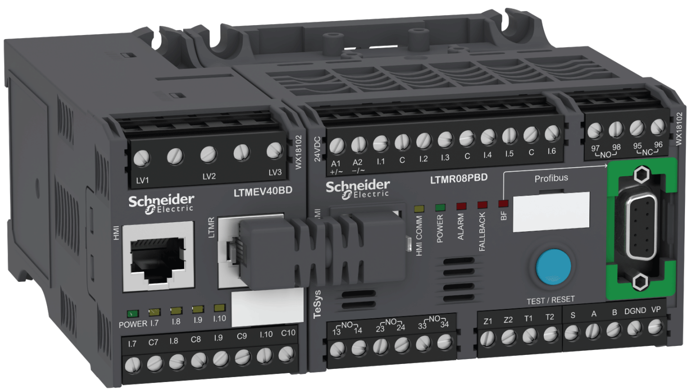
TeSys™ T LTMR

Motor Management Controller

PROFIBUS DP Communication Guide

DOCA0131EN-03
02/2024



Schneider Electric

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Legal Information

This document contains standardized industry terms that may be deemed inappropriate by our customers.

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.

Product Related Information

Read and understand these instructions before performing any procedure with this device.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this system. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Many components of the product, including the printed circuit boards, operate with mains voltage. Do not touch. Use only electrically insulated tools.
- Do not touch unshielded components or terminals with voltage present.
- Motors can generate voltage when the shaft is rotated. Prior to performing any type of work on the system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors of the motor cable.
- Before performing work on the system, disconnect all power including external control power that may be present; place a **Do Not Turn On** label on all power switches; and lock all power switches in the open position.
- Install and close all covers before applying voltage.

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

Controllers may perform unexpected movements because of incorrect wiring, incorrect settings, incorrect data, or other user errors.

Damaged products or accessories may cause electric shock or unanticipated equipment operation.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Do not use damaged products or accessories.

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

Contact your local Schneider Electric sales office if you detect any damage whatsoever.

WARNING

UNANTICIPATED EQUIPMENT OPERATION

- Carefully install the wiring in accordance with the EMC requirements.
- Do not operate the product with unknown or unsuitable settings or data.
- Perform a comprehensive commissioning test.

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

⚠ 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.
- 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.
- Observe all accident prevention regulations and local safety guidelines.[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.

⚠ **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.

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

About the Book

Document Scope

This guide describes the PROFIBUS DP 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 all 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 (HMI) 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 PROFIBUS DP 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 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 - CANopen Communication Guide	This guide describes the CANopen network protocol version of the TeSys T LTMR motor management controller.	DOCA0132EN
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

Title of Documentation	Description	Reference Number
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 overview of electromagnetic compatibility considerations for equipment installations.	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

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

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 industrial applications. 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.

Firmware Update Policy

Firmware update is recommended to benefit from the latest features and potential bug fixes. Update the firmware to the latest version when the latest features and bug fixes are required for your application. Use the firmware release notes to confirm if an update to the latest version of the firmware is relevant for your application. The latest firmware and release notes can be found together by searching for "TeSys T Firmware" at www.se.com.

Firmware Update with TeSys Programmer

Use the latest version of TeSys Programmer software to update the TeSys T range of devices with the latest firmware version available. The latest version of TeSys Programmer software is available at www.se.com. For more information on the use of TeSys Programmer software, refer to TeSys Programmer Help document that is provided with the software.

Cyber Security

Introduction

Cyber Security is a branch of network administration that addresses attacks on or by computer systems and through computer networks that can result in accidental or intentional disruptions.

The objective of Cyber Security is to help provide increased levels of protection for information and physical assets from theft, corruption, misuse, or accidents while maintaining access for their intended users.

No single Cyber Security approach is adequate. Schneider Electric recommends a defense-in-depth approach. Conceived by the **National Security Agency** (NSA), this approach layers the network with security features, appliances, and processes.

The basic components of Schneider Electric's defense-in-depth approach are:

1. Risk assessment. A systematic security analysis of the deployment environment and related systems.
2. A security plan built on the results of the risk assessment.
3. A multi-phase training campaign.
4. Network separation and segmentation. Physical separation of the control network from other networks using a demilitarized zone (DMZ), and the division of the control network itself into segments and security zones.
5. System Access Control. Controlling logical and physical access to the system with firewalls, authentication, authorization, VPN, and antivirus software. This effort also includes traditional physical security measures such as video surveillance, fences, locked doors and gates, and locked equipment cabinets.
6. Device hardening, the process of configuring a device against communication-based threats. Device hardening measures include disabling unused network ports, password management, access control, and the disabling of all unnecessary protocols and services.
7. Network monitoring and maintenance. An effective defense-in-depth campaign requires continual monitoring and system maintenance to meet the challenge of new threats as they develop.

This chapter defines the elements that help you configure a system that is less susceptible to cyber attacks.

For detailed information on the defense-in-depth approach, refer to the document **Reduce Vulnerability to Cyber Attacks in the Control Room** on the Schneider Electric website.

To submit a Cyber Security question, report security issues, or get the latest news from Schneider Electric, visit the Schneider Electric website.

Backing-up and Restoring the Software Configuration

To protect your data, Schneider Electric recommends backing-up the device configuration and keeping your backup file in a secure place. The backup is available in the device DTM, using "load from device" and "store to device" functions.

Remote Access to the Device

When remote access is used between a device and the motor management controller, ensure your network is secure (VPN, firewall…).

Machines, controllers, and related equipment are usually integrated into networks. Unauthorized persons and malware may gain access to the machine as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to software and networks.

⚠WARNING

UNAUTHORIZED ACCESS TO THE MACHINE VIA SOFTWARE AND NETWORKS

- In your hazard and risk analysis, consider all hazards that result from access to and operation on the network/fieldbus and develop an appropriate cyber security concept.
- Verify that the hardware infrastructure and the software infrastructure into which the machine is integrated as well as all organizational measures and rules covering access to this infrastructure consider the results of the hazard and risk analysis and are implemented according to best practices and standards covering IT security and cyber security (such as: ISO/IEC 27000 series, Common Criteria for Information Technology Security Evaluation, ISO/ IEC 15408, IEC 62351, ISA/IEC 62443, NIST Cybersecurity Framework, Information Security Forum - Standard of Good Practice for Information Security).
- Verify the effectiveness of your IT security and cyber security systems using appropriate, proven methods.

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

Data Flow Restriction

To control the access to the device and limit the data flow, the use of a firewall is required (for example, a ConneXium Tofino Firewall).

The ConneXium TCSEFEA Tofino firewall is a security appliance that provides levels of protection against cyber threats for industrial networks, automation systems, SCADA systems, and process control systems.

This firewall is designed to permit or deny communications between devices connected to the external network connection of the firewall and the devices connected to the internal network connection.

The firewall can restrict network traffic based on user defined rules that would permit only authorized devices, communication types and services.

The firewall includes built-in security modules and an off-line configuration tool for creating zones within an industrial automation environment.

Wiring of the PROFIBUS DP Network

Overview

This chapter describes how to connect the LTMR controller to an RS 485 PROFIBUS DP network with a SUB-D 9 or an open-style connector.

⚠ 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.
- 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.
- Observe all accident prevention regulations and local safety guidelines.[2]
- 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.

PROFIBUS DP Network Characteristics

Overview

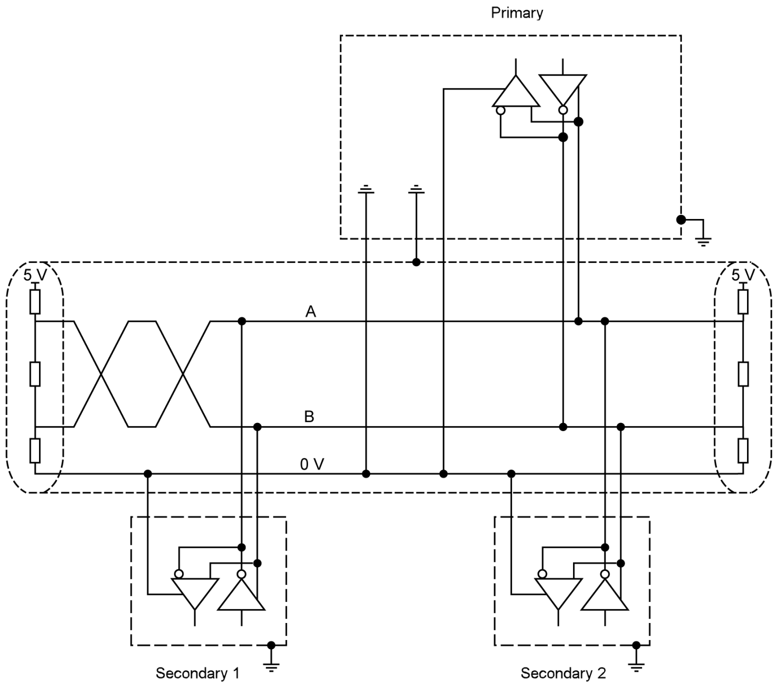
The LTMR PROFIBUS DP controller complies with the PROFIBUS DP standard specification.

The *PROFIBUS Installation Guideline for Design* and *PROFIBUS Installation Guideline for Cabling and Assembly*, published on www.profibus.com/downloads/, define the characteristics of the Modbus protocol.

PROFIBUS DP Network Standard Diagram

The diagram below corresponds to the PROFIBUS DP standard specification.

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



Characteristics for Connection to the PROFIBUS DP RS 485 Bus

The RS 485 standard allows variants of some characteristics:

- Polarization
- Line terminator
- Number of secondaries
- Bus length

Characteristics	Value
Topology	Linear bus with line terminations
Transmission Mode	Half duplex
Transmission Rate	From (in kBaud): • 9.6 • 19.2 • 45.45 • 93.75 • 187.5 • 500 • 1,500 Up to (in MBaud): • 3 • 6 • 12
Possible Transmission Media	Twisted-pair line (standard version, type RS 485)
Maximum number of secondaries connected to one primary	128 (0, 126, and 127 are reserved)
Maximum number of secondaries per derivation	32

Characteristics	Value
Maximum number of repeaters per bus	Nine repeaters maximum including five repeaters maximum cascaded in one derivation
Line terminator	Active termination

Use of Repeaters

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

- Maximum length of the sum of derivations reached
- Need to connect more than 32 secondary communicating devices 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 PROFIBUS Installation Guideline for Design.

Maximum Bus Cable Length

The bus cable lengths and corresponding baud rates are as follows:

Maximum Bus Cable Length per Segment	Maximum Bus Cable Length with Three Repeaters	Baud Rates
1,200 m (3,936 ft)	4,800 m (15,748 ft)	9.6 / 19.2 / 45.45 / 93.75 kBaud
1,000 m (3,280 ft)	4,000 m (13,123 ft)	187.5 kBaud
500 m (1,640 ft)	2,000 m (6,561 ft)	500 kBaud
200 m (656 ft)	800 m (2,624 ft)	1.5 MBaud
100 m (328 ft)	400 m (1,312 ft)	3 / 6 / 12 MBaud

PROFIBUS DP Communication Port Wiring Terminal Characteristics

General

The main physical characteristics of a PROFIBUS DP port are:

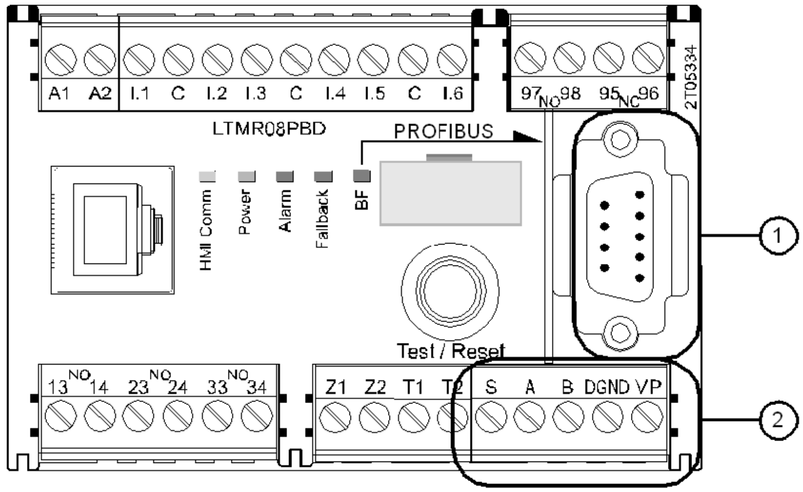
Physical interface	Multipoint 2-wire RS 485 - electrical networking
Connector	Terminal block and SUB-D 9

Physical Interface and Connectors

The LTMR controller is equipped with two connector types, on the front face:

1. A shielded SUB D 9 socket connector,
2. An open-style removable terminal block.

The figure shows the LTMR front face with the PROFIBUS DP connectors:



Both connectors are electrically identical. They follow the PROFIBUS DP interoperability standards.

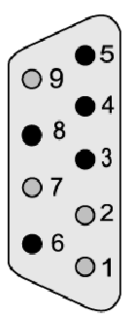
NOTE: The product must be connected through only one port. The use of the SUB-D 9 connector is recommended.

⚠ CAUTION
UNINTENDED EQUIPMENT OPERATION
Pin VP of the terminal block is used for the line termination resistance connection. Do not connect any power supply on it. **Failure to follow these instructions can result in injury or equipment damage.**

SUB-D 9 Connector Pinout

The LTMR controller is connected to the PROFIBUS DP network with a SUB-D 9-pin connector in compliance with the following wiring:

Front view



The SUB-D 9 wiring layout is as follows:

Pin No.	Signal	Description
1	(Shield)	Not used
2	M24	Not used

Pin No.	Signal	Description
3	RxD/TxD-P (B)	Positive data transmission (RD+ / TD+) = B
4	CNTR-P	Positive repeater monitoring signal (direction monitoring)
5	DGND	Data transmission ground
6	VP	Line termination bias voltage
7	P24	Not used
8	RxD/TxD-N (A)	Negative data transmission (RD- / TD-) = A
9	CNTR-N	(Negative repeater monitoring signal, direction monitoring) Not used

Open Style Terminal Block

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

Pin	Signal	Description
1	Shield	Shield
2	RxD/TxD-N (A)	Negative data transmission (RD- / TD-) = A
3	RxD/TxD-P (B)	Positive data transmission (RD+ / TD+) = B
4	DGND	Data transmission ground
5	VP	Line termination bias voltage

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 PROFIBUS DP Network

Overview

The recommended way to connect an LTMR controller to a PROFIBUS DP network on the RS 485 bus is the connection via the socket shielded SUB-D 9 connector.

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

Precautions

Always follow the recommendations for wiring and connecting.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

This equipment must be installed, programmed, and serviced only by qualified personnel.

- Follow all up-to-date instructions, standards and regulations.
- Check the function settings before starting the motor.
- Do not downgrade or modify these devices.

Incorrect configuration can result in unpredictable behavior of the devices.

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

PROFIBUS DP Wiring Rules

The following wiring rules must be respected in order to reduce EMC disturbance 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 the PROFIBUS DP cable 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 PROFIBUS DP 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.
  - Use a collar to ground the shield.
- 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 an active termination at each end of the bus to avoid malfunctions on the communication bus.
- Wire the bus between each connector directly, without intermediate terminal blocks.
- The common polarity (0 V) 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 primary device or on the polarization device.

For more information, refer to the chapter titled “EMC Guidelines” in Electrical Installation Guide, document number EIGED306001EN (available in English only).

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.

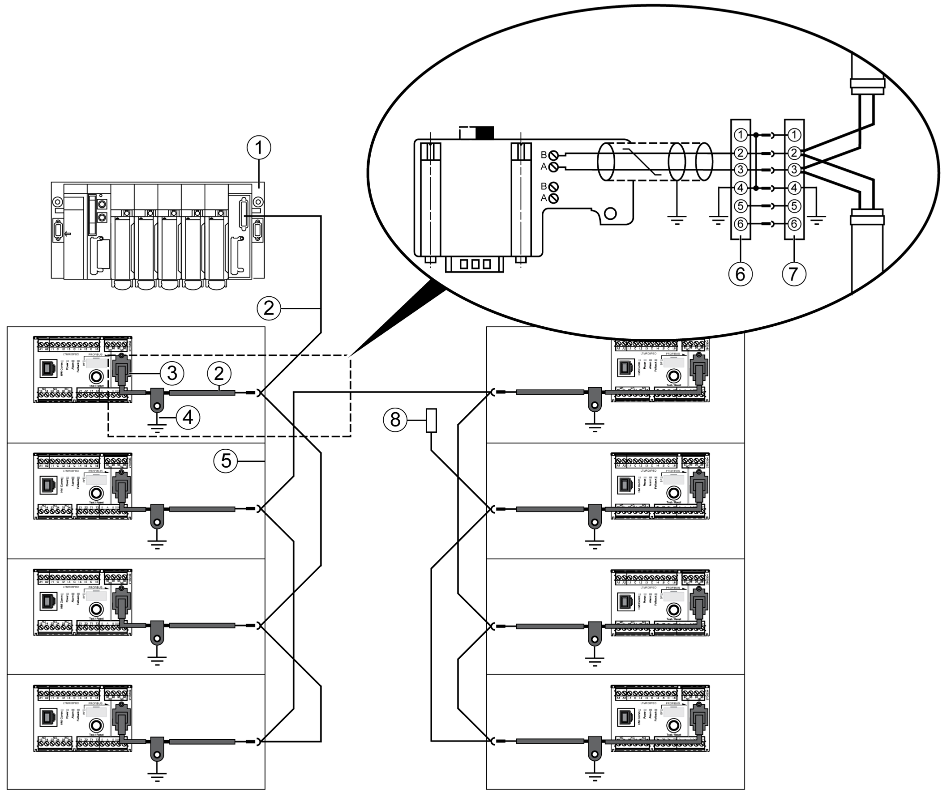
LTMR Controllers Installed in a Blokset or Okken Motor Control Switchboard

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 EMC instructions described in this guide and also refer to the 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 RS 485 bus via the SUB-D 9 connector and hardwired cables is as follows:



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

2 PROFIBUS DP shielded cable TSX PBS CA •00

3 SUB-D 9 plug connector 490 NAD 911 0•

4 Grounding of the PROFIBUS DP cable shield

5 Withdrawable drawer

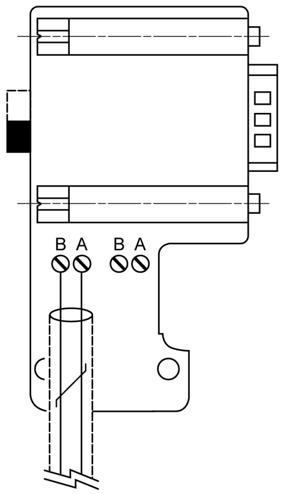
6 Withdrawable drawer part of the auxiliary connector

7 Fixed part of the auxiliary connector

8 Line terminator VW3 A8 306 DR (120 Ω)

SUB-D 9 Plug Connector

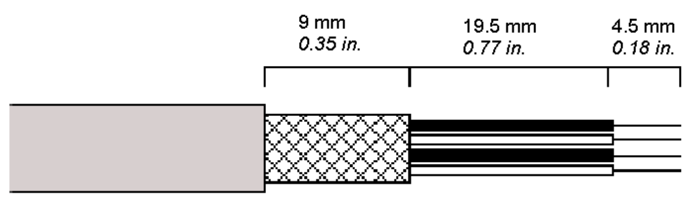
The following figure illustrates the connection of a PROFIBUS DP cable:



SUB-D 9 Connector Wiring

The following table 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 the end of each wire and mount on terminals.



List of PROFIBUS DP Accessories

List of PROFIBUS DP connection accessories:

Designation	Description	Reference
PROFIBUS DP SUB-D 9 plug connectors	Connector with terminator	490 NAD 911 03
	In-line connector	490 NAD 911 04
	In-line connector with programming port	490 NAD 911 05

List of PROFIBUS DP Cables

List of PROFIBUS DP connection cables:

Description	Reference
100 m (328 ft) cable	TSX PBS CA 100
400 m (1,312 ft) cable	TSX PBS CA 400

Using the PROFIBUS DP Communication Network

Overview

This chapter describes how to use the LTMR controller via the network port using the PROFIBUS DP 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.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or interruptions of the link.
- Observe all accident prevention regulations and local safety guidelines.[3]
- 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.

⚠ 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.

PROFIBUS DP Protocol Principle and Main Features

Overview

PROFIBUS DP is an open industrial standard for integrated communication. It is a serial fieldbus, which provides a decentralized connection between sensors, actuators and I/O modules produced by various manufacturers, and connects them to the superset control level.

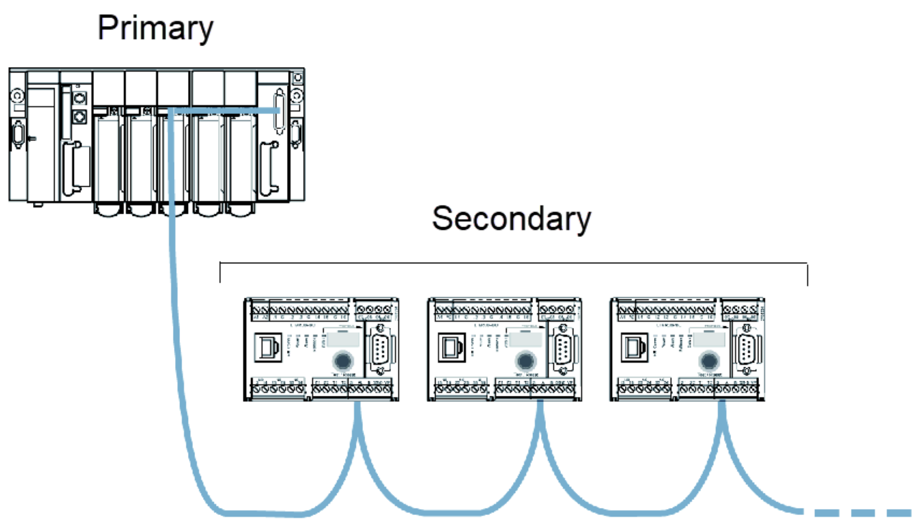
PROFIBUS DP (**D**istributed **P**eriphery - Primary/Secondary Network) is a PROFIBUS communication profile which is optimized for performance. It is optimized for speed,

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

efficiency and inexpensive hook-up cost and is designed especially for communication between automation systems and distributed peripheral equipment.

The PROFIBUS DP network supports multiple primary systems with several secondaries.

The PROFIBUS DP protocol is a primary-secondary protocol:



PROFIBUS DP Features

The following table contains specifications of the PROFIBUS DP:

Standard	EN 501 70 DIN 19245
Transmission Equipment (Physical Profile)	EIA RS-485
Transfer Procedure	Half-duplex
Bus Topology	Linear bus with active bus termination
Bus Cable Type	Shielded, twisted-pair conductors
Connector	SUB-D 9-pin Open style
Number of Nodes on the Bus	Maximum of 32 with no repeaters Maximum of 125 with three repeaters in four segments

General Information on Implementation via PROFIBUS DP

Overview

The PROFIBUS DP LTMR controller supports a PROFIBUS DP application profile based on DP V0 and DP V1 services: Motor Management Starter (MMS).

Cyclic/Acyclic Services

In general, data is exchanged via cyclic services and via acyclic services.

The application profiles define, for the cyclic data:

- Manufacturer independent data,
- Manufacturer-specific data.

The fixed set and defined use of manufacturer independent data enables the replacement of a module from vendor A by a module from vendor B.

DP V1 Read/ Write Services

DP V1 read and write services enable access to the data that cannot be accessed by cyclic data exchange.

PKW Feature

In order to make this data accessible also for DP V0 primaries, a special feature, called PKW (**P**eriodically **K**ept in acyclic **W**ords), is implemented.

In cyclically exchanged data, there are encapsulated request and response frames. They provide access to the TeSys T system´s internal registers.

NOTE: This feature can be selected or deselected by choosing the relevant item (module) from the list offered during configuration with any PROFIBUS DP configuration tool.

Clear Mode Option

The LTMR controller supports the Clear Mode option. When the PROFIBUS DP primary is in Clear Mode, the LTMR controller generates a communication trip, if enabled, and applies its fallback condition.

As soon as PROFIBUS DP data packets are received, the LTMR controller removes its fallback condition.

NOTE: Clear Mode is only applied by the PROFIBUS DP primary on DP V0 output data packets. Get Diagnostics packets, SYNC packets, DP V1 packets are not impacted by Clear Mode. For this reason, if communication trip is enabled, as for other trips, the LTMR controller O.4 output (trip relay) must be used.

Configuration of the LTMR PROFIBUS DP Network Port

Communication Parameters

Use the TeSys T DTM or the HMI to configure the following PROFIBUS DP 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 PROFIBUS DP bus. You can assign an address from 1 to 125. The factory setting for the address is 126.

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: Address 0 is an invalid value and is not permitted. A return to factory settings command sets the Node-ID to the invalid value 126.

Setting the Baud Rate

Set the baud rate to the only possible speed: 65,535 = Autobaud.

Use the TeSys T DTM or the HMI to configure the communication parameter Network Port Baud Rate Setting.

The factory setting for the Network Port Baud Rate Setting parameter is Autobaud (0xFFFF). Using Autobaud, the LTMR controller adapts its baud rate to that of the primary.

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).

Modules as Presented in the GS*-File

Overview

The TeSys T system is presented as a "modular device" on PROFIBUS DP.

You must select one of the modules described in the following sections with/without PKW during configuration.

The TeSys T system is described by a GS*-file. This file is used by any PROFIBUS DP configuration tool to get information about the device.

GS*-Files

The file for the PROFIBUS DP LTMR is called CCCCCC.GS*. The asterisk (*) is replaced by E for English, F for French, G for German, and so on (D for Default).

- For the GSx files 2.01, CCCCCC stands for SE210B48.GSx.
- For the GSx files 2.02, CCCCCC stands for SE220B48.GSx.

The GS*-files and icons 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 files > EDS&GSD for TeSys T**). GS*-files and icons are grouped in a single compressed Zip file that you must unzip to a single directory on your hard disk drive.

⚠DANGER

UNINTENDED EQUIPMENT OPERATION

Do not modify the GS*-file in any way.

Modifying the GS*-file can cause unpredictable behavior of the devices.

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

NOTE: If the GS*-file is modified in any way, the Schneider Electric guarantee is immediately voided.

Modules Without PKW

Short and long description of modules without PKW:

Short Description as Shown in the General Station Description (GSD)	Long Description
MMC R	Motor Management Controller, remote configuration mode
MMC R EV40	Motor Management Controller, LTMEV40, remote configuration mode
MMC L	Motor Management Controller, local configuration mode
MMC L EV40	Motor Management Controller, LTMEV40, local configuration mode

In local configuration mode, the parameter Config via Network Port Enable must be disabled. This mode preserves the local configuration made via the HMI port.

In remote configuration mode, the parameter Config via Network Port Enable must be enabled. This mode enables the configuration of the MMC through the network.

Modules without PKW exchange cyclically 10 input bytes (5 input words) and 6 output bytes (3 output words).

Modules with PKW

Short and long description of modules with PKW:

Short Description as Shown in the GSD	Long Description
MMC R PKW	Motor Management Controller, remote configuration mode with PKW
MMC R PKW EV40	Motor Management Controller, LTMEV40, remote configuration mode with PKW
MMC L PKW	Motor Management Controller, local configuration mode with PKW
MMC L PKW EV40	Motor Management Controller, LTMEV40, local configuration mode with PKW

The PKW feature is implemented to allow acyclic read or write access to any register using cyclic data. It is useful with Primary DP V0.

Modules with PKW exchange cyclically 18 input bytes (9 input words) and 14 output bytes (7 output words).

PROFIBUS DP Configuration via the SyCon Configuration Tool

Introduction

With SyCon software, you can configure the PROFIBUS DP network and generate an ASCII file to import into the PLC configuration into Unity Pro (or PL7 or Concept).

Network conditions

The network conditions for the example are

- Protocol: PROFIBUS DP
- Address: 4
- Baud rate: 3 Mb/s

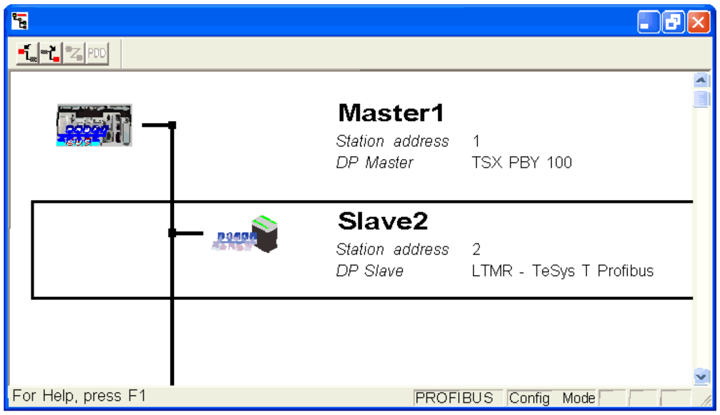
Configuration of a TeSys T System

Example of a network configuration:

Step	Action
1	Import your GSD file with **File > Copy GSD**.
2	Select the path where GS*-files have been unzipped, and click OK.
3	Insert a primary (master): • Click **Insert > Master...**, or • Select 
4	Select the network speed: • Click **Settings > Bus Parameter > Baud rate** • Select the baud rate adapted to the transmission speed of your application (for example, 3000 kBaud). The PROFIBUS DP secondaries (slaves) adapt automatically their baud rate to the primary (master) baud rate.
5	In the **Insert Master** window, select a primary (master) (for example, `TSX PBY 100`) from the **Available masters** list. Press the **Add>>** button and confirm with **OK**.
6	Insert a secondary (slave): • Click **Insert > Slave...**, or • Select 

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>7</td><td>In the Insert Slave window, select <code>LTMR - TeSys T Profibus</code> from the Available slaves list.

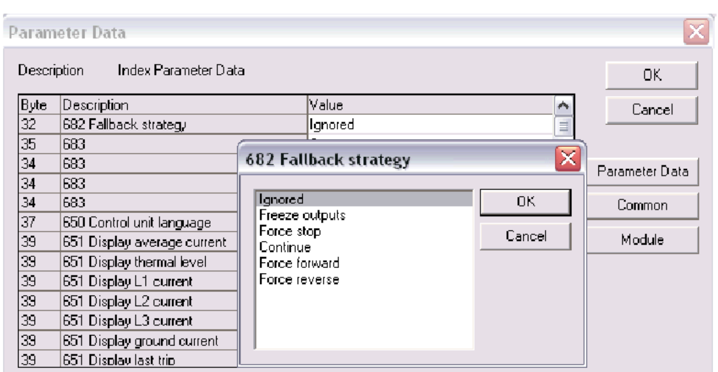
Press the Add>> button and confirm with OK. The following view appears:


</td></tr>
<tr><td>8</td><td>Select <code>Slave1</code> and double-click to open the Slave Configuration:
Set Station address (for example, to 4).
Change the factory setting of the Description (for example, to <code>MMC_4)</code>.
Select the correct module from the list:
<table>
<tr><th>Module</th><th>Inputs</th><th>Outputs</th><th>In/Out</th><th>Identifier</th></tr>
<tr><td>MMC R</td><td>10 Byte</td><td>6 Byte</td><td></td><td>0xC4, 0x05,</td></tr>
<tr><td>MMC R EV40</td><td>10 Byte</td><td>6 Byte</td><td></td><td>0xC4, 0x05,</td></tr>
<tr><td>MMC L</td><td>10 Byte</td><td>6 Byte</td><td></td><td>0xC4, 0x05,</td></tr>
<tr><td>MMC L EV40</td><td>10 Byte</td><td>6 Byte</td><td></td><td>0xC4, 0x05,</td></tr>
<tr><td>MMC R PKW</td><td>10 Byte</td><td>6 Byte</td><td>8 Byte</td><td>0xC4, 0x05,
0x09, 0x31,</td></tr>
</table>

Note:

Refer to Modules as Presented in the GS*-File, page 25.

Go on with steps 9 to 12 if a Remote (R) configuration mode has been selected.</td></tr>
<tr><td>9</td><td>Click the Parameter Data... button to open the Parameter Data window.</td></tr>
<tr><td>10</td><td>Click the Module button to open the corresponding Parameter Data window and set the parameter values.</td></tr>
<tr><td>11</td><td>Double-click one of the available parameters (foe example, the <code>Fallback strategy)</code>. An additional selection table opens, allowing you to change the parameter value:



Click OK.</td></tr>
<tr><td>12</td><td>Click the OK button of each open dialog window to confirm the selected parameter values.</td></tr>
</table>

Save and Export the Network Configuration

Save and export the configuration for importation into the PLC configuration (PL7, Concept or Unity Pro).

Step	Action
1	Select **File > Save As** to open the **Save as** window.
2	Choose the **Project path** and a **File name** and click **Save** (extension .pb).
3	Select **File > Export > ASCII** to export the configuration as an ASCII file (extension .cnf).
4	Import the PROFIBUS DP configuration into the PLC configuration (PL7, Concept or Unity Pro).

PROFIBUS DP Profile

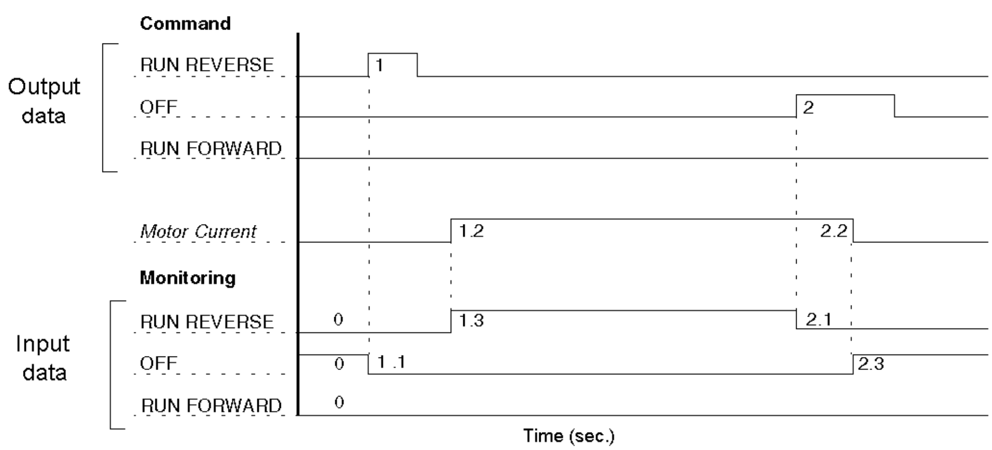
Introduction

The LTMR controller is compliant with the Motor Management Starter (MMS) device class according to the Low Voltage Switchgear (LSVG) PROFIBUS DP profile.

The cyclic data of these devices uses edge triggered signals.

Operational States

The following diagram gives the operational states of the Motor Management Starter in normal operation.



NOTE: The pulse width must be more than 1 s.

Sequence	Description
0	Device switched OFF (no current, no internally stored switch-ON command)
1	**REVERSE/FORWARD command activated**
1.1	- actual or internally stored switch-ON command activated
1.2	- after a delay time, current will be measured
1.3	- a measured current in addition to the actual or internally stored switch-ON command (RUN REVERSE/FORWARD) impacts the confirmation signal RUN FORWARD/REVERSE (will be set to high)
2	**OFF command activated**

Sequence	Description
2.1	- the confirmation signal RUN FORWARD/REVERSE will be cleared to low
2.2	- after a motor stop, no current will be measured
2.3	- no current and no (internally) stored switch-ON command impacts the OFF signal

Type and Size of Cyclic Data

The size and type of the cyclic data exchanged depend on whether or not modules with PKW are selected during configuration.

The table below indicates the size and type of cyclic data for each module.

	Module	Inputs	Outputs
Without PKW	MMC R	10 status bytes (= 4 status words)	6 command bytes (= 3 command words)
	MMC R EV40		
	MMC L		
	MMC L EV40		
With PKW	MMC R PKW	10 status bytes (= 4 status words) + 8 PKW in bytes (= 4 PKW in words)	6 command bytes (= 3 command words) + 8 PKW out bytes (= 4 PKW out words)
	MMC R PKW EV40		
	MMC L PKW		
	MMC L PKW EV40		

The 8 status bytes and 6 command bytes are common to all modules.

Modules with PKW exchange 8 additional bytes dedicated to PKW function , page 40.

Cyclic Data Format

Depending on the PLC platform used, cyclic data bytes are seen and organized differently.

To facilitate LTMR setup, cyclic data are described according to the following formats:

- Byte format (used by Siemens PLCs for example)
- Word little endian format (used by Premium PLCs for example)
- Word big endian format (used by Siemens PLCs for example)

Cyclic Data Description

Introduction

The tables below describe the different cyclic data types in byte format and word format (little endian and big endian):

- Status: input data
- Command: output data
- PKW IN: input data (available only in word format)
- PKW OUT: output data (available only in word format)

Cyclic Data in Byte Format

Cyclic data types in byte format are:

- Status: input data
- Command: output data

Status input data in byte format: Input 0 to Input 9

Position	Description
Input 0.0 Run Reverse	The main circuit contacts are closed.
Input 0.1 Off	Indication that the device is in the OFF state.
Input 0.2 Run Forward	The main circuit contacts are closed.
Input 0.3 Thermal Overload Alarm	An overload alarm condition exists. (461.3)
Input 0.4 Lockout Time	Communication status register high byte (456.4)
Input 0.5 Auto Mode	Indication to a remote host controller that the RUN FORWARD, RUN REVERSE and STOP commands will or will not be accepted. 0 = LOCAL CONTROL 1 = AUTO MODE
Input 0.6 System Trip	A trip condition exists. (455.2)
Input 0.7 System Alarm	An alarm condition exists. (455.3)
Input 1.0 to 1.3 Reserved	Reserved
Input 1.4 System Ready	Ready (455.0)
Input 1.5 Motor Ramping	Motor ramping: start in progress (455.15)
Input 1.6 Motor Running	Motor running: current > 20% FLC Min (455.7)
Input 1.7 System tripped	System tripped (455.4)
Input 2	Iav average current - MSB
Input 3	Iav average current - LSB
Input 4 Logic Inputs 9-16 of expansion module	Logic inputs status High byte (457.8-15)

Status input data in byte format: Input 0 to Input 9 (Continued)

Position	Description
Input 5 Logic Inputs 1-6 of LTMR controller + inputs 7-8 of expansion module	Logic inputs status Low byte (457.0-7)
Input 6 Reserved	Logic outputs status High byte (458.8-9) (458.10-15 are not significant)
Input 7 Status of logic outputs 13, 23, 33, and 95	Logic outputs status Low byte (458.0-3) (458.4-7 are not significant)
Input 8 (456.8) Network port comm loss (456.9) Motor lockout (456.10-15) Reserved	System status register 2 High byte (456.8-15)
Input 9 (456.0) Auto reset active (456.1) Reserved (456.2) Controller power cycle requested (456.3) Motor restart time undefined (456.4) Rapid cycle lockout (456.5) Load shedding (456.6) Motor high speed (456.7) HMI port comm loss	System status register 2 Low byte (456.0-7)

Command output data in byte format: Output 0 to Output 5

Position	Description
Output 0.0 Run Reverse	Instructs the starter to energize the motor in the reverse direction.
Output 0.1 Off	Instructs the device to go to the OFF state. 0 = ENABLE RUN FORWARD/ RUN REVERSE 1 = OFF
Output 0.2 Run Forward	Instructs the starter to energize the motor in the forward direction.
Output 0.3 Self Test Command	Instructs the device to initiate an internal test routine within the device. (704.5)

Command output data in byte format: Output 0 to Output 5 (Continued)

Position	Description
Output 0.4 Clear Thermal Capacity Level Command	Reset thermal memory Instructs the starter to override any trip condition and allows starting. (705.2) **Note**: This command inhibits thermal protection. Continued operation with inhibited thermal protection should be limited to applications where immediate restart is vital. By setting this bit to 1, the thermal state of the motor is lost: the thermal protection will no longer protect an already warm motor.
Output 0.5 Reserved	Reserved
Output 0.6 Trip Reset Command	Trip reset Instructs the starter to reset all resettable trips (one of the preconditions for READY). (704.3)
Output 0.7 Reserved	Reserved
Output 1.0 to 1.4 Reserved	Reserved
Output 1.5 Motor Low Speed Command	Low speed (704.6)
Output 1.6 to 1.7 Reserved	Reserved
Output 2 Additional Output	Analog output (to manage by custom logic, future extension) (706.8-15)
Output 3 Additional Output	Analog output (to manage by custom logic, future extension) (706.0-7)
Output 4 Additional Output	Logic outputs command register High byte (700.8-15: Reserved)
Output 5 Additional Output	Logic outputs command register Low byte (700.0-3: associated to Output 1 to 4 if custom logic manages it) (700.4-15: Reserved)

Cyclic Data in Word Little Endian Format

Cyclic data types in Word little endian format are:

- Status: input data
- PKW IN: input data
- Command: output data
- PKW OUT: output data

Status input data in word little endian format: IW 0 to IW 4

Word Arrangement				Byte N°
IW 0	MSB	bit 15	System tripped (455.4)	Input 1
		bit 14	Motor running (455.7)	
		bit 13	Motor starting (455.15)	
		bit 12	System ready (455.0)	
		bit 8 to bit 11	Reserved	
	LSB	bit 7	System alarm (455.3)	Input 0
		bit 6	System trip (455.2)	
		bit 5	Auto mode	
		bit 4	Lock out time	
		bit 3	Thermal overload alarm (461.3)	
		bit 2	Run Forward	
		bit 1	Off	
		bit 0	Run Reverse	
IW 1	MSB	bit 8 to bit 15	IAV average current % FLC LSB 466.0 to 466.7	Input 3
	LSB	bit 0 to bit 7	IAV average current % FLC MSB 466.8 to 466.15	Input 2
IW 2	MSB	bit 8 to bit 15	Logic inputs status LSB 457.0 to 457.7 Inputs 1-6 of controller Inputs 7-8 of expansion module	Input 5
	LSB	bit 0 to bit 7	Logic inputs status MSB 457.8 to 457.15 Inputs 9-16 of expansion module (11-16 future extension)	Input 4
IW 3	MSB	bit 12 to bit 15	Outputs 5-8 of expansion module (future extension) 458.4 to 458.7	Input 7
		bit 11	Logic output 95 status (458.3)	
		bit 10	Logic output 33 status (458.2)	
		bit 9	Logic output 23 status (458.1)	
		bit 8	Logic output 13 status (458.0)	
	LSB	bit 0 to bit 7	Outputs 9-16 of expansion module (future extension) 458.8 to 458.15	Input 6

Status input data in word little endian format: IW 0 to IW 4 (Continued)

Word Arrangement				Byte N°
IW 4	MSB	bit 15	HMI port comm loss (456.7)	Input 9
		bit 14	Motor high speed (456.6)	
		bit 13	Load shedding (456.5)	
		bit 12	Rapid cycle lockout (456.4)	
		bit 11	Motor restart time undefined (456.3)	
		bit 10	Controller power cycle requested (456.2)	
		bit 9	Reserved (456.1)	
		bit 8	Auto reset active (456.0)	
	LSB	bit 2 to bit 7	Reserved (456.10 to 456.15)	Input 8
		bit 1	Motor transition lockout (456.9)	
		bit 0	Network port comm loss (456.8)	

PKW IN input data in word little endian format: IW 5 to IW 8 (supported by modules with PKW)

Word Arrangement			
IW 5	MSB	bit 8 to bit 15	Object address MSB
	LSB	bit 0 to bit 7	Object address LSB
IW 6	MSB	bit 15	Toggle bit
		bit 8 to bit 14	Function
	LSB	bit 0 to bit 7	Not used: 0x00
IW 7	MSB	bit 8 to bit 15	Data read in register 1 MSB
	LSB	bit 0 to bit 7	Data read in register 1 LSB
IW 8	MSB	bit 8 to bit 15	Data read in register 2 MSB
	LSB	bit 0 to bit 7	Data read in register 2 LSB

Command output data in word little endian format: QW 0 to QW 2

Word Arrangement				Byte N°
QW 0	MSB	bit 14 to bit 15	Reserved	Output 1
		bit 13	Motor low speed command (704.6)	
		bit 8 to bit 12	Reserved	
	LSB	bit 7	Reserved	Output 0
		bit 6	Trip reset command	
		bit 5	Auto mode	
		bit 4	Clear thermal capacity level command (705.2)	
		bit 3	Self test command (704.5)	
		bit 2	Run Forward (704.0)	
		bit 1	OFF	
		bit 0	Run Reverse (704.1)	
QW 1	MSB	bit 8 to bit 15	Analog output LSB (future extension) 706.0 to 7	Output 3
	LSB	bit 0 to bit 7	Analog output MSB (future extension) 706.8 to 15	Output 2
QW 2	MSB	bit 9 to bit 15	Logic output command register LSB 700.4 to 7 Outputs 5 to 8 (future extension)	Output 5
		bit 8 to 11	Logic output command register LSB 700.0 to 3 Outputs 1 to 4 (13, 23, 33, 95) if custom logic manages it	
	LSB	bit 0 to bit 7	Logic output command register MSB 700.8 to 15 Outputs 9 to 16 (future extension)	Output 4

PKW OUT output data in word little endian format: QW 3 to QW 6 (supported by modules with PKW)

Word Arrangement			
QW 3	MSB	bit 8 to bit 15	Object address MSB
	LSB	bit 0 to bit 7	Object address LSB
QW 4	MSB	bit 15	Toggle bit
		bit 8 to bit 14	Function
	LSB	bit 0 to bit 7	Not used: 0x00
QW 5	MSB	bit 8 to bit 15	Data write in register 1 MSB
	LSB	bit 0 to bit 7	Data write in register 1 LSB
QW 6	MSB	bit 8 to bit 15	Data write in register 2 MSB
	LSB	bit 0 to bit 7	Data write in register 2 LSB

Cyclic Data in Word Big Endian Format

Cyclic data types in Word big endian format are:

- Status: input data
- PKW IN: input data
- Command: output data
- PKW OUT: output data

Status input data in word big endian format: IW 0 to IW 4

Word Arrangement				Byte N°
IW 0	MSB	bit 15	System alarm (455.3)	Input 0
		bit 14	System trip (455.2)	
		bit 13	Auto mode	
		bit 12	Lock out time	
		bit 11	Thermal overload alarm (461.3)	
		bit 10	Run Forward	
		bit 9	OFF	
		bit 8	Run Reverse	
	LSB	bit 7	System tripped (455.4)	Input 1
		bit 6	Motor running (455.7)	
		bit 5	Motor ramping (455.15)	
		bit 4	System ready (455.0)	
		bit 0 to 3	Reserved	
IW 1	MSB	bit 8 to bit 15	IAV average current % FLC MSB 466.8 to 466.15	Input 2
	LSB	bit 0 to bit 7	IAV average current % FLC LSB 466.0 to 466.7	Input 3
IW 2	MSB	bit 8 to bit 15	Logic input status MSB 457.8 to 15 Inputs 9-16 of expansion module (11-16 future extension)	Input 4
	LSB	bit 0 to bit 7	Logic input status LSB 457.0 to 457.7 Inputs 1-6 of controller Inputs 7-8 of expansion module	Input 5

Status input data in word big endian format: IW 0 to IW 4 (Continued)

Word Arrangement				Byte N°
IW 3	MSB	bit 8 to bit 15	Outputs 9-16 of expansion module (future extension) 458.8 to 458.15	Input 6
	LSB	bit 4 to bit 7	Outputs 5-8 of expansion module (future extension) 458.4 to 458.7	Input 7
		bit 3	Logic output 95 status (458.3)	
		bit 2	Logic output 33 status (458.2)	
		bit 1	Logic output 23 status (458.1)	
		bit 0	Logic output 13 status (458.0)	
IW 4	MSB	bit 10 to bit 15	Reserved (456.10 to 456.15)	Input 8
		bit 9	Motor transition lockout (456.9)	
		bit 8	Network port comm loss (456.8)	
	LSB	bit 7	HMI port comm loss (456.7)	Input 9
		bit 6	Motor high speed (456.6)	
		bit 5	Load shedding (456.5)	
		bit 4	Rapid cycle lockout (456.4)	
		bit 3	Motor restart time undefined (456.3)	
		bit 2	Controller power cycle requested (456.2)	
		bit 1	Reserved (456.1)	
		bit 0	Auto reset active (456.0)	

PKW IN input data in word big endian format: IW 5 to IW 8 (supported by modules with PKW)

Word Arrangement			
IW 5	MSB	bit 8 to bit 15	Object address LSB
	LSB	bit 0 to bit 7	Object address MSB
IW 6	MSB	bit 8 to bit 15	Not used: 0x00
	LSB	bit 7	Toggle bit
		bit 0 to bit 6	Function
IW 7	MSB	bit 8 to bit 15	Data read in register 1 LSB
	LSB	bit 0 to bit 7	Data read in register 1 MSB
IW 8	MSB	bit 8 to bit 15	Data read in register 2 LSB
	LSB	bit 0 to bit 7	Data read in register 2 MSB

Command output data in word big endian format: QW 0 to QW 2

Word Arrangement				Byte N°
QW 0	MSB	bit 15	Reserved	Output 0
		bit 14	Trip reset command	
		bit 13	Auto mode	
		bit 12	Clear thermal capacity level command (705.2)	
		bit 11	Self test command (704.5)	
		bit 10	Run Forward (704.0)	
		bit 9	OFF	
		bit 8	Run Reverse (704.1)	
	LSB	bit 6 to bit 7	Reserved	Output 1
		bit 5	Motor low speed command (704.6)	
		bit 0 to bit 4	Reserved	
QW 1	MSB	bit 8 to bit 15	Analog output MSB (future extension) 706.8 to 15	Output 2
	LSB	bit 0 to bit 7	Analog output LSB (future extension) 706.0 to 7	Output 3
QW 2	MSB	bit 8 to bit 15	Logic output command register MSB 700.8 to 15 Outputs 9 to 16 (future extension)	Output 4
	LSB	bit 4 to bit 7	Logic output command register LSB 700.4 to 7 Outputs 5 to 8 (future extension)	Output 5
		bit 0 to 3	Logic output command register LSB 700.0 to 3 Outputs 1 to 4 (13, 23, 33, 95) if custom logic manages it	

PKW OUT output data in word big endian format: QW 3 to QW 6 (supported by modules with PKW)

Word Arrangement			
QW 3	MSB	bit 8 to bit 15	Object address LSB
	LSB	bit 0 to bit 7	Object address MSB
QW 4	MSB	bit 8 to bit 15	Not used: 0x00
	LSB	bit 7	Toggle bit
		bit 0 to bit 6	Function
QW 5	MSB	bit 8 to bit 15	Data write in register 1 LSB
	LSB	bit 0 to bit 7	Data write in register 1 MSB
QW 6	MSB	bit 8 to bit 15	Data write in register 2 LSB
	LSB	bit 0 to bit 7	Data write in register 2 MSB

PKW: Encapsulated Acyclic Accesses in DP V0

Overview

Some PROFIBUS DP primaries (masters) do not provide DP V1 services. The PKW feature is implemented to allow acyclic read or write access in DP V0.

This feature is enabled in the PROFIBUS DP configuration tool by selecting the appropriate module. For each module, a second entry with PKW exists.

The PKW data is added to the cyclic data.

Read/Write Registers

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

PKW OUT Data

PKW OUT Data request (PROFIBUS DP Master → LTMR) are mapped in modules supporting PKW.

To access a register, you must select 1 of the following function codes:

- R_REG_16 = 0x25 to read 1 register
- R_REG_32 = 0x26 to read 2 registers
- W_REG_16 = 0x2A to write 1 register
- W_REG_32 = 0x2B to write 2 registers.

Register numbers are given in Register Map (Organization of Communication Variables), page 48.

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

Depending on the PLC platform used, refer to the tables describing PKW OUT in Little and Big endian formats in the section Cyclic Data Description, page 30 to know the positioning of each field inside each word.

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

The toggle bit must change at each consecutive request. This mechanism allows the request initiator to detect that a response is ready by polling the toggle bit in response.

When this bit in the OUT data becomes equal to the response emitted toggle bit in the IN data, then the response is ready.

PKW IN Data

PKW IN Data Response (LTMR → PROFIBUS DP Master) is mapped in modules supporting PKW. The LTMR echoes the same register address and function code or eventually a detected error code:

Word 1	Word 2			Word 3	Word 4
Register address	Toggle bit (bit 15)	Function bits (bits 8 to 14)	Not used (bits 0 to 7)	Data to write	
Same register number as in request	Same as request	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		–	–

Depending on the PLC platform used, refer to the tables describing PKW IN in Little and Big endian formats in the section Cyclic Data Description, page 30 to know the positioning of each field inside each word.

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 answered (Function code = toggle bit + 0x4E). The exact detected error code can be found in words 3 and 4. The request is not accepted and the object or register remains at the old value.

If you want to re-trigger exactly the same command, you must:

- Reset the Function code to 0x00,
- Wait for the response frame with the function code equal to 0x00, then
- Set it again to its previous value.

This is useful for a limited primary (master) like an HMI.

Another way of re-triggering exactly the same command is to:

- Invert the toggle bit in the function code byte.

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

PKW Detected Error Codes

Detected Write Errors

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

Detected Read Errors

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

Acyclic Data Read/Write via PROFIBUS DP V1

Overview

For Acyclic DP V1 access, a mechanism based on slot/index and length-addressing is implemented in the LTMR controller.

NOTE: All accessible registers are described in the section Communication Variable Groups, page 49. They are organized in groups (Identification variables, Statistics variables,...) and sub-groups, if necessary.

Variables are accessed every 10 registers. You cannot access registers located between two sub-groups. If the access is not possible, no register is accessed and a detected error value (for example, "not all registers found") will be returned via DP V1.

Reading Acyclic Data (DS_Read)

With `DS_Read` function, the PROFIBUS DP primary can read data from the secondary. The following table illustrates the contents of a DS_Read frame.

Byte	Syntax
0 [Function Number]	0x5E [DS_Read Function]
1 [Slot Number]	Constant value = 1
2 [Index]	Register address / 10 Common access to registers is every 10 registers. The index is always rounded down to an integer.
3 [Length]	Length of data blocks in bytes (Number of registers) x 2 Maximum number of registers = 20 (40 bytes) Any length between 2 and 40 bytes is possible.
4 to (length + 3)	Block of data bytes to be read.

DS_Read Example

Example: Reading of Identification registers 50 to 62

Byte	Value
0 [Function Number]	**0x5E** [DS_Read Function]
1 [Slot Number]	**1**
2 [Index]	**5** [50/10]
3 [Length]	**26** [(50 to 62 = 13) x 2]
4 to 29	Value of registers 50 to 62

Sending Acyclic Data (DS_Write)

With DS_Write function, the PROFIBUS DP primary can send data to the secondary.

Before writing a block of data, it is recommended to read a block of data first, in order to protect data that is not impacted. The whole block will only be written if you have write permission, to be checked within each register table in the section Communication Variable Groups, page 49. Column 3 table headers indicate if the variables within each table are Read-only or Read/Write.

The following table illustrates the contents of a DS_Write frame.

Byte	Syntax
0 [Function Number]	0x5F [DS_Write Function]
1 [Slot Number]	Constant value = 1
2 [Index]	Register address / 10 Common access to registers is every 10 registers. The index is always rounded down to an integer.

Byte	Syntax
3 [Length]	Length of data blocks in bytes (Number of registers) x 2 Maximum number of registers = 20 (40 bytes) Any length between 2 and 40 bytes is possible.
4 to (length + 3)	Block of data bytes to be written.

DS_Write Example: Process Description

Example: Resetting a trip by setting bit 704.3 to 1

1. Read 700 to 704.

Byte	Value
0 [Function Number]	**0x5E** [`DS_Read` Function]
1 [Slot Number]	**1**
2 [Index]	**70** [700/10]
3 [Length]	**10** [(700 to 704 = 5) x 2]
4 to 13	Current values of registers 700 to 704

2. Set bit 3 of register 704 to 1.

3. Write the registers 700 to 704.

Byte	Value
0 [Function Number]	**0x5F** [`DS_Write` Function]
1 [Slot Number]	**1**
2 [Index]	70 [700/10]
3 [Length]	10 [(700 to 704 = 5) x 2]
4 to 13	New values of registers 700 to 704

Feedback in Case of Detected Error

If the access is not possible, no register is accessed and a detected error value will be returned via DP V1.

The first 4 bytes of the response on DP in the case of a detected error are as follows:

Byte	Value	Meaning
0	0xDE/ 0xDF	for DS_Read / DS_Write
1	0x80	indicating DP V1
2	0xB6	detected error class + detected error code 1 = access denied
3	0xXX	detected error code 2, LTMR specific (see following table)

Below is Detected Error Code 2, LTMR Specific:

Detected Error Code 2	Meaning
01	Internal stack request full
03	Register not managed or super user access rights needed
06	Register defined but not written
07	Not all registers found
08	Registers not authorized to be written
10	Written value outside the register range, word value too large (too high)
11	Written value outside the register range, word value too small (too low)
12	Written value outside the register range (MSB value too large)
13	Written value outside the register range (MSB value too small)
14	Written value outside the register range (LSB value too large)
15	Written value outside the register range (LSB value too small)
16	Written value not a valid value
20	Module rejects, sends back a detected error frame
255	Internal error detected

The presentation of a detected error code and a detected error class to the user logic depends on the primary implementation (for example, the PLC).

The mechanism only accesses blocks of parameters starting at a dedicated parameter (MB address). This means that unused parameters (MB addresses) are also accessed. The data value read from these parameters is 0x00; but in case of writing, it is necessary to write the value 0x00 to these parameters. Otherwise, the complete write access will be rejected.

TeSys T Internal Registers

For more details about the TeSys T internal registers, refer to the Communication Variables tables, page 48.

Diagnostic Telegram for PROFIBUS DP

Overview

A Diagnostic Telegram is sent by the LTMR controller when:

- There is a change of node address,
- A system shut down (due to a power cycle, soft reboot, or watch dog) is detected,
- A detected error or an alarm occurs.

The maximum length of a diagnostic telegram is 36 bytes. This information is useful for PROFIBUS DP primary (master) configuration.

Byte 0-9

DP V0 Byte	DP V1 Byte	Byte Name	Description
0-5	0-5	PROFIBUS DP standard diagnostic data	
6	6	Header byte	Device-related diagnostic with length including header
7	-	PROFIBUS DP firmware	PROFIBUS DP firmware version, high byte
8	-	PROFIBUS DP firmware	PROFIBUS DP firmware version, low byte
9	-	PROFIBUS DP firmware	PROFIBUS DP firmware version, test version
-	7	-	DP V1: 0x81= Status, Type: Diagnostic Alarm
-	8	-	DP V1: slot number, e.g. 0x01
-	9	-	DP V1: 0x81= Status, Type: Diagnostic Alarm

Byte 10-13

<table>
<tr><th>DP V0 / DP V1 Byte</th><th>Byte Name</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">10</td><td rowspan="2">Manufacturer Specific ID</td><td colspan="2">Module identifier:</td></tr>
<tr><td colspan="2">31: LTMR controller only
32: LTMR controller with expansion module</td></tr>
<tr><td rowspan="4">11</td><td rowspan="4">PROFIBUS DP device status</td><td colspan="2">State of the PROFIBUS DP fieldbus handler</td></tr>
<tr><td>11.0</td><td>Local / remote
0 = PROFIBUS DP parameters have priority
1 = Locally set parameters have priority</td></tr>
<tr><td>11.1-11.6</td><td>Reserved</td></tr>
<tr><td>11.7 = 1</td><td>PROFIBUS DP application profile:
1 = motor management starter</td></tr>
<tr><td>12</td><td>PROFIBUS DP detected error byte</td><td colspan="2"></td></tr>
<tr><td rowspan="7">13</td><td rowspan="7">PROFIBUS DP information and detected error byte</td><td colspan="2">Report detected errors with internal communication</td></tr>
<tr><td>13.0</td><td>1 = an attempt to write setting registers from a PROFIBUS DP parameter frame was received when the motor was running</td></tr>
<tr><td>13.1</td><td>1 = writing values from a PROFIBUS DP parameter frame detected an error even when the motor was not running</td></tr>
<tr><td>13.2</td><td>1 = an internal error was detected during the generation of the PROFIBUS DP diagnostic frame</td></tr>
<tr><td>13.3</td><td>1 = the internal cyclic data exchange (callback) detected an error</td></tr>
<tr><td>13.4</td><td>1 = system fall down was detected</td></tr>
<tr><td>13.5</td><td>1 = node address has changed</td></tr>
</table>

Byte 14-35

DP V0 / DP V1 Byte	Byte Name	Description
14	Register 455 (455.8-455.15)	Monitoring of status
15	Register 455 (455.0-455.7)	
16	Register 456 (456.8-456.15)	
17	Register 456 (456.0-456.7)	
18	Register 457 (457.8-457.15)	
19	Register 457 (457.0-457.7)	
20	Register 460 (460.8-460.15)	Monitoring of alarms
21	Register 460 (460.0-460.7)	
22	Register 461 (461.8-15)	
23	Register 461 (461.0-461.7)	
24	Register 462 (462.8-462.15)	
25	Register 462 (462.0-462.7)	
26	Reserved	
27		
28	Register 451 (451.8-451.15)	Monitoring of trips
29	Register 451 (451.0-451.7)	
30	Register 452 (452.8-452.15)	
31	Register 452 (452.0-452.7)	
32	Register 453 (453.8-453.15)	
33	Register 453 (453.0-453.7)	
34	Reserved	
35		

NOTE: For descriptions of registers, refer to the Communication Variables tables, introduced in Register Map (Organization of Communication Variables), page 48.

User Map Variables (User Defined Indirect Registers)

Overview

User Map variables are designed to optimize the access to several non-contiguous registers in one single request.

You can define several read and write areas.

The user map can be defined via:

- A PC running SoMove with TeSys T DTM
- A PLC via the network port

User Map Variables

User Map variables are divided into two groups:

User Map Addresses	800 to 898
User Map Values	900 to 998

The User Map Address group is used to select a list of addresses to read or write. It can be considered as a configuration area.

The User Map Value group is used to read or write values associated with addresses configured in the User Map Address area:

- Read or write of register 900 allows you to read or write the register address defined in register 800.
- Read or write of register 901 allows you to read or write the register address defined in register 801,...

Example of Use

The User Map Address configuration below gives an example of user map address configuration to access non-contiguous registers:

User Map Address Register	Value Configured	Register
800	452	Trip register 1
801	453	Trip register 2
802	461	Alarm register 1
803	462	Alarm register 2
804	450	Minimum wait time
805	500	Average current (0.01 A) MSW
806	501	Average current (0.01 A) LSW
850	651	HMI display items register 1
851	654	HMI display items register 2
852	705	Control register 2

With this configuration, monitoring information is accessible with one single read request through register addresses 900 to 906.

Configuration and command can be written with one single write using registers 950 to 952.

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
Identification variables	00 to 99
Statistics variables	100 to 449
Monitoring variables	450 to 539
Configuration variables	540 to 699
Command variables	700 to 799
User Map variables	800 to 999
Custom Logic variables	1200 to 1399

Table Structure

Communication variables are listed in 4-column tables:

Column 1	Column 2	Column 3	Column 4
Register (in decimal format)	Variable type , page 51	Variable name and access via Read-only or Read/Write Modbus 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[4]
B	The variable can be written only in configuration mode (for example, static characteristics)[5]
C	The variable can be written only with no trip[5]
D-Z	Not used

4. Restrictions A, B, and C apply only to bits, not to whole registers. If you try to write a value when a restriction is applied, the bit will not be changed and no exception code will be returned. Exception codes are returned at register level, not at bit level.
5. Restrictions A, B, and C may apply only to bits, not to whole registers. If you try to write a value when a restriction is applied, the bit will not be changed and no exception code will be returned. Exception codes are returned at register level, not at bit level.

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 at all.

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 51.

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 52).

Addresses 655 to 658, **Word[4]**, (DT_DateTime, page 52).

Data Types

Overview

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

List of Data Types

The most commonly used data types are as follows:

- DT_ACInputSetting
- DT_CommercialReference
- DT_DateTime
- DT_ExtBaudRate
- DT_ExtParity
- DT_TripCode
- DT_FirmwareVersion
- DT_Language5
- DT_OutputFallbackStrategy
- DT_PhaseNumber
- DT_ResetMode
- DT_AlarmCode

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 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 2 BCD digits.
  The value range is [00-59] in BCD.
- 0 = unused
- H = hour
  The format is 2 BCD digits.
  The value range is [00-23] in BCD.
- m = minute
  The format is 2 BCD digits.
  The value range is [00-59] in BCD.
- M = month
  The format is 2 BCD digits.
  The value range is [01-12] in BCD.
- D = day
  The format is 2 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 4 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_TripCode

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

Trip Code	Description
0	No detected error
3	Ground current
4	Thermal overload
5	Long start
6	Jam
7	Current phase imbalance
8	Undercurrent
10	Test
11	HMI port error detected
12	HMI port communication loss
13	Network port internal error detected
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 trip
55	Controller internal trip (Stack overflow)

Trip Code	Description
56	Controller internal trip (RAM detected error)
57	Controller internal trip (RAM checksum detected error)
58	Controller internal trip (Hardware watchdog trip)
60	L2 current detected in single-phase mode
64	Non-volatile memory trip
65	Expansion module communication trip
66	Stuck reset button
67	Logic function trip
100-104	Network port internal trip
109	Network port comm trip
111	Fast device replacement trip
555	Network port configuration trip

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_AlarmCode

DT_AlarmCode 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
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	Variable Type	Read-only Variables	Note, page 49
0-34		*(Not significant)*	
35-40	Word[6]	Expansion commercial reference , page 52	1
41-45	Word[5]	Expansion serial number	1
46	UInt	Expansion ID code	
47	UInt	Expansion firmware version , page 57	1
48	UInt	Expansion compatibility code	1
49-60		*(Not significant)*	
61	UInt	Network port ID code	
62	UInt	Network port firmware version , page 57	
63	UInt	Network port compatibility code	
64-69	Word[6]	Controller commercial reference , page 52	
70-74	Word[5]	Controller serial number	
75	UInt	Controller ID code	
76	UInt	Controller firmware version , page 57	
77	UInt	Controller compatibility code	
78	UInt	Current scale ratio (0.1%)	
79	UInt	Current sensor max	
80		*(Not significant)*	
81	UInt	Current range max (x 0.1 A)	
82-94		*(Not significant)*	
95	UInt	Load CT ratio (x 0.1 A)	
96	UInt	Maximum Full Load Current (FLC) range (x 0.1 A)	
97-99		*(Forbidden)*	

Statistics Variables

Statistics Overview

Statistics variables are grouped as shown in the following table. Trip statistics are organized into main tables and extension tables.

Statistics Variable Groups	Registers
Global statistics	100 to 121
LTM monitoring statistics	122 to 149
Last trip statistics and extension	150 to 179 300 to 309
Trip n-1 statistics and extension	180 to 209 330 to 339
Trip n-2 statistics and extension	210 to 239 360 to 369

Statistics Variable Groups	Registers
Trip n-3 statistics and extension	240 to 269 390 to 399
Trip n-4 statistics and extension	270 to 299 420 to 429

Global Statistics

The global statistics are described in the following table:

Register	Variable Type	Read-only Variables	Note, page 49
100-101		*(Not significant)*	
102	UInt	Ground current trips count	
103	UInt	Thermal overload trips count	
104	UInt	Long start trips count	
105	UInt	Jam trips count	
106	UInt	Current phase imbalance trips count	
107	UInt	Undercurrent trips count	
109	UInt	HMI port trips count	
110	UInt	Controller internal trips count	
111	UInt	Internal port trips count	
112	UInt	*(Not significant)*	
113	UInt	Network port config trips count	
114	UInt	Network port trips count	
115	UInt	Auto-resets count	
116	UInt	Thermal overload alarms count	
117-118	UDInt	Motor starts count	
119-120	UDInt	Operating time (s)	
121	Int	Controller internal temperature max (°C)	

LTM Monitoring Statistics

The LTM monitoring statistics are described in the following table:

Register	Variable type	Read-only variables	Note, page 49
122	UInt	Trips count	
123	UInt	Alarms count	
124-125	UDInt	Motor LO1 closings count	
126-127	UDInt	Motor LO2 closings count	
128	UInt	Diagnostic trips count	
129	UInt	*(Reserved)*	
130	UInt	Overcurrent trips count	

Register	Variable type	Read-only variables	Note, page 49
131	UInt	Current phase loss trips count	
132	UInt	Motor temperature sensor trips count	
133	UInt	Voltage phase imbalance trips count	1
134	UInt	Voltage phase loss trips count	1
135	UInt	Wiring trips count	1
136	UInt	Undervoltage trips count	1
137	UInt	Overvoltage trips count	1
138	UInt	Underpower trips count	1
139	UInt	Overpower trips count	1
140	UInt	Under power factor trips count	1
141	UInt	Over power factor trips count	1
142	UInt	Load sheddings count	1
143-144	UDInt	Active power consumption (kWh)	1
145-146	UDInt	Reactive power consumption (kVARh)	1
147	UInt	Auto restart immediate count	
148	UInt	Auto restart delayed count	
149	UInt	Auto restart manual count	

Last Trip (n-0) Statistics

The last trip statistics are completed by variables at addresses 300 to 310. See Last Trip (n-0) Statistics Extension, page 65.

Register	Variable type	Read-only variables	Note, page 49
150	UInt	Trip code n-0	
151	UInt	Motor full load current ratio n-0 (% FLC max)	
152	UInt	Thermal capacity level n-0 (% trip level)	
153	UInt	Average current ratio n-0 (% FLC)	
154	UInt	L1 current ratio n-0 (% FLC)	
155	UInt	L2 current ratio n-0 (% FLC)	
156	UInt	L3 current ratio n-0 (% FLC)	
157	UInt	Ground current ratio n-0 (x 0.1 % FLC min)	
158	UInt	Full load current max n-0 (x 0.1 A)	
159	UInt	Current phase imbalance n-0 (%)	
160	UInt	Frequency n-0 (x 0.1 Hz)	2
161	UInt	Motor temperature sensor n-0 (x 0.1 Ω)	
162-165	Word[4]	Date and time n-0 , page 52	
166	UInt	Average voltage n-0 (V)	1
167	UInt	L3-L1 voltage n-0 (V)	1
168	UInt	L1-L2 voltage n-0 (V)	1
169	UInt	L2-L3 voltage n-0 (V)	1

Register	Variable type	Read-only variables	Note, page 49
170	UInt	Voltage phase imbalance n-0 (%)	1
171	UInt	Active power n-0 (x 0.1 kW)	1
172	UInt	Power factor n-0 (x 0.01)	1
173-179		*(Not significant)*	

N-1 Trip Statistics

The n-1 trip statistics are completed by variables at addresses 330 to 340. See N-1 Trip Statistics Extension , page 66.

Register	Variable type	Read-only variables	Note, page 49
180	UInt	Trip code n-1	
181	UInt	Motor full load current ratio n-1 (% FLC max)	
182	UInt	Thermal capacity level n-1 (% trip level)	
183	UInt	Average current ratio n-1 (% FLC)	
184	UInt	L1 current ratio n-1 (% FLC)	
185	UInt	L2 current ratio n-1 (% FLC)	
186	UInt	L3 current ratio n-1 (% FLC)	
187	UInt	Ground current ratio n-1 (x 0.1 % FLC min)	
188	UInt	Full load current max n-1 (x 0.1 A)	
189	UInt	Current phase imbalance n-1 (%)	
190	UInt	Frequency n-1 (x 0.1 Hz)	2
191	UInt	Motor temperature sensor n-1 (x 0.1 Ω)	
192-195	Word[4]	Date and time n-1 , page 52	
196	UInt	Average voltage n-1 (V)	1
197	UInt	L3-L1 voltage n-1 (V)	1
198	UInt	L1-L2 voltage n-1 (V)	1
199	UInt	L2-L3 voltage n-1 (V)	1
200	UInt	Voltage phase imbalance n-1 (%)	1
201	UInt	Active power n-1 (x 0.1 kW)	1
202	UInt	Power factor n-1 (x 0.01)	1
203-209	UInt	*(Not significant)*	

N-2 Trip Statistics

The n-2 trip statistics are completed by variables at addresses 360 to 370. See N-2 Trip Statistics Extension , page 66.

Register	Variable type	Read-only variables	Note, page 49
210	UInt	Trip code n-2	
211	UInt	Motor full load current ratio n-2 (% FLC max)	

Register	Variable type	Read-only variables	Note, page 49
212	UInt	Thermal capacity level n-2 (% trip level)	
213	UInt	Average current ratio n-2 (% FLC)	
214	UInt	L1 current ratio n-2 (% FLC)	
215	UInt	L2 current ratio n-2 (% FLC)	
216	UInt	L3 current ratio n-2 (% FLC)	
217	UInt	Ground current ratio n-2 (x 0.1 % FLC min)	
218	UInt	Full load current max n-2 (x 0.1 A)	
219	UInt	Current phase imbalance n-2 (%)	
220	UInt	Frequency n-2 (x 0.1 Hz)	2
221	UInt	Motor temperature sensor n-2 (x 0.1 Ω)	
222-225	Word[4]	Date and time n-2 , page 52	
226	UInt	Average voltage n-2 (V)	1
227	UInt	L3-L1 voltage n-2 (V)	1
228	UInt	L1-L2 voltage n-2 (V)	1
229	UInt	L2-L3 voltage n-2 (V)	1
230	UInt	Voltage phase imbalance n-2 (%)	1
231	UInt	Active power n-2 (x 0.1 kW)	1
232	UInt	Power factor n-2 (x 0.01)	1
233-239		*(Not significant)*	

N-3 Trip Statistics

The n-3 trip statistics are completed by variables at addresses 390 to 400. See N-3 Trip Statistics Extension , page 66.

Register	Variable type	Read-only variables	Note, page 49
240	UInt	Trip code n-3	
241	UInt	Motor full load current ratio n-3 (% FLC max)	
242	UInt	Thermal capacity level n-3 (% trip level)	
243	UInt	Average current ratio n-3 (% FLC)	
244	UInt	L1 current ratio n-3 (% FLC)	
245	UInt	L2 current ratio n-3 (% FLC)	
246	UInt	L3 current ratio n-3 (% FLC)	
247	UInt	Ground current ratio n-3 (x 0.1 % FLC min)	
248	UInt	Full load current max n-3 (0.1 A)	
249	UInt	Current phase imbalance n-3 (%)	
250	UInt	Frequency n-3 (x 0.1 Hz)	2
251	UInt	Motor temperature sensor n-3 (x 0.1 Ω)	
252-255	Word[4]	Date and time n-3 , page 52	
256	UInt	Average voltage n-3 (V)	1

Register	Variable type	Read-only variables	Note, page 49
257	UInt	L3-L1 voltage n-3 (V)	1
258	UInt	L1-L2 voltage n-3 (V)	1
259	UInt	L2-L3 voltage n-3 (V)	1
260	UInt	Voltage phase imbalance n-3 (%)	1
261	UInt	Active power n-3 (x 0.1 kW)	1
262	UInt	Power factor n-3 (x 0.01)	1
263-269		*(Not significant)*	

N-4 Trip Statistics

The n-4 trip statistics are completed by variables at addresses 420 to 430. See N-4 Trip Statistics Extension , page 67.

Register	Variable type	Read-only variables	Note, page 49
270	UInt	Trip code n-4	
271	UInt	Motor full load current ratio n-4 (% FLC max)	
272	UInt	Thermal capacity level n-4 (% trip level)	
273	UInt	Average current ratio n-4 (% FLC)	
274	UInt	L1 current ratio n-4 (% FLC)	
275	UInt	L2 current ratio n-4 (% FLC)	
276	UInt	L3 current ratio n-4 (% FLC)	
277	UInt	Ground current ratio n-4 (x 0.1 % FLC min)	
278	UInt	Full load current max n-4 (x 0.1 A)	
279	UInt	Current phase imbalance n-4 (%)	
280	UInt	Frequency n-4 (x 0.1 Hz)	2
281	UInt	Motor temperature sensor n-4 (x 0.1 Ω)	
282-285	Word[4]	Date and time n-4 , page 52	
286	UInt	Average voltage n-4 (V)	1
287	UInt	L3-L1 voltage n-4 (V)	1
288	UInt	L1-L2 voltage n-4 (V)	1
289	UInt	L2-L3 voltage n-4 (V)	1
290	UInt	Voltage phase imbalance n-4 (%)	1
291	UInt	Active power n-4 (x 0.1 kW)	1
292	UInt	Power factor n-4 (x 0.01)	1
293-299		*(Not significant)*	

Last Trip (n-0) Statistics Extension

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

Register	Variable type	Read-only variables	Note, page 49
300-301	UDInt	Average current n-0 (x 0.01 A)	
302-303	UDInt	L1 current n-0 (x 0.01 A)	
304-305	UDInt	L2 current n-0 (x 0.01 A)	
306-307	UDInt	L3 current n-0 (x 0.01 A)	
308-309	UDInt	Ground current n-0 (mA)	
310	UInt	Motor temperature sensor degree n-0 (°C)	

N-1 Trip Statistics Extension

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

Register	Variable type	Read-only variables	Note, page 49
330-331	UDInt	Average current n-1 (x 0.01 A)	
332-333	UDInt	L1 current n-1 (x 0.01 A)	
334-335	UDInt	L2 current n-1 (x 0.01 A)	
336-337	UDInt	L3 current n-1 (x 0.01 A)	
338-339	UDInt	Ground current n-1 (mA)	
340	UInt	Motor temperature sensor degree n-1 (°C)	

N-2 Trip Statistics Extension

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

Register	Variable type	Read-only variables	Note, page 49
360-361	UDInt	Average current n-2 (x 0.01 A)	
362-363	UDInt	L1 current n-2 (x 0.01 A)	
364-365	UDInt	L2 current n-2 (x 0.01 A)	
366-367	UDInt	L3 current n-2 (x 0.01 A)	
368-369	UDInt	Ground current n-2 (mA)	
370	UInt	Motor temperature sensor degree n-2 (°C)	

N-3 Trip Statistics Extension

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

Register	Variable type	Read-only variables	Note, page 49
390-391	UDInt	Average current n-3 (x 0.01 A)	
392-393	UDInt	L1 current n-3 (x 0.01 A)	
394-395	UDInt	L2 current n-3 (x 0.01 A)	
396-397	UDInt	L3 current n-3 (x 0.01 A)	

Register	Variable type	Read-only variables	Note, page 49
398-399	UDInt	Ground current n-3 (mA)	
400	UInt	Motor temperature sensor degree n-3 (°C)	

N-4 Trip Statistics Extension

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

Register	Variable type	Read-only variables	Note, page 49
420-421	UDInt	Average current n-4 (x 0.01 A)	
422-423	UDInt	L1 current n-4 (x 0.01 A)	
424-425	UDInt	L2 current n-4 (x 0.01 A)	
426-427	UDInt	L3 current n-4 (x 0.01 A)	
428-429	UDInt	Ground current n-4 (mA)	
430	UInt	Motor temperature sensor degree n-4 (°C)	

Monitoring Variables

Monitoring Overview

Monitoring variables are grouped according to the following criteria:

Monitoring Variable Groups	Registers
Monitoring of trips	450 to 454
Monitoring of status	455 to 459
Monitoring of alarms	460 to 464
Monitoring of measurements	465 to 539

Monitoring of Trips

Variables for monitoring of trips are described in the following table:

Register	Variable Type	Read-only Variables	Note, page 49
450	UInt	Minimum wait time (s)	
451	UInt	Trip code (code of the last trip, or of the trip that takes priority) , page 56	

Register	Variable Type	Read-only Variables	Note, page 49
452	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	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	Word	Trip register 3	
		bit 0 LTME configuration trip	
		bit 1 LTMR configuration trip	
		bits 2-15 *(Reserved)*	

Monitoring of Status

Variables for monitoring of status are described in the following table:

Register	Variable Type	Read-only Variables	Note, page 49
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 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	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 used 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	Variable Type	Read-only Variables	Note, page 49
457	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	1
		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	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	Variable Type	Read-only Variables	Note, page 49
459	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)	

Monitoring of Alarms

Variables for monitoring of alarms are described in the following table:

Register	Variable Type	Read-only Variables	Note, page 49
460	UInt	Alarm code , page 59	
461	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	Variable Type	Read-only Variables	Note, page 49
462	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)*	1
		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	Word	Alarm register 3	
		bit 0 LTME configuration alarm	
		bits 1-15 *(Reserved)*	
464	UInt	Motor temperature sensor degree (°C)	

Monitoring of Measurements

Variables for monitoring of measurements are described in the following table:

Register	Variable Type	Read-only Variables	Note, page 49
465	UInt	Thermal capacity level (% trip level)	
466	UInt	Average current ratio (% FLC)	
467	UInt	L1 current ratio (% FLC)	
468	UInt	L2 current ratio (% FLC)	
469	UInt	L3 current ratio (% FLC)	
470	UInt	Ground current ratio (x 0.1 % FLC min)	
471	UInt	Current phase imbalance (%)	
472	Int	Controller internal temperature (°C)	
473	UInt	Controller config checksum	
474	UInt	Frequency (x 0.01 Hz)	2
475	UInt	Motor temperature sensor (x 0.1 Ω)	
476	UInt	Average voltage (V)	1
477	UInt	L3-L1 voltage (V)	1

Register	Variable Type	Read-only Variables	Note, page 49
478	UInt	L1-L2 voltage (V)	1
479	UInt	L2-L3 voltage (V)	1
480	UInt	Voltage phase imbalance (%)	1
481	UInt	Power factor (x 0.01)	1
482	UInt	Active power (x 0.1 kW)	1
483	UInt	Reactive power (x 0.1 kVAR)	1
484	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	Word	Controller last power OFF duration	
486-489	Word	*(Not significant)*	
490	Word	Network port monitoring	
		bit 0 Network port monitoring	
		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	UInt	Network port baud rate , page 54	
492		*(Not significant)*	
493	UInt	Network port parity , page 54	
494-499		*(Not significant)*	
500-501	UDInt	Average current (x 0.01 A)	
502-503	UDInt	L1 current (x 0.01 A)	
504-505	UDInt	L2 current (x 0.01 A)	
506-507	UDInt	L3 current (x 0.01 A)	
508-509	UDInt	Ground current (mA)	
510	UInt	Controller port ID	
511	UInt	Time to trip (x 1 s)	
512	UInt	Motor last start current ratio (% FLC)	
513	UInt	Motor last start duration (s)	
514	UInt	Motor starts per hour count	

Register	Variable Type	Read-only Variables	Note, page 49
515	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		*(Reserved)*	
524-539		*(Forbidden)*	

Configuration Variables

Configuration Overview

Configuration variables are grouped according to the following criteria:

Configuration Variable Groups	Registers
Configuration	540 to 649
Setting	650 to 699

Configuration Variables

The configuration variables are described in the following table:

Register	Variable Type	Read/Write Variables	Note, page 49
540	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	UInt	Motor transition timeout (s)	
542-544		*(Reserved)*	

Register	Variable Type	Read/Write Variables	Note, page 49
545	Word	Controller AC inputs setting register	
		bits 0-3 Controller AC logic inputs configuration , page 52	
		bits 4-15 *(Reserved)*	
546	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	UInt	Thermal overload trip definite timeout (s)	
548		*(Reserved)*	
549	UInt	Motor temperature sensor trip threshold (x 0.1 Ω)	
550	UInt	Motor temperature sensor alarm threshold (x 0.1 Ω)	
551	UInt	Motor temperature sensor trip threshold degree (°C)	
552	UInt	Motor temperature sensor alarm threshold degree (°C)	
553	UInt	Rapid cycle lockout timeout (s)	
554		*(Reserved)*	
555	UInt	Current phase loss timeout (x 0.1 s)	
556	UInt	Overcurrent trip timeout (s)	
557	UInt	Overcurrent trip threshold (% FLC)	
558	UInt	Overcurrent alarm threshold (% FLC)	
559	Word	Ground current trip configuration	B
		bit 0 Ground current mode	
		bit 1 Ground trip disabled while starting	
		bits 2-15 *(Reserved)*	
560	UInt	Ground current sensor primary	
561	UInt	Ground current sensor secondary	
562	UInt	External ground current trip timeout (x 0.01 s)	
563	UInt	External ground current trip threshold (x 0.01 A)	
564	UInt	External ground current alarm threshold (x 0.01 A)	
565	UInt	Motor nominal voltage (V)	1
566	UInt	Voltage phase imbalance trip timeout starting (x 0.1 s)	1
567	UInt	Voltage phase imbalance trip timeout running (x 0.1 s)	1
568	UInt	Voltage phase imbalance trip threshold (% imb)	1
569	UInt	Voltage phase imbalance alarm threshold (% imb)	1

Register	Variable Type	Read/Write Variables	Note, page 49
570	UInt	Overvoltage trip timeout (x 0.1 s)	1
571	UInt	Overvoltage trip threshold (% Vnom)	1
572	UInt	Overvoltage alarm threshold (% Vnom)	1
573	UInt	Undervoltage trip timeout	1
574	UInt	Undervoltage trip threshold (% Vnom)	1
575	UInt	Undervoltage alarm threshold (% Vnom)	1
576	UInt	Voltage phase loss trip timeout (x 0.1 s)	1
577	Word	Voltage dip setting	1
		bits 0-1 Voltage dip mode 0 = None (factory setting) 1 = Load shedding 2 = Auto-restart	
		bits 3-15 *(Reserved)*	
578	UInt	Load shedding timeout (s)	1
579	UInt	Voltage dip threshold (% Vnom)	1
580	UInt	Voltage dip restart timeout (s)	1
581	UInt	Voltage dip restart threshold (% Vnom)	1
582	UInt	Auto restart immediate timeout (x 0.1 s)	
583	UInt	Motor nominal power (x 0.1 kW)	1
584	UInt	Overpower trip timeout (s)	1
585	UInt	Overpower trip threshold (% Pnom)	1
586	UInt	Overpower alarm threshold (% Pnom)	1
587	UInt	Underpower trip timeout (s)	1
588	UInt	Underpower trip threshold (% Pnom)	1
589	UInt	Underpower alarm threshold (% Pnom)	1
590	UInt	Under power factor trip timeout (x 0.1 s)	1
591	UInt	Under power factor trip threshold (x 0.01 PF)	1
592	UInt	Under power factor alarm threshold (x 0.01 PF)	1
593	UInt	Over power factor trip timeout (x 0.1 s)	1
594	UInt	Over power factor trip threshold (x 0.01 PF)	1
595	UInt	Over power factor alarm threshold (x 0.01 PF)	1
596	UInt	Auto restart delayed timeout (s)	
597-599		*(Reserved)*	
600		*(Not significant)*	

Register	Variable Type	Read/Write Variables	Note, page 49
601	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 58	B
		bit 15 Motor auxiliary fan cooled (factory setting = 0)	
602	Word	General configuration register 2	
		bits 0-2 Trip reset mode , page 58	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	
		bit 11 HMI motor status LED color	
		bits 12-15 *(Reserved)*	
603	UInt	HMI port address setting	
604	UInt	HMI port baud rate setting (Baud)	
605		*(Reserved)*	
606	UInt	Motor trip class (s)	
607		*(Reserved)*	
608	UInt	Thermal overload trip reset threshold (% trip level)	
609	UInt	Thermal overload alarm threshold (% trip level)	
610	UInt	Internal ground current trip timeout (x 0.1 s)	
611	UInt	Internal ground current trip threshold (% FLCmin)	
612	UInt	Internal ground current alarm threshold (% FLCmin)	
613	UInt	Current phase imbalance trip timeout starting (x 0.1 s)	
614	UInt	Current phase imbalance trip timeout running (x 0.1 s)	
615	UInt	Current phase imbalance trip threshold (% imb)	
616	UInt	Current phase imbalance alarm threshold (% imb)	
617	UInt	Jam trip timeout (s)	

Register	Variable Type	Read/Write Variables	Note, page 49
618	UInt	Jam trip threshold (% FLC)	
619	UInt	Jam alarm threshold (% FLC)	
620	UInt	Undercurrent trip timeout (s)	
621	UInt	Undercurrent trip threshold (% FLC)	
622	UInt	Undercurrent alarm threshold (% FLC)	
623	UInt	Long start trip timeout (s)	
624	UInt	Long start trip threshold (% FLC)	
625		*(Reserved)*	
626	UInt	HMI display contrast setting	
		bits 0-7 HMI display contrast setting	
		bits 8-15 HMI display brightness setting	
627	UInt	Contactor rating (0.1 A)	
628	UInt	Load CT primary	B
629	UInt	Load CT secondary	B
630	UInt	Load CT multiple passes (passes)	B
631	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	Variable Type	Read/Write Variables	Note, page 49
632	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	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	Variable Type	Read/Write Variables	Note, page 49
634	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
635-6		*(Reserved)*	
637	UInt	Auto-reset attempts group 1 setting (resets)	
638	UInt	Auto-reset group 1 timeout (s)	
639	UInt	Auto-reset attempts group 2 setting (resets)	
640	UInt	Auto-reset group 2 timeout (s)	
641	UInt	Auto-reset attempts group 3 setting (resets)	
642	UInt	Auto-reset group 3 timeout (s)	
643	UInt	Motor step 1 to 2 timeout (x 0.1 s)	
644	UInt	Motor step 1 to 2 threshold (% FLC)	
645	UInt	HMI port fallback setting , page 58	
646-649		*(Reserved)*	

Setting Variables

The setting variables are described in the following table:

Register	Variable Type	Read/Write Variables	Note, page 49
650	Word	HMI language setting register:	
		bits 0-4 HMI language setting , page 57	
		bits 5-15 *(Not significant)*	
651	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	UInt	Motor full load current ratio, FLC1 (% FLCmax)	
653	UInt	Motor high speed full load current ratio, FLC2 (% FLCmax)	
654	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	

Register	Variable Type	Read/Write Variables	Note, page 49
655-658	Word[4]	Date and time setting , page 52	
659	Word	HMI display items register 3	
		bit 0 HMI display temperature sensor degree CF	
		bits 1-15 *(Reserved)*	
660-681		*(Reserved)*	
682	UInt	Network port fallback setting , page 58	
683	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		*(Reserved)*	
693	UInt	Network port comm loss timeout (x 0.01 s) (Modbus only)	
694	UInt	Network port parity setting (Modbus only)	
695	UInt	Network port baud rate setting (Baud) , page 54	

Register	Variable Type	Read/Write Variables	Note, page 49
696	UInt	Network port address setting	
697-699		*(Not significant)*	

Command Variables

Command Variables

Command variables are described in the following table:

Register	Variable Type	Read/Write Variables	Note, page 49
700	Word	Register available to remotely write commands that can be processed in a specific custom logic	
701-703		*(Reserved)*	
704	Word	Control register 1	
		bit 0 Motor run forward command [6]	
		bit 1 Motor run reverse command [6]	
		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	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		*(Reserved)*	
710-799		*(Forbidden)*	

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

User Map Variables

User Map Variables

User Map variables are described in the following table:

User Map Variable Groups	Registers
User Map addresses	800 to 899
User Map values	900 to 999

Register	Variable Type	Read/Write Variables	Note, page 49
800-898	Word[99]	User map addresses setting	
899		*(Reserved)*	
Register	**Variable Type**	**Read/Write Variables**	**Note, page 49**
900-998	Word[99]	User map values	
999		*(Reserved)*	

Custom Logic Variables

Custom Logic Variables

Custom logic variables are described in the following table:

Register	Variable Type	Read-only Variables	Note, page 49
1200	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	Word	Custom logic version	

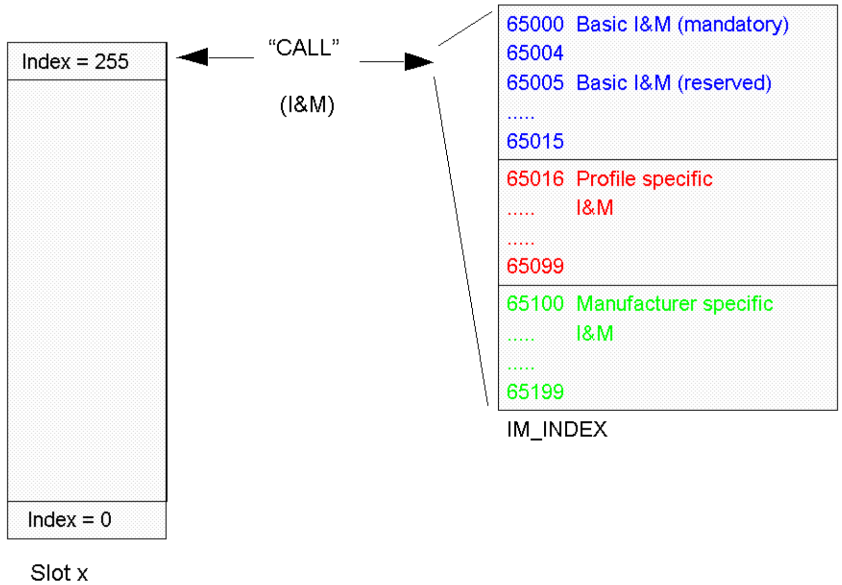
Register	Variable Type	Read-only Variables	Note, page 49
1202	Word	Custom logic memory space	
1203	Word	Custom logic memory used	
1204	Word	Custom logic temporary space	
1205	Word	Custom logic non volatile space	
1206-1249		*(Reserved)*	
Register	**Variable Type**	**Read/Write Variables**	**Note, page 49**
1250	Word	Custom logic setting register 1	
		bit 0 (Reserved)	
		bit 1 Logic input 3 external ready enable	
		bits 2-15 (Reserved)	
1251-1269		*(Reserved)*	
1270	Word	Custom logic command register 1	
		bit 0 Custom logic external trip command	
		bits 1-15 (Reserved)	
1271-1279		*(Reserved)*	
Register	**Variable Type**	**Read-only Variables**	**Note, page 49**
1280	Word	Custom logic monitoring register 1	
		bit 0 (Reserved)	
		bit 1 Custom logic system ready	
		bits 2-15 (Reserved)	
1281-1300		*(Reserved)*	
Register	**Variable Type**	**Read/Write Variables**	**Note, page 49**
1301-1399	Word[99]	General purpose registers for logic functions	

Identification and Maintenance Functions (IMF)

IM Index Space and Partitions

In order to avoid conflicts with any PROFIBUS DP devices already installed in the field and to save address space for operational parameters, the I&M proposal follows the CALL_REQ service defined within IEC 61158-6.

This service, part of the "Load Domain" Upload/Download services, can be used within any module independent from any directory in a representative module (for example, slot 0) of a device. It uses index 255 within any slot and opens a separate addressable sub-index space. For I&M functions, the sub-index range from 65000 to 65199 is reserved. Sub-index blocks are called IM_Index.



The CALL_REQ service needs several header bytes, reducing the possible net data length to 236 bytes.

For I&M functions the following block of sub indices (IM_INDEX) is used:

IM_INDEX	Usage
65000	I&M0
65001	I&M1
65002	I&M2
65003	I&M3
65004	I&M4
65005 ... 65015	Reserved for additional general I&M functions
65016 ... 65099	Profile specific I&M functions
65100 ... 65199	Manufacturer specific I&M functions

I&M0 - The Mandatory Record

The transport of the I&M parameters across the PROFIBUS DP network via MS1 (optional) or MS2 (mandatory) is supported. Only I&M0 data with IM0_Index = 65000 can be read. No other IM_Indices are supported.

Structure of the I&M0 record:

```
// structure for I&M0 (mandatory)
typedef struct
{
  UBYTE    abHeader[10];
  UWORD    wManufacturerID;
  UBYTE    abOrderID[20];
  UBYTE    abSerialNumber[16];
  UWORD    wHardwareRevision;
  UBYTE    abSoftwareRevision[4];
  UWORD    wRevCounter;
  UWORD    wProfileID;
  UWORD    wProfileSpecificType;
  UBYTE    abIMVersion[2];
  UWORD    wIMSupported;
} sIM0;
```

During startup of the firmware this structure is initialized with the relevant information. A PROFIBUS DPV1 primary (master) (MS1 or MS2) can read this information at any time using the CALL_REQ mechanism.

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 (e.g. temperature) or outputs (e.g. 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 (e.g. 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 (e.g. 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:

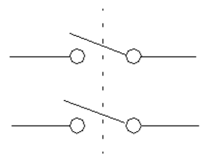
Deutsches Institut für Normung. The European organization that organizes the creation and maintenance of dimensional and engineering standards.

discrete:

Describes inputs (e.g. switches) or outputs (e.g. coils) that can be only *ON* or *OFF*. Contrast with analog.

DPST:

double-pole/single-throw. A switch that connects or disconnects 2 circuit conductors in a single branch circuit. A DPST switch has 4 terminals, and is the equivalent of 2 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 2 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 delays the response of the LTMR controller before it stops measuring the duration of detected 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 (e.g. current). Contrast with definite time.

M

Modbus:

Modbus is the name of the master-slave/client-server serial communications protocol developed by Modicon (now Schneider Electric) 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 2-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 (e.g. 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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W

Schneider Electric
800 Federal Street
Andover, MA 01810
USA

888–778–2733

www.se.com

As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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