453	2004 : 04	Word	Trip register 2	
			bit 0 External system trip	
			bit 1 Diagnostic trip	
			bit 2 Wiring trip	
			bit 3 Overcurrent trip	
			bit 4 Current phase loss trip	
			bit 5 Current phase reversal trip	
			bit 6 Motor temperature sensor trip	1
			bit 7 Voltage phase imbalance trip	1
			bit 8 Voltage phase loss trip	1
			bit 9 Voltage phase reversal trip	1
			bit 10 Undervoltage trip	1
			bit 11 Overvoltage trip	1
			bit 12 Underpower trip	1
			bit 13 Overpower trip	1
			bit 14 Under power factor trip	1
			bit 15 Over power factor trip	1
454	2004 : 05	Word	Trip register 3	
			bit 0 LTME configuration trip	
			bits 1-15 (Reserved)	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
455	2004 : 06	Word	System status register 1	
			bit 0 System ready	
			bit 1 System on	
			bit 2 System trip	
			bit 3 System alarm	
			bit 4 System tripped	
			bit 5 Trip reset authorized	
			bit 6 Controller power	
			bit 7 Motor running (with detection of a current if greater than 10% FLC)	
			bits 8-13 Motor average current ratio 32 = 100% FLC - 63 = 200% FLC	
			bit 14 In remote	
			bit 15 Motor starting (start in progress) 0 = descending current is less than 150% FLC 1 = ascending current is greater than 10% FLC	
456	2004 : 07	Word	System status register 2	
			bit 0 Auto-reset active	
			bit 1 *(Not significant)*	
			bit 2 Trip power cycle requested	
			bit 3 Motor restart time undefined	
			bit 4 Rapid cycle lockout	
			bit 5 Load shedding	1
			bit 6 Motor speed 0 = FLC1 setting is use 1 = FLC2 setting is used	
			bit 7 HMI port comm loss	
			bit 8 Network port comm loss	
			bit 9 Motor transition lockout	
			bits 10-15 (Not significant)	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
457	2004 : 08	Word	Logic inputs status	
			bit 0 Logic input 1	
			bit 1 Logic input 2	
			bit 2 Logic input 3	
			bit 3 Logic input 4	
			bit 4 Logic input 5	
			bit 5 Logic input 6	
			bit 6 Logic input 7	
			bit 7 Logic input 8	1
			bit 8 Logic input 9	1
			bit 9 Logic input 10	1
			bit 10 Logic input 11	1
			bit 11 Logic input 12	1
			bit 12 Logic input 13	1
			bit 13 Logic input 14	1
			bit 14 Logic input 15	1
			bit 15 Logic input 16	1
458	2004 : 09	Word	Logic outputs status	
			bit 0 Logic output 1	
			bit 1 Logic output 2	
			bit 2 Logic output 3	
			bit 3 Logic output 4	
			bit 4 Logic output 5	1
			bit 5 Logic output 6	1
			bit 6 Logic output 7	1
			bit 7 Logic output 8	1
			bits 8-15 (Reserved)	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
459	2004 : 0A	Word	I/O status	
			bit 0 Input 1	
			bit 1 Input 2	
			bit 2 Input 3	
			bit 3 Input 4	
			bit 4 Input 5	
			bit 5 Input 6	
			bit 6 Input 7	
			bit 7 Input 8	
			bit 8 Input 9	
			bit 9 Input 10	
			bit 10 Input 11	
			bit 11 Input 12	
			bit 12 Output 1 (13-14)	
			bit 13 Output 2 (23-24)	
			bit 14 Output 3 (33-34)	
			bit 15 Output 4 (95-96, 97-98)	
460	2004 : 0B	UInt	Alarm code , page 49	
461	2004 : 0C	Word	Alarm register 1	
			bits 0-1 (Not significant)	
			bit 2 Ground current alarm	
			bit 3 Thermal overload alarm	
			bit 4 (Not significant)	
			bit 5 Jam alarm	
			bit 6 Current phase imbalance alarm	
			bit 7 Undercurrent alarm	
			bits 8-9 (Not significant)	
			bit 10 HMI port alarm	
			bit 11 Controller internal temperature alarm	
			bits 12-14 (Not significant)	
			bit 15 Network port alarm	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
462	2004 : 0D	Word	Alarm register 2	
			bit 0 (Not significant)	
			bit 1 Diagnostic alarm	
			bit 2 (Reserved)	
			bit 3 Overcurrent alarm	
			bit 4 Current phase loss alarm	
			bit 5 Current phase reversal alarm	
			bit 6 Motor temperature sensor alarm	
			bit 7 Voltage phase imbalance alarm	1
			bit 8 Voltage phase loss alarm	1
			bit 9 (Not significant)	
			bit 10 Undervoltage alarm	1
			bit 11 Overvoltage alarm	1
			bit 12 Underpower alarm	1
			bit 13 Overpower alarm	1
			bit 14 Under power factor alarm	1
			bit 15 Over power factor alarm	1
463	2004 : 0E	Word	Alarm register 3	
			bit 0 LTME configuration alarm	
			bits 1-15 (Reserved)	
464	2004 : 0F		Motor temperature sensor degree (°C)	
465	2004 : 10	UInt	Thermal capacity level (% trip level)	
466	2004 : 11	UInt	Average current ratio (% FLC)	
467	2004 : 12	UInt	L1 current ratio (% FLC)	
468	2004 : 13	UInt	L2 current ratio (% FLC)	
469	2004 : 14	UInt	L3 current ratio (% FLC)	
470	2004 : 15	UInt	Ground current ratio (x 0.1 % FLC min)	
471	2004 : 16	UInt	Current phase imbalance (%)	
472	2004 : 17	Int	Controller internal temperature (°C)	
473	2004 : 18	UInt	Controller config checksum	
474	2004 : 19	UInt	Frequency (x 0.01 Hz)	2
475	2004 : 1A	UInt	Motor temperature sensor (x 0.1 Ω)	
476	2004 : 1B	UInt	Average voltage (V)	1
477	2004 : 1C	UInt	L3-L1 voltage (V)	1
478	2004 : 1D	UInt	L1-L2 voltage (V)	1
479	2004 : 1E	UInt	L2-L3 voltage (V)	1
480	2004 : 1F	UInt	Voltage phase imbalance (%)	1
481	2004 : 20	UInt	Power factor (x 0.01)	1
482	2004 : 21	UInt	Active power (x 0.1 kW)	1

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
483	2004 : 22	UInt	Reactive power (x 0.1 kVAR)	1
484	2004 : 23	Word	Auto restart status register	
			bit 0 Voltage dip occurred	
			bit 1 Voltage dip detection	
			bit 2 Auto restart immediate condition	
			bit 3 Auto restart delayed condition	
			bit 4 Auto restart manual condition	
			bits 5-15 (Not significant)	
485-489	2004 : 24 - 2004 : 28		*(Not significant)*	
490	2004 : 29	Word	Network port status	
			bit 0 Network port communicating	
			bit 1 Network port connected	
			bit 2 Network port self-testing	
			bit 3 Network port self-detecting	
			bit 4 Network port bad config	
			bits 5-15 (Not significant)	
491	2004 : 2A	UInt	network port baud rate , page 45	
492	2004 : 2B		*(Not significant)*	
493	2004 : 2C	UInt	Network port parity , page 46	
494-499	2004 : 2D - 2004 : 32		*(Not significant)*	
500-501	2004 : 33 - 2004 : 34	UDInt	Average current (x 0.01 A)	
502-503	2004 : 35 - 2004 : 36	UDInt	L1 current (x 0.01 A)	
504-505	2004 : 37 - 2004 : 38	UDInt	L2 current (x 0.01 A)	
506-507	2004 : 39 - 2004 : 3A	UDInt	L3 current (x 0.01 A)	
508-509	2004 : 3B - 2004 : 3C	UDInt	Ground current (mA)	
510	2004 : 3D	UInt	Controller port ID	
511	2004 : 3E	UInt	Time to trip (x 1 s)	
512	2004 : 3F	UInt	Motor last start current ratio (% FLC)	
513	2004 : 40	UInt	Motor last start duration (s)	
514	2004 : 41	UInt	Motor starts per hour count	

Register	CANopen Address	Variable Type	Read-only Variables	Note, page 41
515	2004 : 42	Word	Phase imbalances register	
			bit 0 L1 current highest imbalance	
			bit 1 L2 current highest imbalance	
			bit 2 L3 current highest imbalance	
			bit 3 L1-L2 voltage highest imbalance	1
			bit 4 L2-L3 voltage highest imbalance	1
			bit 5 L3-L1 voltage highest imbalance	1
			bits 6-15 (Not significant)	
516-523	2004 : 43 - 2004 : 4A	UInt	*(Reserved)*	1
524-539	2004 : 4B - 2004 : 5A	UInt	*(Forbidden)*	1

Configuration Variables

Configuration Variables

Configuration variables are described in the following table:

Configuration Variable Groups	Modbus Addresses	CANopen Addresses
Configuration	540 to 649	2005 : 01 to 2006 : 32
Setting	650 to 699	2007 : 01 to 2007 : 32

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
540	2005 : 01	UInt	Motor operating mode: 2 = 2-wire overload 3 = 3-wire overload 4 = 2-wire independent 5 = 3-wire independent 6 = 2-wire reverser 7 = 3-wire reverser 8 = 2-wire 2-step 9 = 3-wire 2-step 10 = 2-wire 2-speed 11 = 3-wire 2-speed 256-511 = Custom logic program (0-255)	B
541	2005 : 02	UInt	Motor transition timeout (s)	
542-544	2005 : 03 - 2005 : 05		*(Reserved)*	

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
545	2005 : 06	Word	Controller AC inputs setting register	
			bits 0-3 Controller AC logic inputs configuration , page 43	
			bits 4-15 (Reserved)	
546	2005 : 07	UInt	Thermal overload setting	B
			bits 0-2 Motor temperature sensor type: 0 = None 1 = PTC binary 2 = PT100 3 = PTC analog 4 = NTC analog	
			bits 3-4 Thermal overload mode: 0 = Definite 2 = Inverse thermal	
			bits 5-15 (Reserved)	
547	2005 : 08	UInt	Thermal overload trip definite timeout (s)	
548	2005 : 09		*(Reserved)*	
549	2005 : 0A	UInt	Motor temperature sensor trip threshold (x 0.1 Ω)	
550	2005 : 0B	UInt	Motor temperature sensor alarm threshold (x 0.1 Ω)	
551	2005 : 0C	UInt	Motor temperature sensor trip threshold degree (°C)	
552	2005 : 0D	UInt	Motor temperature sensor alarm threshold degree (°C)	
553	2005 : 0E	UInt	Rapid cycle lockout timeout (s)	
554	2005 : 0F	UInt	*(Reserved)*	
555	2005 : 10	UInt	Current phase loss timeout (x 0.1 s)	
556	2005 : 11	UInt	Overcurrent trip timeout (s)	
557	2005 : 12	UInt	Overcurrent trip threshold (% FLC)	
558	2005 : 13	UInt	Overcurrent alarm threshold (% FLC)	
559	2005 : 14	Word	Ground current trip configuration	B
			bit 0 Ground current mode	
			bits 1-15 (Reserved)	
560	2005 : 15	UInt	Ground current sensor client	
561	2005 : 16	UInt	Ground current sensor server	
562	2005 : 17	UInt	External ground current trip timeout (x 0.01 s)	
563	2005 : 18	UInt	External ground current trip threshold (x 0.01 A)	
564	2005 : 19	UInt	External ground current alarm threshold (x 0.01 A)	
565	2005 : 1A	UInt	Motor nominal voltage (V)	1
566	2005 : 1B	UInt	Voltage phase imbalance trip timeout starting (x 0.1 s)	1
567	2005 : 1C	UInt	Voltage phase imbalance trip timeout running (x 0.1 s)	1
568	2005 : 1D	UInt	Voltage phase imbalance trip threshold (% imb)	1
569	2005 : 1E	UInt	Voltage phase imbalance alarm threshold (% imb)	1
570	2005 : 1F	UInt	Overvoltage trip timeout (x 0.1 s)	1

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
571	2005 : 20	UInt	Overvoltage trip threshold (x Vnom)	1
572	2005 : 21	UInt	Overvoltage alarm threshold (x Vnom)	1
573	2005 : 22	UInt	Undervoltage trip timeout (x 0.1 s)	1
574	2005 : 23	UInt	Undervoltage trip threshold (x Vnom)	1
575	2005 : 24	UInt	Undervoltage alarm threshold (x Vnom)	1
576	2005 : 25	UInt	Voltage phase loss trip timeout (x 0.1 s)	1
577	2005 : 26	Word	Voltage dip setting	1
			bit 0 Load shedding enable	
			bit 1 Auto-restart enable	
			bits 2-15 (Reserved)	
578	2005 : 27	UInt	Load shedding timeout (s)	1
579	2005 : 28	UInt	Voltage dip threshold (% Vnom)	1
580	2005 : 29	UInt	Voltage dip restart timeout (s)	1
581	2005 : 2A	UInt	Voltage dip restart threshold (% Vnom)	1
582	2005 : 2B	UInt	Auto restart immediate timeout (x 0.1 s)	
583	2005 : 2C	UInt	Motor nominal power (x 0.1 kW)	1
584	2005 : 2D	UInt	Overpower trip timeout (s)	1
585	2005 : 2E	UInt	Overpower trip threshold (% Pnom)	1
586	2005 : 2F	UInt	Overpower alarm threshold (% Pnom)	1
587	2005 : 30	UInt	Underpower trip timeout (s)	1
588	2005 : 31	UInt	Underpower trip threshold (% Pnom)	1
589	2005 : 32	UInt	Underpower alarm threshold (% Pnom)	1
590	2005 : 33	UInt	Under power factor trip timeout (x 0.1 s)	1
591	2005 : 34	UInt	Under power factor trip threshold (x 0.01 PF)	1
592	2005 : 35	UInt	Under power factor alarm threshold (x 0.01 PF)	1
593	2005 : 36	UInt	Over power factor trip timeout (x 0.1 s)	1
594	2005 : 37	UInt	Over power factor trip threshold (x 0.01 PF)	1
595	2005 : 38	UInt	Over power factor alarm threshold (x 0.01 PF)	1
596	2005 : 39		Auto restart delayed timeout (s)	
597-599	2005 : 3A - 2005 : 3C		*(Reserved)*	
600	2006 : 01		*(Not significant)*	

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
601	2006 : 02	Word	General configuration register 1	
			bit 0 Controller system config required: 0 = exit the configuration menu 1 = go to the configuration menu	A
			bits 1-7 (Reserved)	
			Control mode configuration, bits 8-10 (one bit is set to 1):	
			bit 8 Config via HMI keypad enable	
			bit 9 Config via HMI engineering tool enable	
			bit 10 Config via network port enable	
			bit 11 Motor star-delta	B
			bit 12 Motor phases sequence: 0 = A B C 1 = A C B	
			bits 13-14 Motor phases , page 49	B
			bit 15 Motor auxiliary fan cooled (factory setting = 0)	
602	2006 : 03	Word	General configuration register 2	
			bits 0-2 Trip reset mode , page 49	C
			bit 3 HMI port parity setting: 0 = none 1 = even (factory setting)	
			bits 4-8 (Reserved)	
			bit 9 HMI port endian setting	
			bit 10 Network port endian setting	
			bits 11 HMI motor status LED color	
			bits 12-15 (Reserved)	
603	2006 : 04	UInt	HMI port address setting	
604	2006 : 05	UInt	HMI port baud rate setting (Baud)	
605	2006 : 06		*(Reserved)*	
606	2006 : 07	UInt	Motor trip class (s)	
607	2006 : 08		*(Reserved)*	
608	2006 : 09	UInt	Thermal overload trip reset threshold (% trip level)	
609	2006 : 0A	UInt	Thermal overload alarm threshold (% trip level)	
610	2006 : 0B	UInt	Internal ground current trip timeout (x 0.1 s)	
611	2006 : 0C	UInt	Internal ground current trip threshold (% FLCmin)	
612	2006 : 0D	UInt	Internal ground current alarm threshold (% FLCmin)	
613	2006 : 0E	UInt	Current phase imbalance trip timeout starting (x 0.1 s)	
614	2006 : 0F	UInt	Current phase imbalance trip timeout running (x 0.1 s)	
615	2006 : 10	UInt	Current phase imbalance trip threshold (% imb)	
616	2006 : 11	UInt	Current phase imbalance alarm threshold (% imb)	

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
617	2006 : 12	UInt	Jam trip timeout (s)	
618	2006 : 13	UInt	Jam trip threshold (% FLC)	
619	2006 : 14	UInt	Jam alarm threshold (% FLC)	
620	2006 : 15	UInt	Undercurrent trip timeout (s)	
621	2006 : 16	UInt	Undercurrent trip threshold (% FLC)	
622	2006 : 17	UInt	Undercurrent alarm threshold (% FLC)	
623	2006 : 18	UInt	Long start trip timeout (s)	
624	2006 : 19	UInt	Long start trip threshold (% FLC)	
625	2006 : 1A		*(Reserved)*	
626	2006 : 1B	UInt	HMI display contrast setting	
			bits 0-7 HMI display contrast setting	
			bits 8-15 HMI display brightness setting	
627	2006 : 1C	UInt	Contactor rating (0.1 A)	
628	2006 : 1D	UInt	Load CT client	B
629	2006 : 1E	UInt	Load CT server	B
630	2006 : 1F	UInt	Load CT multiple passes (passes)	B
631	2006 : 20	Word	Trip enable register 1	
			bits 0-1 (Reserved)	
			bit 2 Ground current trip enable	
			bit 3 Thermal overload trip enable	
			bit 4 Long start trip enable	
			bit 5 Jam trip enable	
			bit 6 Current phase imbalance trip enable	
			bit 7 Undercurrent trip enable	
			bit 8 (Reserved)	
			bit 9 Self test enable 0 = disable 1 = enable (factory setting)	
			bit 10 HMI port trip enable	
			bits 11-14 (Reserved)	
			bit 15 Network port trip enable	

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
632	2006 : 21	Word	Alarm enable register 1	
			bit 0 (Not significant)	
			bit 1 (Reserved)	
			bit 2 Ground current alarm enable	
			bit 3 Thermal overload alarm enable	
			bit 4 (Reserved)	
			bit 5 Jam alarm enable	
			bit 6 Current phase imbalance alarm enable	
			bit 7 Undercurrent alarm enable	
			bits 8- 9 (Reserved)	
			bit 10 HMI port alarm enable	
			bit 11 Controller internal temperature alarm enable	
			bits 12-14 (Reserved)	
			bit 15 Network port alarm enable	
633	2006 : 22	Word	Trip enable register 2	
			bit 0 (Reserved)	
			bit 1 Diagnostic trip enable	
			bit 2 Wiring trip enable	
			bit 3 Overcurrent trip enable	
			bit 4 Current phase loss trip enable	
			bit 5 Current phase reversal trip enable	
			bit 6 Motor temperature sensor trip enable	
			bit 7 Voltage phase imbalance trip enable	1
			bit 8 Voltage phase loss trip enable	1
			bit 9 Voltage phase reversal trip enable	1
			bit 10 Undervoltage trip enable	1
			bit 11 Overvoltage trip enable	1
			bit 12 Underpower trip enable	1
			bit 13 Overpower trip enable	1
			bit 14 Under power factor trip enable	1
			bit 15 Over power factor trip enable	1

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
634	2006 : 23	Word	Alarm enable register 2	
			bit 0 (Reserved)	
			bit 1 Diagnostic alarm enable	
			bit 2 (Reserved)	
			bit 3 Overcurrent alarm enable	
			bit 4 Current phase loss alarm enable	
			bit 5 (Reserved)	
			bit 6 Motor temperature sensor alarm enable	
			bit 7 Voltage phase imbalance alarm enable	1
			bit 8 Voltage phase loss alarm enable	1
			bit 9 (Reserved)	1
			bit 10 Undervoltage alarm enable	1
			bit 11 Overvoltage alarm enable	1
			bit 12 Underpower alarm enable	1
			bit 13 Overpower alarm enable	1
			bit 14 Under power factor alarm enable	1
			bit 15 Over power factor alarm enable	1
635-636	2006 : 24 - 2006 : 25		*(Reserved)*	
637	2006 : 26	UInt	Auto-reset attempts group 1 setting	
638	2006 : 27	UInt	Auto-reset group 1 timeout	
639	2006 : 28	UInt	Auto-reset attempts group 2 setting	
640	2006 : 29	UInt	Auto-reset group 2 timeout	
641	2006 : 2A	UInt	Auto-reset attempts group 3 setting	
642	2006 : 2B	UInt	Auto-reset group 3 timeout	
643	2006 : 2C	UInt	Motor step 1 to 2 timeout	
644	2006 : 2D	UInt	Motor step 1 to 2 threshold	
645	2006 : 2E	UInt	HMI port fallback setting , page 48	
646-649	2006 : 2F - 2006 : 32		*(Reserved)*	
650	2007 : 01	Word	HMI language setting register:	
			bit 0-4 HMI language setting , page 48	
			bits 5-15 (Not significant)	

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
651	2007 : 02	Word	HMI display items register 1	
			bit 0 HMI display average current enable	
			bit 1 HMI display thermal capacity level enable	
			bit 2 HMI display L1 current enable	
			bit 3 HMI display L2 current enable	
			bit 4 HMI display L3 current enable	
			bit 5 HMI display ground current enable	
			bit 6 HMI display motor status enable	
			bit 7 HMI display current phase imbalance enable	
			bit 8 HMI display operating time enable	
			bit 9 HMI display I/O status enable	
			bit 10 HMI display reactive power enable	
			bit 11 HMI display frequency enable	
			bit 12 HMI display starts per hour enable	
			bit 13 HMI display control mode enable	
			bit 14 HMI display start statistics enable	
			bit 15 HMI motor temperature sensor enable	
652	2007 : 03	UInt	Motor full load current ratio, FLC1 (% FLCmax)	
653	2007 : 04	UInt	Motor high speed full load current ratio, FLC2 (% FLCmax)	
654	2007 : 05	Word	HMI display items register 2	
			bit 0 HMI display L1-L2 voltage enable	1
			bit 1 HMI display L2-L3 voltage enable	1
			bit 2 HMI display L3-L1 voltage enable	1
			bit 3 HMI display average voltage enable	1
			bit 4 HMI display active power enable	1
			bit 5 HMI display power consumption enable	1
			bit 6 HMI display power factor enable	1
			bit 7 HMI display average current ratio enable	
			bit 8 HMI display L1 current ratio enable	1
			bit 9 HMI display L2 current ratio enable	1
			bit 10 HMI display L3 current ratio enable	1
			bit 11 HMI display thermal capacity remaining enable	
			bit 12 HMI display time to trip enable	
			bit 13 HMI display voltage phase imbalance enable	1
			bit 14 HMI display date enable	
			bit 15 HMI display time enable	
655-658	2007 : 06 - 2007 : 09	Word[4]	Date and time setting , page 44	

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
659	2007 : 0A	Word	HMI display items register 3	
			bit 0 HMI display temperature sensor degree CF	
			bits 1-15 (Reserved)	
660-681	2007 : 0B - 2007 : 20		*(Reserved)*	
682	2007 : 21	UInt	Network port fallback setting , page 48	
683	2007 : 22	Word	Control setting register	
			bits 0-1 *(Reserved)*	
			bit 2 Control remote local default mode (with LTMCU) 0 = remote 1 = local	
			bit 3 *(Reserved)*	
			bit 4 Control remote local buttons enable (with LTMCU) 0 = disable 1 = enable	
			bits 5-6 Control remote channel setting (with LTMCU) 0 = network 1 = terminal strip 2 = HMI	
			bit 7 *(Reserved)*	
			bit 8 Control local channel setting 0 = terminal strip 1 = HMI	
			bit 9 Control direct transition 0 = stop required during transition 1 = stop not required during transition	
			bit 10 Control transfer mode 0 = bump 1 = bumpless	
			bit 11 Stop terminal strip disable 0 = enable 1 = disable	
			bit 12 Stop HMI disable 0 = enable 1 = disable	
			bits 13-15 *(Reserved)*	
684-692	2007 : 23 - 2007 : 2D	Word	*(Reserved*	
695	2007 : 2E	UInt	Network port baud rate setting (Baud) , page 45	
696	2007 : 2F	UInt	Network port address setting	
697-699	2007 : 30 - 2007 : 32	Word	*(Not significant)*	

Command Variables

Command Variables

Command variables are described in the following table:

Register	CANopen Address	Variable Type	Read/Write Variables	Note, page 41
700	2008 : 01	Word	Register available to remotely write commands that can be processed in a specific custom logic	
701-703	2008 : 02 - 2008 : 04		*(Reserved)*	
704	2008 : 05	Word	Control register 1	
			bit 0 Motor run forward command[3]	
			bit 1 Motor run reverse command (1)	
			bit 2 (Reserved)	
			bit 3 Trip reset command	
			bit 4 (Reserved)	
			bit 5 Self test command	
			bit 6 Motor low speed command	
			bits 7-15 (Reserved)	
705	2008 : 06	Word	Control register 2	
			bit 0 Clear all command Clear all parameters, except: • Motor LO1 closings count • Motor LO2 closings count • Controller internal temperature max • Thermal capacity level	
			bit 1 Clear statistics command	
			bit 2 Clear thermal capacity level command	
			bit 3 Clear controller settings command	
			bit 4 Clear network port settings command	
			bits 5-15 (Reserved)	
706-709	2008 : 07 - 2008 : 0A		*(Reserved)*	
707-799	2008 : 0B - 2008 : 64		*(Forbidden)*	

Custom Logic Variables

Custom Logic Variables

Custom logic variables are described in the following tables:

3. Even in Overload mode, bits 0 and 1 of register 704 can be used to remotely control LO1 and LO2.

Modbus Address	CANopen Address	Variable Type	Read-only Variables	Note, page 41
1200	200D : 01	Word	Custom logic status register	
			bit 0 Custom logic run	
			bit 1 Custom logic stop	
			bit 2 Custom logic reset	
			bit 3 Custom logic second step	
			bit 4 Custom logic transition	
			bit 5 Custom logic phase reverse	
			bit 6 Custom logic network control	
			bit 7 Custom logic FLC selection	
			bit 8 (Reserved)	
			bit 9 Custom logic auxiliary 1 LED	
			bit 10 Custom logic auxiliary 2 LED	
			bit 11 Custom logic stop LED	
			bit 12 Custom logic LO1	
			bit 13 Custom logic LO2	
			bit 14 Custom logic LO3	
			bit 15 Custom logic LO4	
1201	200D : 02	Word	Custom logic version	
1202	200D : 03	Word	Custom logic memory space	
1203	200D : 04	Word	Custom logic memory used	
1204	200D : 05	Word	Custom logic temporary space	
1205	200D : 06	Word	Custom logic non volatile space	
1206-1249	200D : 07 - 200D : 32		*(Reserved*)	

Modbus Address	CANopen Address	Variable Type	Read-only Variables	Note, page 41
1250	200D : 33	Word	Custom logic setting register 1	
			bit 0 (Reserved)	
			bit 1 Logic input 3 external ready enable	
			bits 2-15 (Reserved)	
1251-1269	200D : 34 - 200D : 46		*(Reserved*)	
1270	200D : 47	Word	Custom logic command register 1	
			bit 0 Custom logic external trip command	
			bits 1-15 (Reserved)	
1271-1279	200D : 48 - 200D : 50		*(Reserved*)	

Modbus Address	CANopen Address	Variable Type	Read-only Variables	Note, page 41
1280	200D : 51	Word	Custom logic monitoring register 1	
			bit 0 Custom logic monitoring external trip	
			bit 1 Custom logic system ready	
			bits 2-15 (Reserved)	
1281-1300	200D : 52 - 200D : 65		*(Reserved*)	
Modbus Address	**CANopen Address**	**Variable Type**	**Read-only Variables**	**Note, page 41**
1301-1399	200D : 66 - 200D : C8	Word[99]	General purpose registers for logic functions	

Glossary

A

active power:

Also known as *real power*, active power is the rate of producing, transferring, or using electrical energy. It is measured in watts (W) and often expressed in kilowatts (kW) or megawatts (MW).

analog:

Describes inputs (for example, temperature) or outputs (for example, motor speed) that can be set to a range of values. Contrast with discrete.

apparent power:

The product of current and voltage, apparent power consists of both active power and reactive power. It is measured in volt-amperes and often expressed in kilovolt-amperes (kVA) or megavolt-amperes (MVA).

C

CANopen:

An open industry standard protocol used on the internal communication bus. The protocol allows the connection of any standard CANopen device to the island bus.

CT:

current transformer.

D

definite time:

A variety of TCC or TVC where the initial magnitude of the trip time delay remains a constant, and does not vary in response to changes in the value of the measured quantity (for example, current). Contrast with inverse thermal.

device:

In the broadest terms, any electronic unit that can be added to a network. More specifically, a programmable electronic unit (for example, PLC, numeric controller, or robot) or I/O card.

DeviceNet:

DeviceNet is a low-level, connection-based network protocol that is based on CAN, a serial bus system without a defined application layer. DeviceNet, therefore, defines a layer for the industrial application of CAN.

DIN rail:

A steel mounting rail, made pursuant to DIN standards (typically 35 mm wide) that allows for easier "snap-on" mounting of IEC electrical devices, including the LTMR controller and the expansion module. Contrast with screw mounting of devices to a control panel by drilling and tapping holes.

DIN:

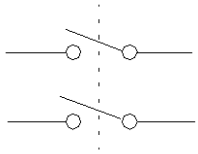
Deutsches Institut für Normung. The European organization that organizes the creation and maintenance of dimensional and engineering standards.

discrete:

Describes inputs (for example, switches) or outputs (for example, coils) that can be only *ON* or *OFF*. Contrast with analog.

DPST:

double-pole/single-throw. A switch that connects or disconnects two circuit conductors in a single branch circuit. A DPST switch has four terminals, and is the equivalent of two single-pole/single-throw switches controlled by a single mechanism, as depicted below:



E

endian setting (big endian):

'big endian' means that the high-order byte/word of the number is stored in memory at the lowest address, and the low-order byte/word at the highest address (the big end comes first).

endian setting (little endian):

'little endian' means that the low-order byte/word of the number is stored in memory at the lowest address, and the high-order byte/word at the highest address (the little end comes first).

EtherNet/IP:

(Ethernet Industrial Protocol) is an industrial application protocol built on TCP/IP and CIP protocols. It is mainly used on automated networks, it defines network devices as network objects as to allow the communication between industrial control system and their components; (programmable automation controller, programmable logic controller, I/O systems).

F

FLC1:

Motor Full Load Current Ratio. FLC parameter setting for low or single speed motors.

FLC2:

Motor High Speed Full Load Current Ratio. FLC parameter setting for high-speed motors.

FLC:

full load current. Also known as *rated current*. The current the motor will draw at the rated voltage and rated load. The LTMR controller has two FLC settings: FLC1 (Motor Full Load Current Ratio) and FLC2 (Motor High Speed Full Load Current Ratio), each set as a percentage of FLC max.

FLCmax:

Full Load Current Max. Peak current parameter.

FLCmin:

Minimum Full Load Current. The smallest amount of motor current the LTMR controller will support. This value is determined by the LTMR controller model.

H

hysteresis:

A value-added to lower limit threshold settings or subtracted from upper limit threshold settings-that retards the response of the LTMR controller before it stops measuring the duration of trips and alarms.

I

inverse thermal:

A variety of TCC where the initial magnitude of the trip time delay is generated by a thermal model of the motor and varies in response to changes in the value of the measured quantity (for example, current). Contrast with definite time.

M

Modbus:

Modbus is the name of the client-server serial communications protocol developed by Modicon (now Schneider Automation, Inc.) in 1979, which has since become a standard network protocol for industrial automation.

N

nominal power:

Motor Nominal Power. Parameter for the power a motor will produce at rated voltage and rated current.

nominal voltage:

Motor Nominal Voltage. Parameter for rated voltage.

NTC analog:

Type of RTD.

NTC:

negative temperature coefficient. Characteristic of a thermistor-a thermally sensitive resistor-whose resistance increases as its temperature falls, and whose resistance decreases as its temperature rises.

P

PLC:

programmable logic controller.

power factor:

Also called *cosine phi* (or ϕ), power factor represents the absolute value of the ratio of active power to apparent power in AC power systems.

PROFIBUS DP:

An open bus system that uses an electrical network based on a shielded two wire line or an optical network based on a fiber-optic cable.

PT100:

Type of RTD.

PTC analog:

Type of RTD.

PTC binary:

Type of RTD.

PTC:

positive temperature coefficient. Characteristic of a thermistor-a thermally sensitive resistor-whose resistance increases as its temperature rises, and whose resistance decreases as its temperature falls.

R

reset time:

Time between a sudden change in the monitored quantity (for example, current) and the switching of the output relay.

rms:

root mean square. A method of calculating average AC current and average AC voltage. Because AC current and AC voltage are bi-directional, the arithmetic average of AC current or voltage always equals 0.

RTD:

resistance temperature detector. A thermistor (thermal resistor sensor) used to measure the temperature of the motor. Required by the LTMR controller's Motor Temp Sensor motor protection function.

T

TCC:

trip curve characteristic. The type of delay used to trip the flow of current in response to a trip condition. As implemented in the LTMR controller, all motor protection function trip time delays are definite time, except for the Thermal Overload function, which also offers inverse thermal trip time delays.

TVC:

trip voltage characteristic. The type of delay used to trip the flow of voltage in response to a trip condition. As implemented by the LTMR controller and the expansion module, all TVCs are definite time.

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