37430A

easYgen-2000 Series
Genset Control

Interface
Software Version 1.xxxx

EASYGEN 2000

Manual 37430A

WARNING

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

The engine, turbine, or other type of prime mover should be equipped with an overspeed (overtemperature, or overpressure, where applicable) shutdown device(s), that operates totally independently of the prime mover control device(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the mechanical-hydraulic governor(s) or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled device(s) fail.

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

CAUTION

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

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Important definitions

WARNING

Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that, if not avoided, could result in damage to equipment.

NOTE

Provides other helpful information that does not fall under the warning or caution categories.

Revision History

Rev.	Date	Editor	Changes
NEW	09-06-09	TE	Release
A	10-06-07	TE	Minor changes

Contents

Figures and Tables

Figures

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General Information

Document Overview

Type		English	German
easYgen-2000 Series			
easYgen-2000 Series - Installation		37426	GR37426
easYgen-2000 Series - Configuration		37427	GR37427
easYgen-2000 Series - Operation		37428	GR37428
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Table 1-1: Manual - overview

Intended Use The unit must only be operated in the manner described by this manual. The prerequisite for a proper and safe operation of the product is correct transportation, storage, and installation as well as careful operation and maintenance.

NOTE

This manual has been developed for a unit fitted with all available options. Inputs/outputs, functions, configuration screens, and other details described, which do not exist on your unit, may be ignored.

The present manual has been prepared to enable the installation and commissioning of the unit. Due to the large variety of parameter settings, it is not possible to cover every combination. The manual is therefore only a guide. In case of incorrect entries or a total loss of functions, the default settings may be taken from the list of parameters enclosed in the configuration manual 37427 or from ToolKit and the respective *.SID file.

Abbreviations

The following abbreviations are frequently used in this documents:

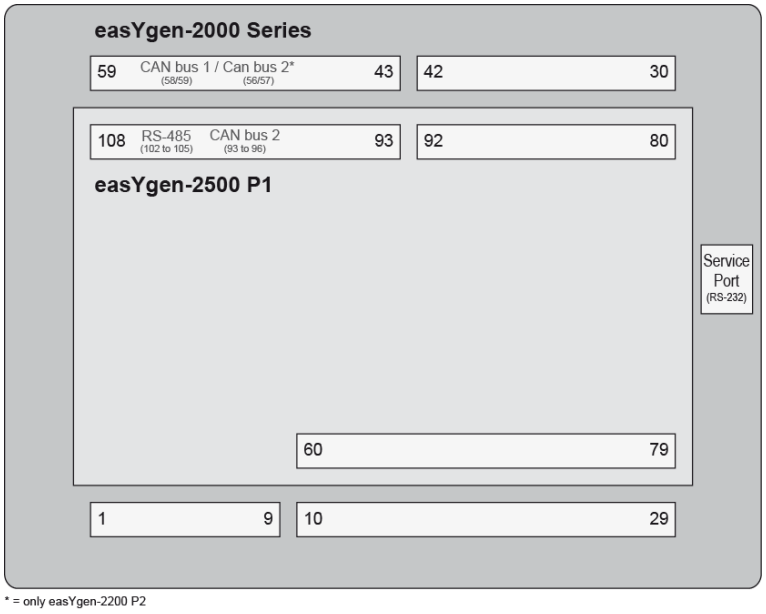
- PDO Process Data Object
- RPDO Receive PDO
- TPDO Transmit PDO
- SDO Service Data Object
- SSDO Server SDO
- MSB Most Significant Bit
- LSB Least Significant Bit

Interface Overview

Depending on the respective model and package, the easYgen-2000 Series provides up to 2 CAN interfaces and 2 serial interfaces. Table 1-2 indicates the interface set up of respective model and package.

Interface(s)	CAN	Serial RS-485	Service Port RS-232
easYgen-2200 P1	1	-	1
easYgen-2200 P2	2	-	1
easYgen-2500 P1	2	1	1

Table 1-2: Interfaces – overview



CAN bus 1	- CANopen (Protocol 5100)
CAN bus 2	- CANopen (IKD 1 and Phoenix expansion boards) - J1939 ECU
RS-485	- Toolkit (Servlink), - Modbus (Protocol 5100)
Service Port (RS-232)	- Toolkit (Servlink), - Modbus (Protocol 5100)

Figure 1-1: easYgen - interface overview

CAN Interfaces

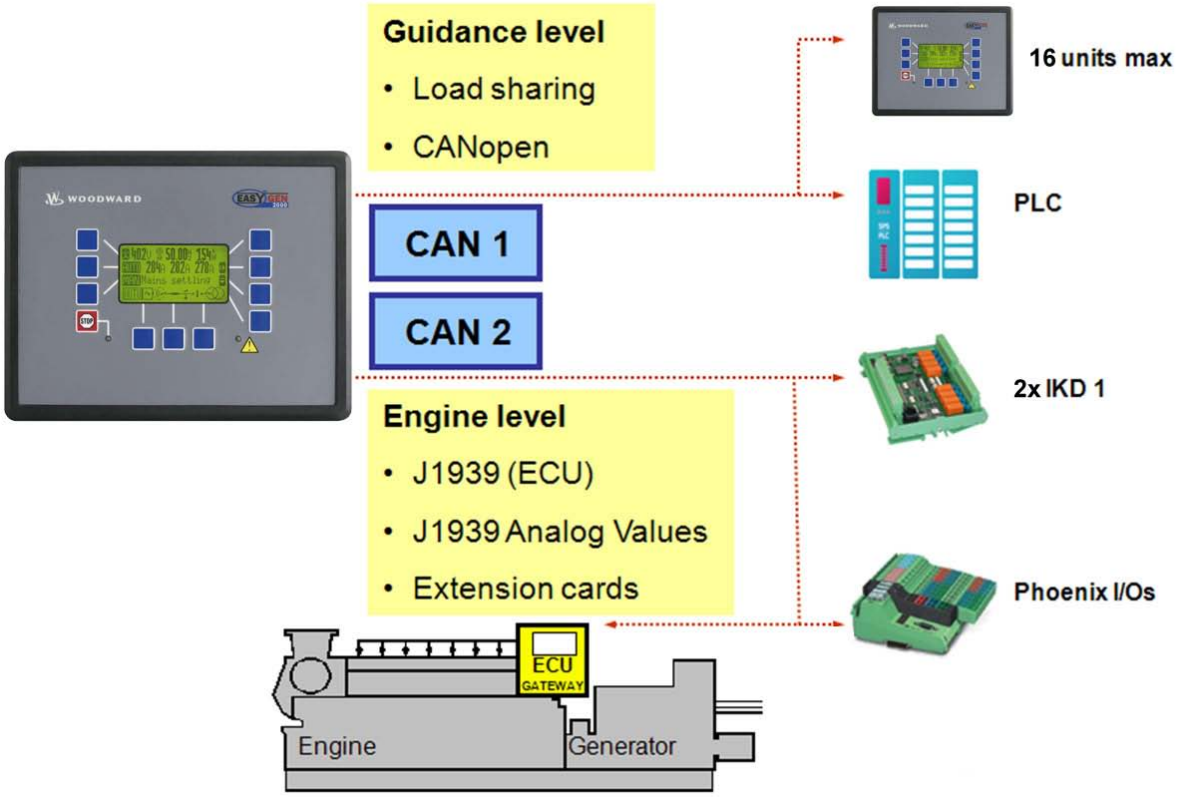


Figure 1-2: Interface overview - CAN interfaces

CAN Interface 1 – Freely Configurable CANopen Interface

CAN interface 1 is a freely configurable CANopen interface with 3 RPDOs (receive boxes), 3 TPDOs (send boxes), and 4 additional Server SDOs.

CAN Interface 2 (Engine Bus)

The CAN interface 2 supports the CANopen and J1939 protocol simultaneously. It supports the connection of a wide range of engine control units (ECUs) and J1939 analog input control modules, which comply with the J1939 standard (e.g. Axiomatic).

Pre-Configured CANopen Interface

CAN interface 2 is pre-configured for several expansion units. These include the I/O expansion boards Woodward IKD 1 and several combinations of the expansion boards of the Phoenix Inline Modular (IL) series.

It is possible to connect several combinations of up to four Woodward IKD 1s and Phoenix Inline Modular (IL) modules with up to 16 discrete inputs/outputs. Refer to the Application Manual 37429 for a list of example configurations of different load sharing applications.

Monitoring

The two CAN interfaces may be monitored individually. Refer to the Configuration Manual 37427 for more information about this monitoring function with a dedicated alarm message and reaction for each interface.

CAN Bus Diagnosis

The state and the load of the CAN interfaces can be monitored. Refer to CAN Bus Diagnosis on page 12 for detailed information.

J1939 Interface

The J1939 protocol enables to connect a vast majority of Engine Control Units (ECUs) with the easYgen on the CAN bus. Beyond this, the following ECUs are supported with additional communication features:

- S6 Scania
- EMR2 Deutz
- EMS 2 Volvo
- ADEC MTU
- EGS Woodward
- EDC7 MAN
- EEM SISU
- Cummins

Serial Interfaces

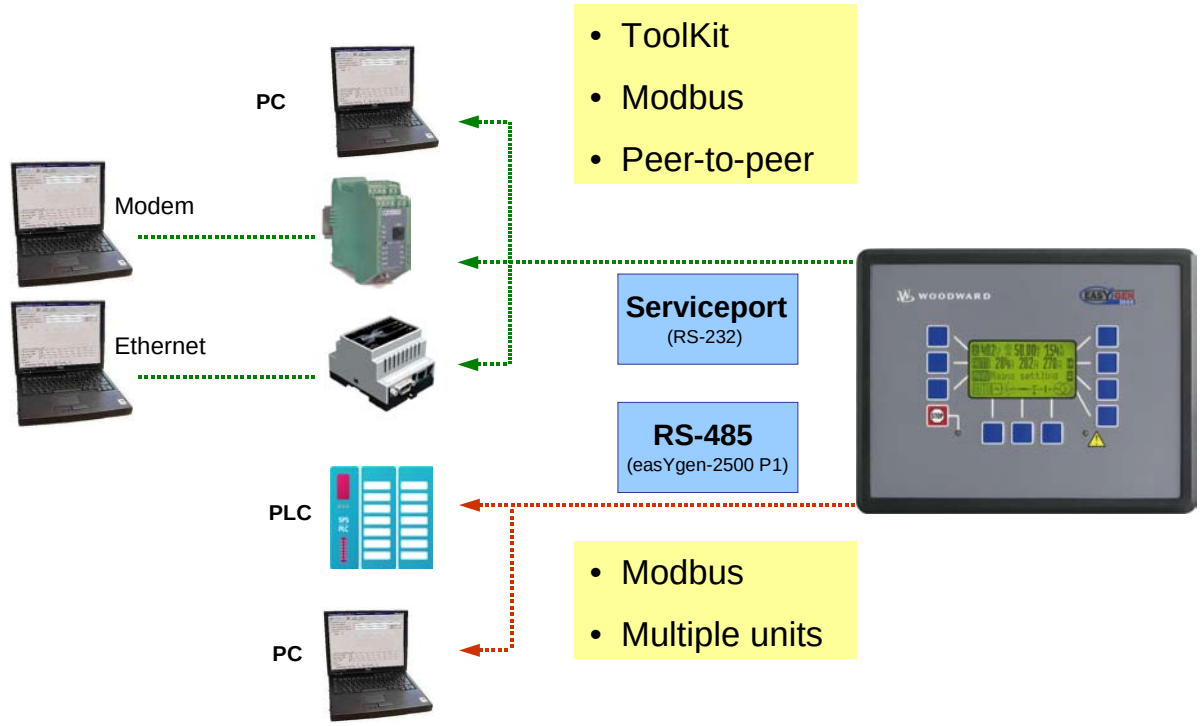


Figure 1-3: Interface overview - serial interfaces

Serial Interface – Serviceport (RS-232)

A freely configurable RS-232 interface is provided to serve as a local service interface for configuring the unit and visualize measured data. It is possible to connect a modem for remote control and alarm signaling. The serial interface provides a ServLink as well as a Modbus protocol.

Serial Interface – RS-485 (easYgen-2500 P1 only)

A freely configurable RS-485 half duplex Modbus RTU Slave interface is provided to add PLC connectivity. It is also possible to configure the unit, visualize measured data and alarm messages, and control the unit remotely.

RS-485 Modbus Half Duplex Application

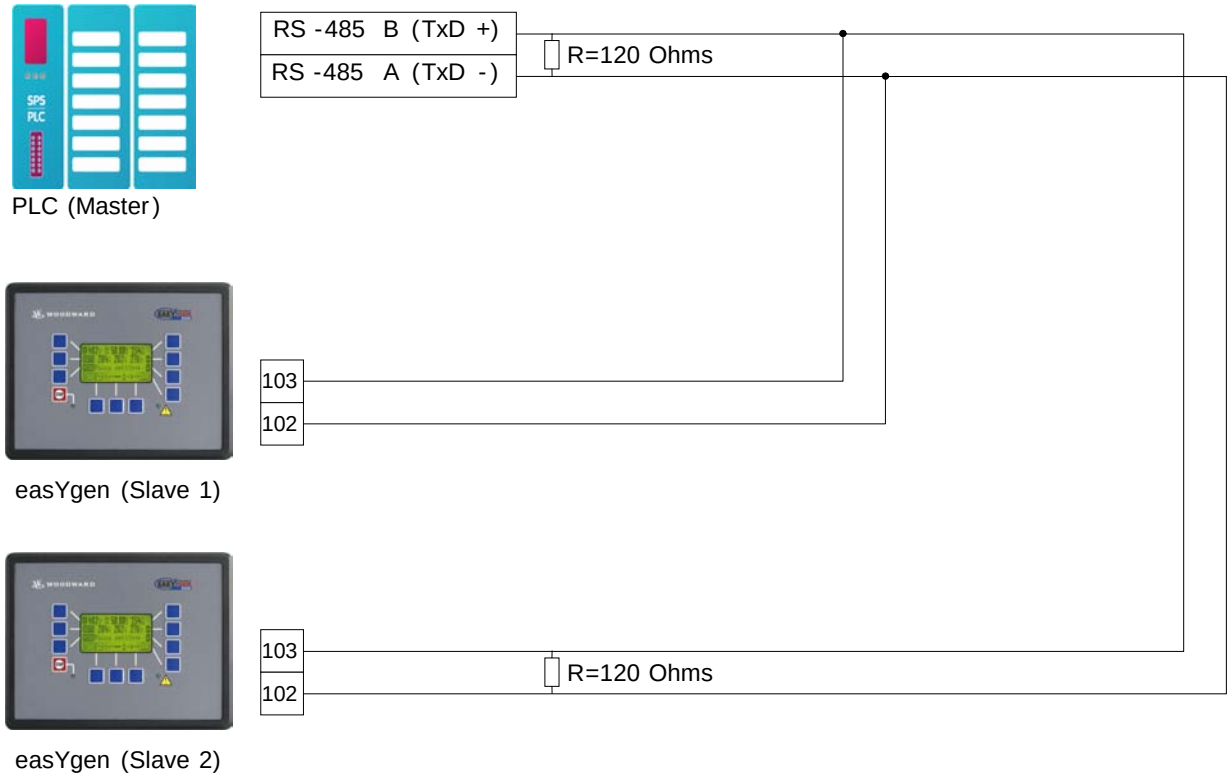


Figure 1-4: Interface overview - serial interface Modbus half-duplex

Chapter 2.
CAN Bus Configuration

CAN Bus Diagnosis

Load Diagnosis

Multiple units on the CAN bus may cause a high bus load depending on the used protocols and baud rate. The easYgen-2000 Series provides a diagnosis screen to monitor the actual load on the CAN bus.

On the start screen, select Main Menu -> Diagnostic -> Miscellaneous -> Load diagnostic to access the Load diagnostic screen. This screen provides information about the total CAN bus load as well as the CANopen and J1939 bus load on CAN bus 1 and 2. The total CAN bus load is the sum of the message load on CAN bus 1 and 2. 33 messages on the CAN buses within 20 ms correspond with 100 % load. If more than 32 messages are sent within 20 ms, the logical command variable "08.20 CAN bus overload" will be enabled and the busses will be disabled consecutively starting with the last in the list (CAN1 bus load J1939) until the load falls below 33 messages per 20 ms. The re-connection of the busses is performed in the opposite order starting with the first in the list (CAN2 bus load CANopen). The easYgen also provides a monitoring function for initiating dedicated actions in case the CAN bus load is exceeded (refer to the Configuration Manual 37427 for detailed information).

Recommendation: The total load of the CAN bus should not exceed 100 % in normal operation.

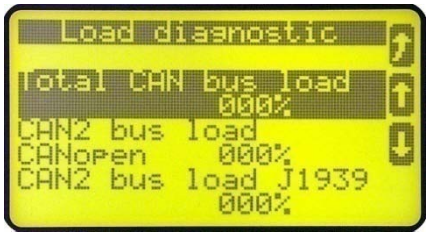


Figure 2-1: CAN bus load diagnostic screen

NOTE

Refer to the Application Manual 37429 for a list of example configurations of different load sharing applications.

Status Diagnosis

The easYgen provides the user with a status of the CAN interfaces to facilitate troubleshooting.

On the start screen, select Main menu -> Diagnostic -> Miscellaneous -> CAN interface 1/2 state to access the CAN interface 1/2 state screen. This screen provides information about the status of the respective CAN interface. The screen shown in Figure 2-2 is available for CAN interface 1 as well as for CAN interface 2.

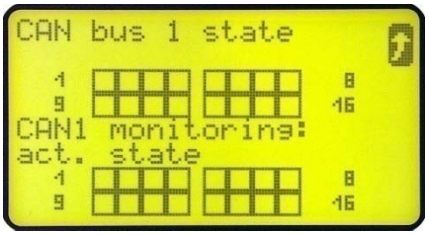


Figure 2-2: CAN interface state screen

If a bit is enabled in this screen, this is indicated by a black square:
- The respective bit is enabled
- The respective bit is disabled

The different bits have the following importance:

Can bus 1 state:
- Bit 1: a TPDO has incorrect mapping parameters
- Bit 2: an RPDO has incorrect mapping parameters
- Bit 3: a TPDO has more than 8 bytes (is configured with several parameters, which exceed a total length of 8 bytes)
- Bit 4: an RPDO has more than 8 bytes (is configured with several parameters, which exceed a total length of 8 bytes)

CAN 1 monitoring (active state):
- Bit {x}: RPDO{x} is not received at the moment

Can bus 2 state:
- Bit 13: one Node ID is assigned to more than 1 device (this results a Node ID conflict, because each device must have a different Node ID)

CAN 2 monitoring (active state):
- Bit {x}: CAN Node ID {x} is not received at the moment

All other bits, which are not described here, are not used and have no importance.

CAN Interface Parameters

NOTE

The following parameters are available for configuring the CAN bus Interfaces. Refer to the Configuration Manual 37427 for detailed information about all parameters.

Configure CAN Interface 1

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 1			
3156	Baudrate	20 / 50 / 100 / 125 / 250 / 500 / 800 / 1000 kBd	250 kBd
8950	Node-ID CAN-Bus 1	1 to 127	1
8993	CANopen Master	Default Master / On / Off	Default Master
9120	Producer heartbeat time	0 to 65500 ms	2000 ms
9100	COB ID SYNC Message	1 to FFFFFFFF hex	80 hex
8940	Producer SYNC Message time	0 to 65500 ms	20 ms
9101	COB ID TIME Message	1 to FFFFFFFF hex	100 hex

Table 2-1: CAN bus - CAN interface 1 - parameters

Additional Server SDOs (Service Data Objects)

NOTE

The CAN bus is a field bus and subject to various disturbances. Therefore, it cannot be guaranteed that every request will be answered. We recommend to repeat a request, which is not answered within reasonable time.

NOTE

The first Node ID is the standard Node ID of CAN interface 1 (parameter 8950).

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 1: additional Server SDOs			
33040	2. Node-ID	0 to 127	0
33041	3. Node-ID	0 to 127	0
33042	4. Node-ID	0 to 127	0
33043	5. Node-ID	0 to 127	0

Table 2-2: CAN bus - CAN interface 1 - additional server SDOs - parameters

Receive PDOs (Process Data Objects) 1 to 3

Figure 2-3 shows the principle of PDO mapping.

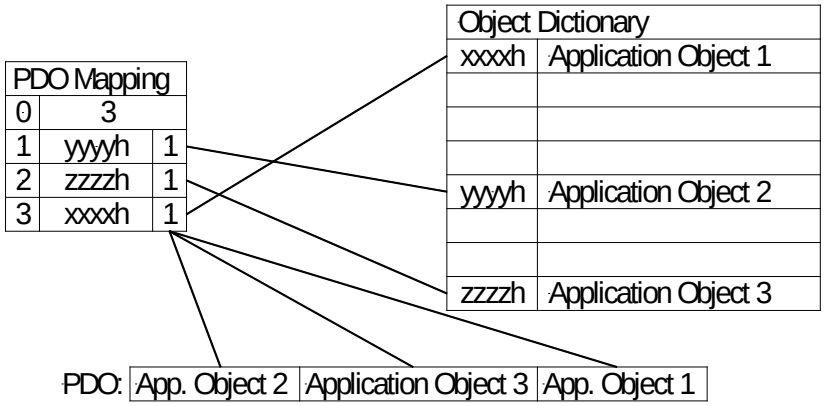


Figure 2-3: Interfaces - principle of PDO mapping

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 1: receive PDO 1			
9300	COB-ID	1 to FFFFFFFF hex	80000000 hex
9121	Event-timer	0 to 65500 ms	2000 ms
8970	Selected data protocol	0 to 65535	0
9910	Number of Mapped Objects	0 to 4	0
9911	1. Mapped Object	0 to 65535	0
9912	2. Mapped Object	0 to 65535	0
9913	3. Mapped Object	0 to 65535	0
9914	4. Mapped Object	0 to 65535	0

Table 2-3: CAN bus - CAN interface 1 - receive PDO 1 - parameters

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 1: receive PDO 2			
9310	COB-ID	1 to FFFFFFFF hex	80000000 hex
9122	Event-timer	0 to 65500 ms	2000 ms
8971	Selected data protocol	0 to 65535	0
33855	Number of Mapped Objects	0 to 4	0
9916	1. Mapped Object	0 to 65535	0
9917	2. Mapped Object	0 to 65535	0
9918	3. Mapped Object	0 to 65535	0
9919	4. Mapped Object	0 to 65535	0

Table 2-4: CAN bus - CAN interface 1 - receive PDO 2 - parameters

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 1: receive PDO 3			
9320	COB-ID	1 to FFFFFFFF hex	80000000 hex
9123	Event-timer	0 to 65500 ms	2000 ms
8972	Selected data protocol	0 to 65535	0
33860	Number of Mapped Objects	0 to 4	0
9906	1. Mapped Object	0 to 65535	0
9907	2. Mapped Object	0 to 65535	0
9908	3. Mapped Object	0 to 65535	0
9909	4. Mapped Object	0 to 65535	0

Table 2-5: CAN bus - CAN interface 1 - receive PDO 3 - parameters

NOTE

Do not configure an RPDO or TPDO with a COB-ID higher than 580 (hex) or lower than 180 (hex). These IDs are reserved for internal purposes.

Transmit PDOs (Process Data Objects) 1 to 3

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 1: transmit PDO 1			
9600	COB-ID	1 to FFFFFFFF hex	00000181 hex
9602	Transmission type	0 to 255	255
9604	Event timer	0 to 65500 ms	20 ms
8962	Selected data protocol	0 to 65535	5100
9609	Number of Mapped Objects	0 to 4	0
9605	1. Mapped Object	0 to 65535	0
9606	2. Mapped Object	0 to 65535	0
9607	3. Mapped Object	0 to 65535	0
9608	4. Mapped Object	0 to 65535	0

Table 2-6: CAN bus - CAN interface 1 - transmit PDO 1 - parameters

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 1: transmit PDO 2			
9610	COB-ID	1 to FFFFFFFF hex	80000000 hex
9612	Transmission type	0 to 255	255
9614	Event timer	0 to 65500 ms	20 ms
8963	Selected data protocol	0 to 65535	0
9619	Number of Mapped Objects	0 to 4	0
9615	1. Mapped Object	0 to 65535	0
9616	2. Mapped Object	0 to 65535	0
9617	3. Mapped Object	0 to 65535	0
9618	4. Mapped Object	0 to 65535	0

Table 2-7: CAN bus - CAN interface 1 - transmit PDO 2 - parameters

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 1: transmit PDO 3			
9620	COB-ID	1 to FFFFFFFF hex	80000000 hex
9622	Transmission type	0 to 255	255
9624	Event timer	0 to 65500 ms	20 ms
8964	Selected data protocol	0 to 65535	0
9629	Number of Mapped Objects	0 to 4	0
9625	1. Mapped Object	0 to 65535	0
9626	2. Mapped Object	0 to 65535	0
9627	3. Mapped Object	0 to 65535	0
9628	4. Mapped Object	0 to 65535	0

Table 2-8: CAN bus - CAN interface 1 - transmit PDO 3 - parameters

NOTE

Do not configure an RPDO or TPDO with a COB-ID higher than 580 (hex) or lower than 180 (hex). These IDs are reserved for internal purposes.

Configure CAN Interface 2

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 2			
3157	Baudrate	20 / 50 / 100 / 125 / 250 kBd	250 kBd

Table 2-9: CAN bus - CAN interface 2 - parameters

CANopen Interface

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 2: CANopen			
9940	This device	Node-ID 1 / 2 / 3 / 4 / 5 / 6 / 7	Node-ID 7
9930	IKD1 DI/DO 1..8	Off / Node-ID 1 / 2 / 3 / 4 / 5 / 6 / 7	Off
9931	IKD1 DI/DO 9..16	Off / Node-ID 1 / 2 / 3 / 4 / 5 / 6 / 7	Off
9934	Phoenix DI/DO 1..16	Off / Node-ID 1 / 2 / 3 / 4 / 5 / 6 / 7	Off
15134	Configure external devices	Yes / No	No

Table 2-10: CAN bus - CAN interface 2 - CANopen - parameters

J1939 Interface

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 2: J1939			
15106	J1939 own adress	0 to 255	234
15107	Engine control address	0 to 255	0
15108	Reset previous act. DTCs - DM3	Yes / No	No
15133	Reset act. DTCs – DM11	Yes / No	No
15103	SPN version	Version 1 / Version 2 / Version 3	Version 1
15102	Device type	Off / Standard / S6 Scania / EMR2 Deutz / EMS 2 Volvo / ADEC MTU / EGS Woodward / EDC7 MAN / EEM SISU / Cummins	Standard
15127	ECU remote controlled	On / Off	Off
5537	Speed deviation ECU	0 to 1400 rpm	120 rpm

Table 2-11: CAN bus - CAN interface 2 - J1939 - parameters

CAN Bus Load Sharing

Multi-Master Principle

It is important to know that the load share and load-dependent start/stop functionality is subject to a multi-master principle. This means that there is no dedicated master and slave function. Each easYgen decides for itself how it has to behave. The benefit is that there is no master control, which may cause a complete loss of this functionality in case it fails. Each control is also responsible for controlling common breakers like a mains circuit or generator group breaker.

Load Share Monitoring

The easYgen provides two monitoring functions for load sharing (refer to the Configuration Manual 37427 for a detailed description of these functions):

Multi-Unit Parameter Alignment

The multi-unit parameter alignment functionality requires that the relevant parameters are all configured identically at all participating units.

Multi-Unit Missing Members

The multi-unit missing members monitoring function checks whether all participating units are available (sending data on the load share line).

General Load Share Information

The maximum number of participating easYgen-2000 Series devices for load sharing is 16. The CANopen bus load increases with the number of units participating in load sharing.

The following parameters affect the bus load:

- Number of CAN participants
- Baud rate
- Transfer rate of load share messages
- Visualization

We recommend to consider whether all data has to be sent on the CAN bus when planning the CAN bus. It is also possible to send visualization data via RS-485 for example.

NOTE

Refer to the Application Manual 37429 for a list of example configurations of different load sharing applications.

Measures for Reducing the Bus Load

If you need to reduce the bus load of the load share CAN bus, the following measured may be used:

- Increase the baud rate (parameter 3156) under consideration of the bus length (refer to Installation Manual 37426)
- Reduce the transfer rate of the load share message (parameter 9921)
- Reduce the transfer rate of the visualization message, i.e. the event timer (parameter 9604)
- Disable the transmission visualization data on the CAN bus and use the RS-485 interface to transmit visualization data
- Disable SYNC message (parameter 9100) and/or TIME message (parameter 9101) and/or the producer heartbeat time SYNC message (parameter 9120), if possible

Configure Load Share Parameters

Load Share Parameters

NOTE

The following parameters are available for configuring the CAN bus Interfaces. Refer to the Configuration Manual 37427 for detailed information about all parameters.

Parameter table

ID	Text	Setting range	Default value
Configure CAN interface 2: load share			
9923	Load share Interface	CAN #1 / Off	CAN #1
9921	Transfer rate LS fast message	0.10 to 0.30 s	0.10 s
9920	Load Share CAN-ID	2xx Hex / 3xx Hex 4xx Hex / 5xx Hex	5xx Hex

Table 2-12: CAN bus - CAN interface 2 - load share parameters

NOTE

We recommend to configure the Node-IDs (parameter 8950) for units, which participate in load sharing, as low as possible to facilitate establishing of communication.

Definition of CANopen Protocol Descriptions

If a data protocol is used, a CAN message looks like this:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
MUX	Data byte	Data byte	Data byte	Data byte	Data byte	Data byte	internal

The MUX byte is counted up, the meaning of the data byte changes according to the value of the MUX byte.
In the protocol tables is listed which parameter at which MUX on which position is transmitted.
The meaning of the parameter can be taken by means of the number of the parameter description ("CANopen Mapping parameter").

Example:

MUX	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
1	118				147		internal

In MUX 1 (byte 1 has got value 1) the value of parameter 118 is included in the byte 2 up to byte 5 (mains voltage 1-2).
In byte 6 up to byte 7 the value of parameter 147 is included (mains frequency).
Byte 8 includes internal definitions and can be ignored.
The data format is low Byte/high Byte (compare with CiA draft standard 01 on page 26).

Definition of CANopen Data Format

Unsigned Integer

UNSIGNED type data has positive integers as values. The range is between 0 and 2n-1. The data is shown by the bit sequence of length n.

Bit sequence $b = b_0$ to b_{n-1}

shows the value $UNSIGNEDn(b) = b_{n-1}*2^{n-1}+....+b_1*2^1+b_0*2^0$

NOTE

Please note that the bit sequence starts on the left with the least significant byte.

Example: Value 266 = 10A hex of type UNSIGNED16 is transmitted on the bus in two octets, first 0A hex and then 01 hex.

The following UNSIGNED data types are transmitted as follows:

Octet Number	1.	2.	3.	4.	5.	6.	7.	8.
UNSIGNED8	b_7 to b_0							
UNSIGNED16	b_7 to b_0	b_{15} to b_8						
UNSIGNED24	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}					
UNSIGNED32	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}				
UNSIGNED40	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}			
UNSIGNED48	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}		
UNSIGNED56	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	
UNSIGNED64	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	b_{63} to b_{56}

Table 2-13: CAN bus - transfer syntax for data type UNSIGNEDn

Signed Integer

SIGNED type data has integers as values. The range is between 0 and 2^n-1. The data is shown by the bit sequence of length n.

Bit sequence $b = b_0$ to b_{n-1}

shows the value $SIGNEDn(b) = b_{n-2}*2^{n-2}+...+b_1*2^1+b_0*2^0$ if $b_{n-1} = 0$

and with two's complement $SIGNEDn(b) = SIGNEDn(\hat{}b)-1$ if $b_{n-1} = 1$

NOTE

Please note that the bit sequence starts on the left with the least significant byte.

Example: The value -266 = FEF6 hex of type SIGNED16 is transmitted in two octets, first F6 hex and then FE hex.

The following SIGNED data types are transmitted as follows:

Octet Number	1.	2.	3.	4.	5.	6.	7.	8.
SIGNED8	b_7 to b_0							
SIGNED16	b_7 to b_0	b_{15} to b_8						
SIGNED24	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}					
SIGNED32	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}				
SIGNED40	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}			
SIGNED48	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}		
SIGNED56	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	
SIGNED64	b_7 to b_0	b_{15} to b_8	b_{23} to b_{16}	b_{31} to b_{24}	b_{39} to b_{32}	b_{47} to b_{40}	b_{55} to b_{48}	b_{63} to b_{56}

Table 2-14: CAN bus - transfer syntax for data type INTEGERn

J1939 Protocol Display Messages

Messages of a device (for example an ECU) are received on the CAN bus according to J1939 protocol and are shown on the display.
This function can be used via the CAN interface parallel to the CANopen protocol or to ToolKit.
The Baud rate is similar for all devices connected to the CAN bus independent of the selected protocol.

Displayed Messages

DM1/DM2

The first 10 active alarm messages (Active Diagnostic Trouble Codes - DM1) and the first 10 unacknowledged alarm messages (Previously Active Diagnostic Trouble Codes - DM2) with SPN, FMI, and OC are displayed. The state of the lamps (amber/red) is always displayed.

- SPN (= Suspect Parameter Number) indicates the measuring value that the alarm code is referring (e.g. SPN = 100 corresponds to oil pressure).
- FMI (= Failure Mode Indicator) specifies the alarm more precisely (e.g. FMI = 3 means: value is valid but higher than the standard value.)
- OC: (Occurrence Count) indicates how often an alarm occurred. IF OC = 0, no alarm is present
- PGN (= Parameter Group Number) defines a particular combination of SPNs.

Refer to the J1939 specification for a list of all SPNs.

Standard Messages

SPN	PGN	Description	Resol.	Data range J1939	Index	Display with defective sensor	Display with missing sensor
52	65262	Engine intercooler temperature	1 °C	-40 to 210 °C	15217	32766 °C	32767 °C
91	61443	Throttle position	0.1 %	0 to 100 %	15207	3276.6 %	3276.7 %
92	61443	Load at current speed	1 %	0 to 250 %	15208	32766 %	32767 %
94	65263	Fuel delivery pressure	1 kPa	0 to 1000 kPa	15218	32766 kPa	32767 kPa
95	65276	Fuel filter difference pressure	1 kPa	0 to 500 kPa	15219	32766 kPa	32767 kPa
98	65263	Engine oil level	0.1 %	0 to 100 %	15210	3276.6 %	3276.7 %
100	65263	Engine oil pressure	1 kPa	0 to 1000 kPa	15205	32766 kPa	32767 kPa
101	65263	Crankcase pressure	1 kPa	-250 to 251 kPa	15220	32766 kPa	32767 kPa
102	65270	Boost pressure	1 kPa	0 to 500 kPa	15214	32766 kPa	32767 kPa
105	65270	Intake manifold temperature	1 °C	-40 to 210 °C	15215	32766 °C	32767 °C
106	65270	Turbo air inlet pressure	1 kPa	0 to 500 kPa	15221	32766 kPa	32767 kPa
107	65270	Air filter 1 difference pressure	0.01 kPa	0 to 12.5 kPa	15222	327.66 kPa	327.67 kPa
108	65269	Barometric pressure	0.1 kPa	0 to 125 kPa	15212	3276.6 kPa	3276.7 kPa
109	65263	Coolant pressure	1 kPa	0 to 500 kPa	15223	32766 kPa	32767 kPa
110	65262	Engine coolant temperature	1 °C	-40 to 210 °C	15202	32766 °C	32767 °C
111	65263	Coolant level	0.1 %	0 to 100 %	15206	3276.6 %	3276.7 %
127	65272	Transmission oil pressure	1 kPa	0 to 4000 kPa	15224	32766 kPa	32767 kPa
157	65243	Fuel rail pressure	0.1 MPa	0 to 251 Mpa	15225	3276.6 MPa	3276.7 MPa
171	65269	Ambient air temperature	0.1 °C	-273 to 1735 °C	15226	3276.6 °C	3276.7 °C
172	65269	Air inlet temperature	1 °C	-40 to 210 °C	15213	32766 °C	32767 °C
173	65270	Exhaust gas temperature	0.1 °C	-273 to 1735 °C	15216	3276.6 °C	3276.7 °C
174	65262	Fuel temperature	1 °C	-40 to 210 °C	15203	32766 °C	32767 °C
175	65262	Engine oil temperature	0.1 °C	-273 to 1735 °C	15309	3276.6 °C	3276.7 °C
176	65262	Turbo oil temperature	0.1 °C	-273 to 1735 °C	15227	3276.6 °C	3276.7 °C
177	65272	Transmission oil temperature	0.1 °C	-273 to 1735 °C	15228	3276.6 °C	3276.7 °C
183	65266	Fuel rate	0.1 l/h	0 to 3212.75 l/h	15307	3276.6 L/h	3276.7 L/h
190	61444	Engine speed	1 rpm	0 to 8031.875 rpm	15308	32766 rpm	32767 rpm
247	65253	Total engine hours [1]	1 h	0 to 210554060 h	15201	4294967294 h	4294967295 h
441	65164	Auxiliary temperature 1	1 °C	-40 to 210 °C	15229	32766 °C	32767 °C
442	65164	Auxiliary temperature 2	1 °C	-40 to 210 °C	15230	32766 °C	32767 °C
513	61444	Actual engine torque	1 %	-125 to 125 %	15209	32766 %	32767 %
1122	65191	Alternator bearing 1 temperature	1 °C	-40 to 210 °C	15231	32766 °C	32767 °C
1123	65191	Alternator bearing 2 temperature	1 °C	-40 to 210 °C	15232	32766 °C	32767 °C
1124	65191	Alternator winding 1 temperature	1 °C	-40 to 210 °C	15233	32766 °C	32767 °C

SPN	PGN	Description	Resol.	Data range J1939	Index	Display with defective sensor	Display with missing sensor
1125	65191	Alternator winding 2 temperature	1 °C	-40 to 210 °C	15234	32766 °C	32767 °C
1126	65191	Alternator winding 3 temperature	1 °C	-40 to 210 °C	15235	32766 °C	32767 °C
1131	65189	Intake manifold 2 temperature	1 °C	-40 to 210 °C	15236	32766 °C	32767 °C
1132	65189	Intake manifold 3 temperature	1 °C	-40 to 210 °C	15237	32766 °C	32767 °C
1133	65189	Intake manifold 4 temperature	1 °C	-40 to 210 °C	15238	32766 °C	32767 °C
1134	65262	Engine thermostat	0.1 %	0 to 100 %	15239	3276.6 %	3276.7 %
1135	65188	Engine oil temperature 2	0.1 °C	-273 to 1735 °C	15240	3276.6 °C	3276.7 °C
1136	65188	Engine ECU temperature	0.1 °C	-273 to 1735 °C	15241	3276.6 °C	3276.7 °C
1137	65187	Exhaust gas port 1 temperature	0.1 °C	-273 to 1735 °C	15242	3276.6 °C	3276.7 °C
1138	65187	Exhaust gas port 2 temperature	0.1 °C	-273 to 1735 °C	15243	3276.6 °C	3276.7 °C
1139	65187	Exhaust gas port 3 temperature	0.1 °C	-273 to 1735 °C	15244	3276.6 °C	3276.7 °C
1140	65187	Exhaust gas port 4 temperature	0.1 °C	-273 to 1735 °C	15245	3276.6 °C	3276.7 °C
1141	65186	Exhaust gas port 5 temperature	0.1 °C	-273 to 1735 °C	15246	3276.6 °C	3276.7 °C
1142	65186	Exhaust gas port 6 temperature	0.1 °C	-273 to 1735 °C	15247	3276.6 °C	3276.7 °C
1143	65186	Exhaust gas port 7 temperature	0.1 °C	-273 to 1735 °C	15248	3276.6 °C	3276.7 °C
1144	65186	Exhaust gas port 8 temperature	0.1 °C	-273 to 1735 °C	15249	3276.6 °C	3276.7 °C
1145	65185	Exhaust gas port 9 temperature	0.1 °C	-273 to 1735 °C	15250	3276.6 °C	3276.7 °C
1146	65185	Exhaust gas port 10 temperature	0.1 °C	-273 to 1735 °C	15251	3276.6 °C	3276.7 °C
1147	65185	Exhaust gas port 11 temperature	0.1 °C	-273 to 1735 °C	15252	3276.6 °C	3276.7 °C
1148	65185	Exhaust gas port 12 temperature	0.1 °C	-273 to 1735 °C	15253	3276.6 °C	3276.7 °C
1149	65184	Exhaust gas port 13 temperature	0.1 °C	-273 to 1735 °C	15254	3276.6 °C	3276.7 °C
1150	65184	Exhaust gas port 14 temperature	0.1 °C	-273 to 1735 °C	15255	3276.6 °C	3276.7 °C
1151	65184	Exhaust gas port 15 temperature	0.1 °C	-273 to 1735 °C	15256	3276.6 °C	3276.7 °C
1152	65184	Exhaust gas port 16 temperature	0.1 °C	-273 to 1735 °C	15257	3276.6 °C	3276.7 °C
1153	65183	Exhaust gas port 17 temperature	0.1 °C	-273 to 1735 °C	15258	3276.6 °C	3276.7 °C
1154	65183	Exhaust gas port 18 temperature	0.1 °C	-273 to 1735 °C	15259	3276.6 °C	3276.7 °C
1155	65183	Exhaust gas port 19 temperature	0.1 °C	-273 to 1735 °C	15260	3276.6 °C	3276.7 °C
1156	65183	Exhaust gas port 20 temperature	0.1 °C	-273 to 1735 °C	15261	3276.6 °C	3276.7 °C
1157	65182	Main bearing 1 temperature	0.1 °C	-273 to 1735 °C	15262	3276.6 °C	3276.7 °C
1158	65182	Main bearing 2 temperature	0.1 °C	-273 to 1735 °C	15263	3276.6 °C	3276.7 °C
1159	65182	Main bearing 3 temperature	0.1 °C	-273 to 1735 °C	15264	3276.6 °C	3276.7 °C
1160	65182	Main bearing 4 temperature	0.1 °C	-273 to 1735 °C	15265	3276.6 °C	3276.7 °C
1161	65181	Main bearing 5 temperature	0.1 °C	-273 to 1735 °C	15266	3276.6 °C	3276.7 °C
1162	65181	Main bearing 6 temperature	0.1 °C	-273 to 1735 °C	15267	3276.6 °C	3276.7 °C
1163	65181	Main bearing 7 temperature	0.1 °C	-273 to 1735 °C	15268	3276.6 °C	3276.7 °C
1164	65181	Main bearing 8 temperature	0.1 °C	-273 to 1735 °C	15269	3276.6 °C	3276.7 °C
1165	65180	Main bearing 9 temperature	0.1 °C	-273 to 1735 °C	15270	3276.6 °C	3276.7 °C
1166	65180	Main bearing 10 temperature	0.1 °C	-273 to 1735 °C	15271	3276.6 °C	3276.7 °C
1167	65180	Main bearing 11 temperature	0.1 °C	-273 to 1735 °C	15272	3276.6 °C	3276.7 °C
1172	65178	Turbo 1 compressor inlet temperature	0.1 °C	-273 to 1735 °C	15273	3276.6 °C	3276.7 °C
1173	65178	Turbo 2 compressor inlet temperature	0.1 °C	-273 to 1735 °C	15274	3276.6 °C	3276.7 °C
1174	65178	Turbo 3 compressor inlet temperature	0.1 °C	-273 to 1735 °C	15275	3276.6 °C	3276.7 °C
1175	65178	Turbo 4 compressor inlet temperature	0.1 °C	-273 to 1735 °C	15276	3276.6 °C	3276.7 °C
1176	65177	Turbo 1 compressor inlet pressure	1 kPa	-250 to 251 kPa	15277	32766 kPa	32767 kPa
1177	65177	Turbo 2 compressor inlet pressure	1 kPa	-250 to 251 kPa	15278	32766 kPa	32767 kPa
1178	65177	Turbo 3 compressor inlet pressure	1 kPa	-250 to 251 kPa	15279	32766 kPa	32767 kPa
1179	65177	Turbo 4 compressor inlet pressure	1 kPa	-250 to 251 kPa	15280	32766 kPa	32767 kPa
1180	65176	Turbo 1 inlet temperature	0.1 °C	-273 to 1735 °C	15281	3276.6 °C	3276.7 °C
1181	65176	Turbo 2 inlet temperature	0.1 °C	-273 to 1735 °C	15282	3276.6 °C	3276.7 °C
1182	65176	Turbo 3 inlet temperature	0.1 °C	-273 to 1735 °C	15283	3276.6 °C	3276.7 °C
1183	65176	Turbo 4 inlet temperature	0.1 °C	-273 to 1735 °C	15284	3276.6 °C	3276.7 °C
1184	65175	Turbo 1 outlet temperature	0.1 °C	-273 to 1735 °C	15285	3276.6 °C	3276.7 °C
1185	65175	Turbo 2 outlet temperature	0.1 °C	-273 to 1735 °C	15286	3276.6 °C	3276.7 °C
1186	65175	Turbo 3 outlet temperature	0.1 °C	-273 to 1735 °C	15287	3276.6 °C	3276.7 °C
1187	65175	Turbo 4 outlet temperature	0.1 °C	-273 to 1735 °C	15288	3276.6 °C	3276.7 °C
1203	65172	Engine auxiliary coolant pressure	1 kPa	0 to 1000 kPa	15289	32766 kPa	32767 kPa
1208	65170	Pre-filter oil pressure	1 kPa	0 to 1000 kPa	15290	32766 kPa	32767 kPa
1212	65172	Engine auxiliary coolant temperature	1 °C	-40 to 210 °C	15291	32766 °C	32767 °C
1382	65130	Fuel filter difference pressure	1 kPa	0 to 500 kPa	15292	32766 kPa	32767 kPa
1800	65104	Battery 1 temperature	1 °C	-40 to 210 °C	15293	32766 °C	32767 °C
1801	65104	Battery 2 temperature	1 °C	-40 to 210 °C	15294	32766 °C	32767 °C
1802	65189	Intake manifold 5 temperature	1 °C	-40 to 210 °C	15295	32766 °C	32767 °C
1803	65189	Intake manifold 6 temperature	1 °C	-40 to 210 °C	15296	32766 °C	32767 °C
2433	65031	Right exhaust gas temperature	0.1 °C	-273 to 1735 °C	15297	3276.6 °C	3276.7 °C
2434	65031	Left exhaust gas temperature	0.1 °C	-273 to 1735 °C	15298	3276.6 °C	3276.7 °C
2629	64979	Turbo 1 Compr. Outlet Tmp.	0.1 °C	-273 to 1736 °C	15310	3276.6 °C	3276.7 °C

[1] If the total engine hours sent by the ECU exceed 419,000 hrs, the display in the unit is not correct anymore

Table 2-15: J1939 protocol - standard messages

Data transmission by Engine Control Unit (ECU)

If the sent values exceed the limits of the specification, the displayed value is not defined.

If a value of the ECU is not sent or sent as not available or defective, the value will be displayed as indicated in the table before.

Special EMR2/EDC4 Engine Stop Information

Suspect Parameter Number	Parameter Group Number	Description
Engine stop	65301 (FF15h)	As Type 0 to 9

Type	Engine stop information	Display in unit	Display in ToolKit
0	**No** or **no special** engine stop	Type 0	Type 0
1	Engine shutdown for engine protection	Type 1	Type 1
2	CAN message engine stop request	Type 2	Type 2
3	Oil pressure too low	Type 3	Type 3
4	Oil level too low	Type 4	Type 4
5	Coolant temperature too high	Type 5	Type 5
6	Coolant level too low	Type 6	Type 6
7	Intake manifold temperature	Type 7	Type 7
8	Reserved (Stop via SAE-J1587)	Type 8	Type 8
9	Reserved (Stop via VP2)	Type 9	Type 9

Table 2-16: J1939 protocol - special EMR messages

Special S6 Messages

Suspect Parameter Number	Parameter Group Number	Description	Display in unit	Display in ToolKit
DLN2-Proprietary	65409 (FF81h)	Assessed messages: Low engine oil level High engine oil level Low oil pressure High coolant temperature	NO Missing YES	NO Missing YES

Table 2-17: J1939 protocol - special S6 messages

Remote Control via CAN

Remote Start/Stop and Acknowledgement

Refer to the Performing Remote Start/Stop and Acknowledgement section in the Special Application Examples section of the application manual 37429 for detailed information.

The easYgen may be started, stopped, or acknowledged with CAN/Modbus. Therefore, two logical command variables have to be configured with the *LogicsManager*:

04.13 Remote request
04.14 Remote acknowledge

Two different methods to perform a remote start/stop/acknowledgement are detailed in the following. These are "Remote start/stop/acknowledgement via RPDO" and "Remote start/stop/acknowledgement via default SDO communication channel". The advantages and the disadvantages of these two methods are as follows:

Comparison of the Two Methods

Start/Stop/Acknowledgement via RPDO

- Classical communication for CANopen devices
- One message
- **No** validation of the received answer
- Only working in operational mode

Start/Stop/Acknowledgement via Default SDO Communication Channel

- Configuration process
- Two messages
- Validation answer, if message has been received by the unit
- May take longer in case of communication with two messages

Remote Start/Stop/Acknowledgement via RPDO

Configuration of CAN Interface 1

Be sure to enable CAN-Open Master (parameter 8993) if there is no PLC taking over the master function.

Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Figure 2-4: Display screen - CAN interface 1 config.

Navigate to the parameter "CAN-Open Master" by using the and softkeys. Press to change the parameter. Change the parameter value to "On" using the and softkeys. Confirm the change with the softkey.

Configuration of the RPDO

Press until you return to the start screen.
Navigate to the "CAN interface 1 config" screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Receive PDO 1" by using the and softkeys and press to enter the "Receive PDO 1" screen.

Figure 2-5: Display screen - Receive PDO 1

Configure the following values for the "Receive PDO 1" parameters using the , and , softkeys and confirm the change by pressing the softkey:

COB-ID (parameter 9300)	00000201 (hex)
Number of Mapped Objects (parameter 9910)	1
1. Mapped Object (parameter 9911)	00503

Setting the COB-ID to 201 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex). With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 503 of the device as mapped object 1.

NOTE

Refer to Chapter 3.Appendix B: Additional Data Protocol Parameters starting on page 103 for a list of additional parameter groups.

CANopen Request

Figure 2-6 shows exemplary request data for the device on the CANopen bus. The data (hex) shows the state of parameter 503 to achieve the required control.

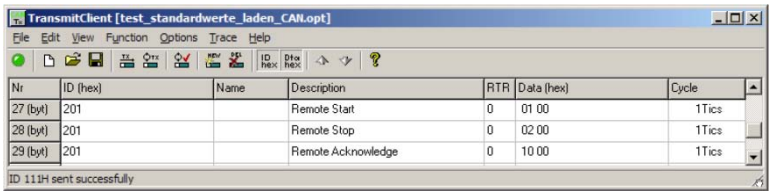


Figure 2-6: CANopen request data

Remote Start/Stop via Default SDO Communication Channel

Another possibility for a remote start/stop/acknowledgement is to send the request via default SDO communication channel.
The device listens to the CAN ID 600 (hex) + Node ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node ID.

The following examples show the request format on CANopen with different Node IDs.

The request on the bus is sent via the control parameter 503 of the device.
The value 2000 (hex) is calculated internally.
503(dec) -- 1F7 (hex)
1F7+2000 (hex) = 21F7 (hex)

Please note that high and low bytes are exchanged in the sent address.
The data (hex) shows the state of parameter 503 to achieve the required control.

Node ID 1 standard

Figure 2-7 shows exemplary request data for the device on the CANopen bus.

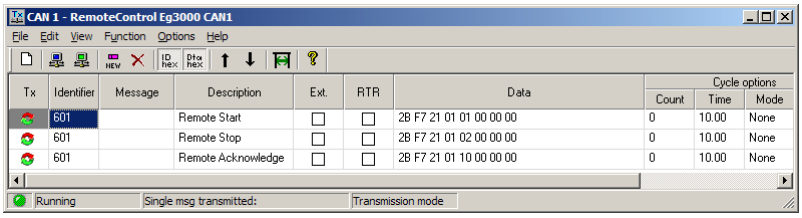


Figure 2-7: CANopen request data for Node ID 1

Node ID (not standard value)

If the Node ID of the device is intended to be different from the standard value, the parameter "Node-ID CAN-Bus 1" (parameter 8950) must be configured accordingly. Node ID 2 is used in the following example.

Press until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Figure 2-8: Display screen - CAN interface 1 config.

Configure the following value for the "Node-ID CAN-Bus 1" parameters using the , and , softkeys and confirm the change by pressing the softkey:

Node-ID CAN-Bus 1 (parameter 8950) 002

With this setting, the Node ID of the CAN interface 1 is set to 002.

The request on the bus is sent via the control parameter 503 of the device.
The hexadecimal value 2000 is calculated internally.
503(dec) -- 1F7 (hex)
1F7 (hex) + 2000 (hex) = 21F7 (hex)

Please note that high and low bytes are exchanged in the sent address.
The data (hex) shows the state of parameter 503 to achieve the required control.

Figure 2-9 shows exemplary request data for the device on the CANopen bus.

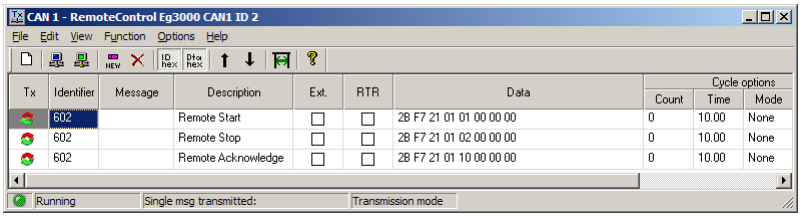


Figure 2-9: CANopen request data for Node ID 2

Additional SDO Communication Channels

It is also possible to allow several PLCs to start/stop/acknowledge the unit in addition to the default SDO communication channel. Four additional SDO communication channels are provided for this. The additional SDO 127 (dec) is used in the following example.

Press until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Additional Server SDOs" by using the and softkeys and press to enter the "Receive PDO 1" screen.

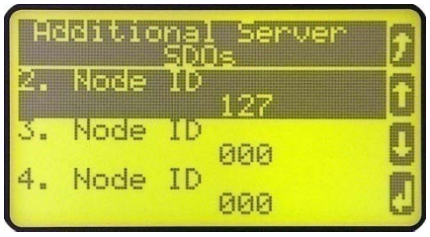


Figure 2-10: Display screen - Additional Server SDOs

Configure the following value for the "2. Node-ID" parameters using the , and softkeys and confirm the change by pressing the softkey:

2. Node-ID (parameter 33040) 127 (dec) = 7F (hex)

With this setting, an additional SDO communication channel is configured to 127.

The control request is equal to the request via default SDO communication channel, but the device will listen to messages including the configured address as well.

The device listens to the CAN ID 600 (hex) + 2. Node ID internally to perform the desired control, the reply from the easYgen is sent on CAN ID 580 (hex) + 2. Node ID.
Receive CAN ID 67F (hex) (600 (hex) + 7F (hex))
Receive CAN ID 5FF (hex) (580 (hex) + 7F (hex))
The same is valid for the additional SDO communication channels 3, 4, and 5.

Figure 2-11 shows exemplary request data for the device on the CANopen bus.

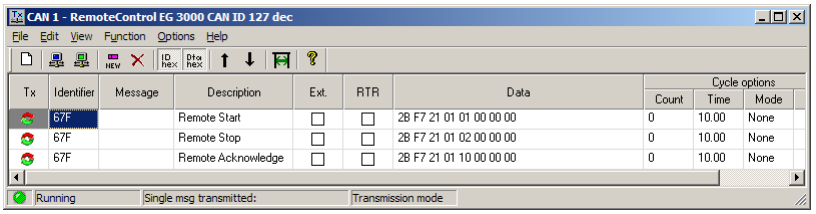


Figure 2-11: CANopen request data for additional Server SDO

NOTE

If parameters are written or read via two or more SDO communication channels at the same time (before the first has answered), the second one will be refused.

Transmitting a Frequency Set Point via CANopen

It is possible to transmit a frequency set point value via the CANopen interface. Prerequisite for the use of a frequency set point via an interface is the configuration of the frequency set point source (parameter ID 5518 for frequency set point 1 source or parameter ID 5519 for frequency set point 2 source; refer to the Configuration Manual 37427 for detailed information). The respective frequency set point source is to be configured to 05.03 "Interface freq.setp.".

Two different methods to transmit a frequency set point via CANopen interface are detailed in the following. Refer to Comparison of the Two Methods on page 26 for the basic differences of these methods.

Transmitting a Frequency Set Point via RPDO

Configuration of CAN Interface 1

Be sure to enable CAN-Open Master (parameter 8993) if there is no PLC taking over the master function. Refer to Configuration of CAN Interface 1 on page 26 for the configuration of this parameter.

Configuration of the RPDO

Press until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Receive PDO 1" by using the and softkeys and press to enter the "Receive PDO 1" screen.

Figure 2-12: Display screen - Receive PDO 1 for frequency set point

Configure the following values for the "Receive PDO 1" parameters using the , and , softkeys and confirm the change by pressing the softkey:

COB-ID (parameter 9300)	00000321 (hex)
Number of Mapped Objects (parameter 9910)	1
1. Mapped Object (parameter 9911)	00509

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex). With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 509 of the device as mapped object 1.

NOTE

Refer to Chapter 3.Appendix B: Additional Data Protocol Parameters starting on page 103 for a list of additional parameter groups.

CANopen Request

Figure 2-13 shows exemplary send data for the device on the CANopen bus. A frequency set point of 50.60 Hz is transmitted (5060 (dec) = 13C4 (hex) -> C4 13 according to the CANopen protocol).

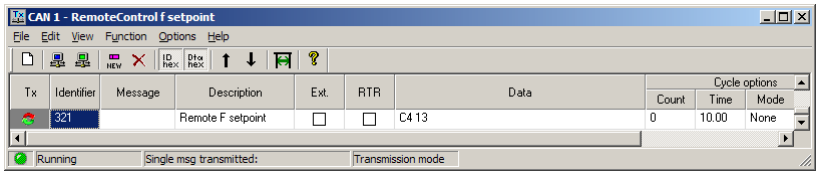


Figure 2-13: CANopen send data for frequency set point

Transmitting a Frequency Set Point via Default SDO Communication Channel

Another possibility for transmitting a frequency set point is to send the value via default SDO communication channel.
The device listens to the CAN ID 600 (hex) + Node ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node ID.

The following example shows the send format on CANopen with Node ID 1.

The value is sent on the bus via the control parameter 509 of the device.
The hexadecimal value 2000 is calculated internally.
509(dec) -- 1FD (hex)
1FD (hex) + 2000 (hex) = 21FD (hex)

Please note that high and low bytes are exchanged in the sent value.
The data (hex) shows the state of parameter 509 to achieve the required control.

Figure 2-14 shows exemplary send data for the device on the CANopen bus.

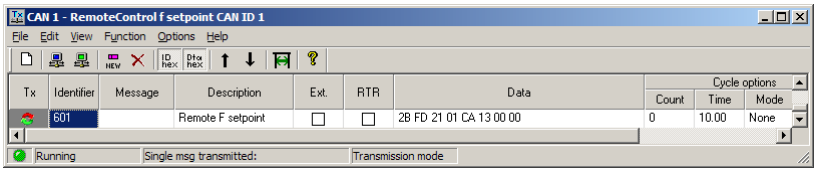


Figure 2-14: CANopen send data for Node ID 1 for frequency set point

Transmitting a Voltage Set Point via CANopen

It is possible to transmit a voltage set point value via the CANopen interface. Prerequisite for the use of a voltage set point via an interface is the configuration of the voltage set point source (parameter ID 5618 for voltage set point 1 source or parameter ID 5619 for voltage set point 2 source; refer to the Configuration Manual 37427 for detailed information). The respective voltage set point source is to be configured to 05.09 "Interface volt.setp.".

Two different methods to transmit a voltage set point via CANopen interface are detailed in the following. Refer to Comparison of the Two Methods on page 26 for the basic differences of these methods.

Transmitting a Voltage Set Point via RPDO

Configuration of CAN Interface 1

Be sure to enable CAN-Open Master (parameter 8993) if there is no PLC taking over the master function. Refer to Configuration of CAN Interface 1 on page 26 for the configuration of this parameter.

Configuration of the RPDO

Press  until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Receive PDO 1" by using the  and  softkeys and press  to enter the "Receive PDO 1" screen.

Figure 2-15: Display screen - Receive PDO 1 for voltage set point

Configure the following values for the "Receive PDO 1" parameters using the  ,  and  , softkeys and confirm the change by pressing the  softkey:

COB-ID (parameter 9300)	00000321 (hex)
Number of Mapped Objects (parameter 9910)	1
1. Mapped Object (parameter 9911)	00510

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex). With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 510 of the device as mapped object 1.

NOTE

Refer to Chapter 3.Appendix B: Additional Data Protocol Parameters starting on page 103 for a list of additional parameter groups.

CANopen Request

Figure 2-16 shows exemplary send data for the device on the CANopen bus in line 1. A voltage set point of 412 V is transmitted (412 (dec) = 019C (hex) -> 9C 01 according to the CANopen protocol).

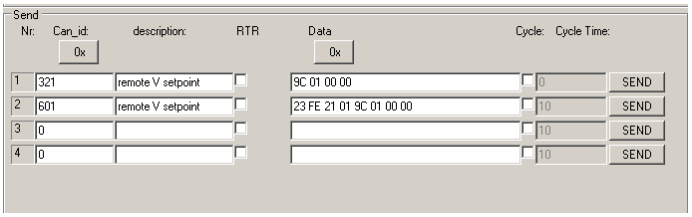


Figure 2-16: CANopen send data for voltage set point

Transmitting a Voltage Set Point via Default SDO Communication Channel

Another possibility for transmitting a voltage set point is to send the value via default SDO communication channel.
The device listens to the CAN ID 600 (hex) + Node ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node ID.

The following example shows the send format on CANopen with Node ID 1.

The value is sent on the bus via the control parameter 510 of the device.
The hexadecimal value 2000 is calculated internally.
510 (dec) -- 1FE (hex)
1FE (hex) +2000 (hex) = 21FE (hex)

Please note that high and low bytes are exchanged in the sent value.
The data (hex) shows the state of parameter 510 to achieve the required control.

Figure 2-16 shows exemplary send data for the device on the CANopen bus in line 2.

Transmitting a Power Factor Set Point via CANopen

It is possible to transmit a power factor set point value via the CANopen interface. Prerequisite for the use of a power factor set point via an interface is the configuration of the power factor set point source (parameter ID 5638 for power factor set point 1 source or parameter ID 5639 for power factor set point 2 source; refer to the Configuration Manual 37427 for detailed information). The respective power factor set point source is to be configured to 05.12 "Interface PF setp.".

Two different methods to transmit a power factor set point via CANopen interface are detailed in the following. Refer to Comparison of the Two Methods on page 26 for the basic differences of these methods.

Transmitting a Power Factor Set Point via RPDO

Configuration of CAN Interface 1

Be sure to enable CAN-Open Master (parameter 8993) if there is no PLC taking over the master function. Refer to Configuration of CAN Interface 1 on page 26 for the configuration of this parameter.

Configuration of the RPDO

Press until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Receive PDO 1" by using the and softkeys and press to enter the "Receive PDO 1" screen.

Figure 2-17: Display screen - Receive PDO 1 for power factor set point

Configure the following values for the "Receive PDO 1" parameters using the , and , softkeys and confirm the change by pressing the softkey:

COB-ID (parameter 9300)	00000321 (hex)
Number of Mapped Objects (parameter 9910)	1
1. Mapped Object (parameter 9911)	00508

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex). With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 508 of the device as mapped object 1.

NOTE

Refer to Chapter 3.Appendix B: Additional Data Protocol Parameters starting on page 103 for a list of additional parameter groups.

CANopen Request

Figure 2-18 shows exemplary send data for the device on the CANopen bus.
A power factor set point of 0.85 capacitive/leading is transmitted (64689 (dec) [65536-850] = FCAE (hex) -> AE FC according to the CANopen protocol) in line 1. Please note that negative (capacitive or leading) power factor values are deducted from 65536 (dec) or FFFF (hex).
A power factor set point of 0.9 inductive/lagging is transmitted (900 (dec) = 0384 (hex) -> 84 03 according to the CANopen protocol) in line 2.
A power factor set point of 1.0 is transmitted (1000 (dec) = 03E8 (hex) -> E8 03 according to the CANopen protocol) in line 3.

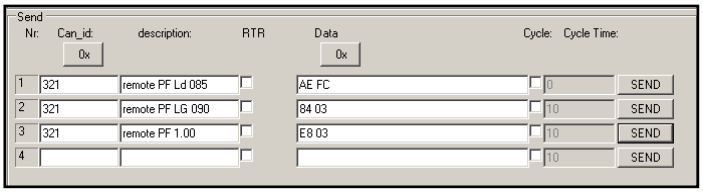


Figure 2-18: CANopen send data for power factor set point

Transmitting a Power Factor Set Point via Default SDO Communication Channel

Another possibility for transmitting a power factor set point is to send the value via default SDO communication channel.
The device listens to the CAN ID 600 (hex) + Node ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node ID.

The following example shows the send format on CANopen with Node ID 1.

Thevalue is sent on the bus via the control parameter 508 of the device.
The hexadecimal value 2000 is calculated internally.
508 (dec) -- 1FC (hex)
1FC (hex) + 2000 (hex) = 21FC (hex)

Please note that high and low bytes are exchanged in the sent value.
The data (hex) shows the state of parameter 508 to achieve the required control.

Figure 2-19 shows exemplary send data for the device on the CANopen bus.

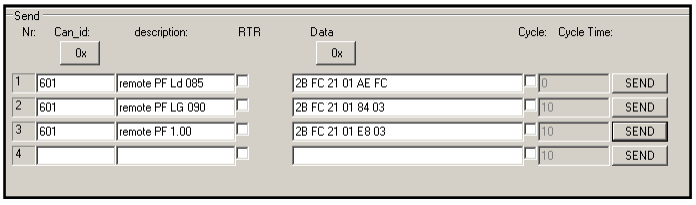


Figure 2-19: CANopen send data for Node ID 1 for power factor set point

Transmitting a Power Set Point via CANopen

It is possible to transmit a power set point value via the CANopen interface. Prerequisite for the use of a power set point via an interface is the configuration of the power set point source (parameter ID 5539 for power set point 1 source or parameter ID 5540 for power set point 2 source; refer to the Configuration Manual 37427 for detailed information). The respective power set point source is to be configured to 05.06 "Interface pow. setp.". Please note that the type of the power set point (Constant, Import, or Export) must also be defined (parameter ID 5526 for load set point 1 or parameter ID 5527 for load set point 2).

Two different methods to transmit a voltage set point via CANopen interface are detailed in the following. Refer to Comparison of the Two Methods on page 26 for the basic differences of these methods.

Transmitting a Power Set Point via RPDO

Configuration of CAN Interface 1

Be sure to enable CAN-Open Master (parameter 8993) if there is no PLC taking over the master function. Refer to Configuration of CAN Interface 1 on page 26 for the configuration of this parameter.

Configuration of the RPDO

Press until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Receive PDO 1" by using the and softkeys and press to enter the "Receive PDO 1" screen.

Figure 2-20: Display screen - Receive PDO 1 for power set point

Configure the following values for the "Receive PDO 1" parameters using the , and , softkeys and confirm the change by pressing the softkey:

COB-ID (parameter 9300)	00000321 (hex)
Number of Mapped Objects (parameter 9910)	1
1. Mapped Object (parameter 9911)	00507

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex). With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 507 of the device as mapped object 1.

NOTE

Refer to Chapter 3.Appendix B: Additional Data Protocol Parameters starting on page 103 for a list of additional parameter groups.

CANopen Request

Figure 2-21 shows exemplary send data for the device on the CANopen bus in line 1. A power set point of 1000.0 kW is transmitted (10000 (dec) = 2710 (hex) -> 10 27 according to the CANopen protocol).

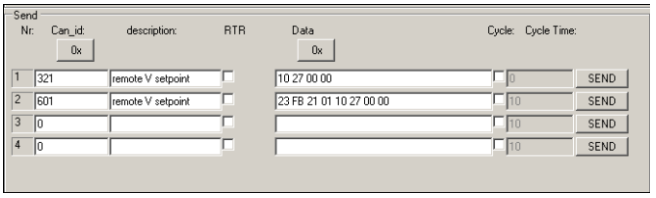


Figure 2-21: CANopen send data for power set point

Transmitting a Power Set Point via Default SDO Communication Channel

Another possibility for transmitting a power set point is to send the value via default SDO communication channel.
The device listens to the CAN ID 600 (hex) + Node ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node ID.

The following example shows the send format on CANopen with Node ID 1.

The value is sent on the bus via the control parameter 507 of the device.
The hexadecimal value 2000 is calculated internally.
507 (dec) -- 1FB (hex)
1FB (hex) + 2000 (hex) = 21FB (hex)

Please note that high and low bytes are exchanged in the sent value.
The data (hex) shows the state of parameter 507 to achieve the required control.

Figure 2-21 shows exemplary send data for the device on the CANopen bus in line 2.

Transmitting Multiple Set Points via CANopen

It is possible to transmit multiple objects with one RPDO. The receive PDO can be used for four objects with 16 bytes. If larger objects (for example 32 bytes, like for voltage and power set points) are used, the maximum number of objects is reduced.

Configuration of the RPDO

Press until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Receive PDO 1" by using the and softkeys and press to enter the "Receive PDO 1" screen.

Figure 2-22: Display screen - Receive PDO 1 for multiple set points

Configure the following values for the "Receive PDO 1" parameters using the , and softkeys and confirm the change by pressing the softkey:

COB-ID (parameter 9300)	00000321 (hex)
Number of Mapped Objects (parameter 9910)	3
1. Mapped Object (parameter 9911)	00509
2. Mapped Object (parameter 9912)	00507
3. Mapped Object (parameter 9913)	00508

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex). With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameters 509, 507, and 508 of the device as mapped object 1.

NOTE

Refer to Chapter 3.Appendix B: Additional Data Protocol Parameters starting on page 103 for a list of additional parameter groups.

CANopen Request

Figure 2-23 shows exemplary send data for the device on the CANopen bus in line 1. The following set points are transmitted:

- Frequency 50.6 Hz (5060 (dec) = 13C4 (hex) -> C4 13 according to the CANopen protocol)
- Power 1000 kW (10000 (dec) = 2710 (hex) -> 10 27 according to the CANopen protocol)
- Power factor 0.9 lagging (900 (dec) = 0384 (hex) -> 84 03 according to the CANopen protocol)

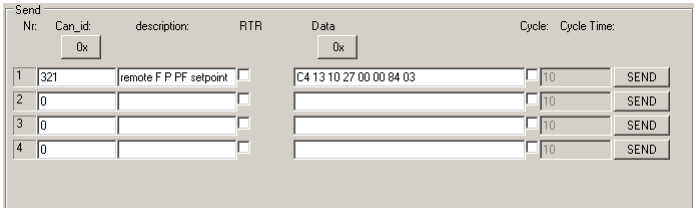


Figure 2-23: CANopen send data for multiple set points

Remotely Changing the Set Point via CANopen

It is possible to remotely change a set point value via the CANopen interface using the parameter ID 504 (refer to Remote Control Word 2 - Object 21F8h (Parameter ID 504) on page 104). In order to use the *LogicsManager* command variables for example to enable the second set, different bits of parameter ID 504 must be enabled:

- [04.37] Remote voltage set point 2 bit 4 10 00 (hex) must be sent to parameter ID 504
- [04.38] Remote frequency set point 2 bit 5 20 00 (hex) must be sent to parameter ID 504
- [04.39] Remote Power Factor set point 2 bit 6 30 00 (hex) must be sent to parameter ID 504
- [04.40] Remote power set point 2 bit 7 80 00 (hex) must be sent to parameter ID 504

NOTE

For remotely changing the control set points, it is necessary to use the interface set points instead of the internal set points as data source in the respective controller. For example, use data source "[05.03] Interface freq.setp." in parameter 5518 (Freq. setpoint 1 source) to transmit a frequency set point via interface.

Two different methods for changing a set point via CANopen interface are detailed in the following. Refer to Comparison of the Two Methods on page 26 for the basic differences of these methods.

Changing a Set Point via RPDO

Configuration of CAN Interface 1

Be sure to enable CAN-Open Master (parameter 8993) if there is no PLC taking over the master function. Refer to Configuration of CAN Interface 1 on page 26 for the configuration of this parameter.

Configuration of the RPDO

Press until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Receive PDO 1" by using the and softkeys and press to enter the "Receive PDO 1" screen.

Figure 2-24: Display screen - Receive PDO 1 for changing the set point

Configure the following values for the "Receive PDO 1" parameters using the , and , softkeys and confirm the change by pressing the softkey:

COB-ID (parameter 9300)	00000321 (hex)
Number of Mapped Objects (parameter 9910)	1
1. Mapped Object (parameter 9911)	00504

Setting the COB-ID to 321 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex). With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 504 of the device as mapped object 1.

CANopen Request

Figure 2-25 shows exemplary send data for the device on the CANopen bus. The respective bits are enabled by sending the data of the respective lines.

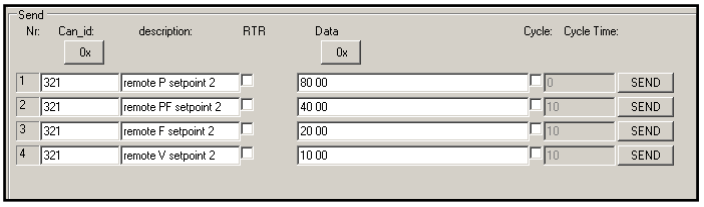


Figure 2-25: CANopen send data for changing the set point

Changing a Set Point via Default SDO Communication Channel

Another possibility for changing a set point is to enable the bit via default SDO communication channel.
The device listens to the CAN ID 600 (hex) + Node ID internally to perform the desired control, the reply is on CAN ID 580 (hex) + Node ID.

The following example shows the send format on CANopen with Node ID 1.

The value is sent on the bus via the control parameter 504 of the device.
The hexadecimal value 2000 is calculated internally.
509 (dec) -- 1F8 (hex)
1F8 (hex) + 2000 (hex) = 21F8 (hex)

Please note that high and low bytes are exchanged in the sent value.
The data (hex) shows the state of parameter 504 to achieve the required control.

Figure 2-26 shows exemplary send data for the device on the CANopen bus.

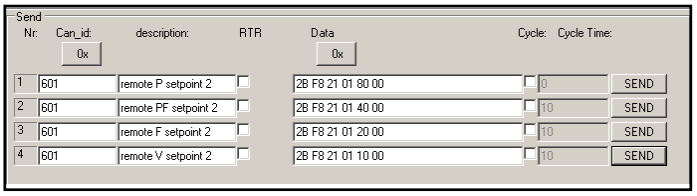


Figure 2-26: CANopen send data for Node ID 1 for changing the set point

Transmitting a Remote Control Bit via CANopen

It is possible to transmit a remote control bit via the CANopen interface. Such a remote control bit can be sent by a PLC to remotely control the easYgen if this remote control bit is used as a command variable in a *LogicsManager* function.

Configuration of the RPDO

Press until you return to the start screen.
Navigate to the "CAN interface 1 config." screen by pressing the following softkeys in this sequence:
Parameter -> Configuration -> Interfaces config. -> CAN interface config. -> CAN interface 1 config.

Navigate to the entry "Receive PDO 1" by using the and softkeys and press to enter the "Receive PDO 1" screen.

Figure 2-27: Display screen - Receive PDO 1 for frequency set point

Configure the following values for the "Receive PDO 1" parameters using the , and , softkeys and confirm the change by pressing the softkey:

COB-ID (parameter 9300)	00000334 (hex)
Number of Mapped Objects (parameter 9910)	1
1. Mapped Object (parameter 9911)	00505

Setting the COB-ID to 334 (hex) is exemplary; usually, the PDOs are in the range of 181 (hex) to 57F (hex). With this setting, the Receive PDO is set to the address, for which the device is listening on the bus. The number of mapped objects is 1 since 1 mapped object is used. The request on the bus is sent with the control parameter 505 of the device as mapped object 1.

NOTE

Refer to Chapter 3.Appendix B: Additional Data Protocol Parameters starting on page 103 for a list of additional parameter groups.

CANopen Request

Figure 2-28 shows exemplary send data for the device on the CANopen bus. Remote control bit 1 is set (1 (dec) = 0001 (hex) -> 01 00 according to the CANopen protocol).

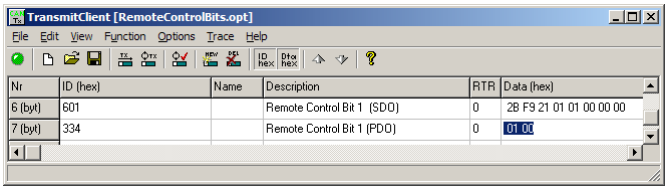


Figure 2-28: CANopen send data for setting a remote control bit

Sending a Data Protocol via TPDO

Cyclically Sending of Data

This is a configuration example for sending an object (data protocol 5003) on CAN ID 181 (hex) every 20 ms on TPDO1. For this, TPDO1 must be configured as follows:

COB-ID	181 (hex)	
Transmission type	255	
Event-timer	20 ms	
Selected data protocol	5100	
Number of Mapped Objects	0	(already defined by the data protocol)

Figure 2-29: Cyclical sending of data - TPDO configuration

Sending of Data on Request

The data to be sent (Mapped Objects) may be provided on request by configuring the Sync Message (parameter 9100) and the Transmission Type (parameter 9602, 9612 and 9622) of a TPDO.
The unit is requested to send its data by sending a Sync Message.

The number of required Sync Messages is determined by the setting of the Transmission Type.

If the data is to be sent on request, Bit 30 of the Sync Message (parameter 9100) must be configured to "0" and the CANopen Master (parameter 8993) function must be configured to "Off".

The Transmission Type of TPDO 1 (parameter 9602) is configured to "2" in the following example (refer to Figure 2-30).
This means that a message of the configured TPDO is sent by the unit after two Sync Messages have been sent to the unit.

Figure 2-30: Sending of data on request - TPDO configuration

The recorded data shows that the data of the Mapped Object (in this example Mux 5) is sent (refer to Figure 2-32) after sending the Sync Message twice (refer to Figure 2-31).

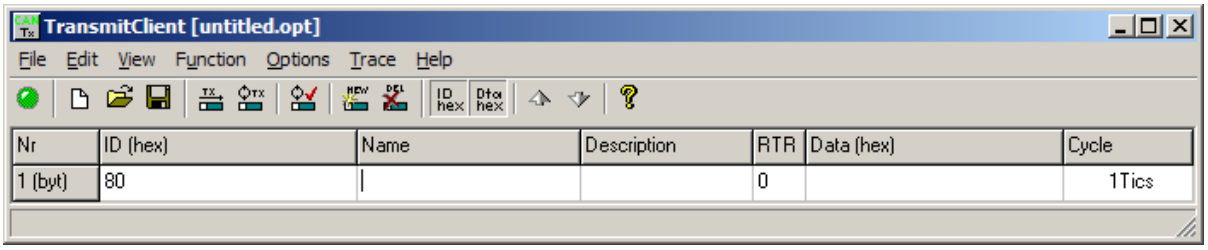


Figure 2-31: Cyclical sending of data - Sync Message request

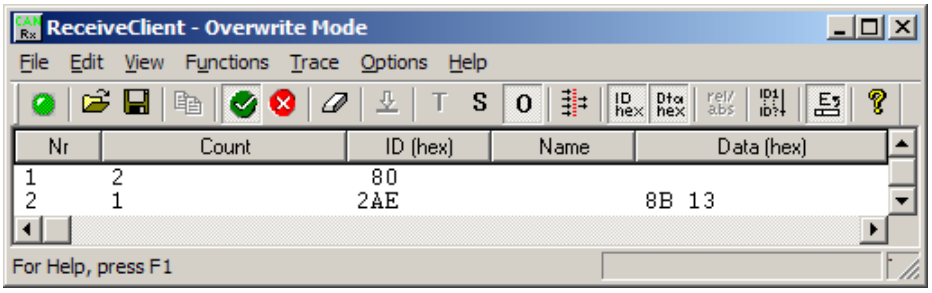


Figure 2-32: Cyclical sending of data - reply

External IOs on CAN Interface 1

Usually, external expansion boards, like a Woodward IKD 1 or Phoenix expansion boards are configured on CAN interface 2. However, it is possible to configure them on CAN interface 1 as well. The following examples describe how to configure an IKD 1 on CAN interface 1.

External DOs for an IKD 1

This is a configuration example for sending objects with the data protocol 65000 on CAN ID 181h every 20 ms on TPDO1. This is used to send messages to an external device. For this, TPDO1 must be configured as follows:

	1st IKD	2nd IKD
COB-ID	181 (hex)	182 (hex)
Transmission type	255	255
Event-timer	20 ms	20 ms
Selected data protocol	65000	65001
Number of Mapped Objects	0 (already defined by the data protocol)	0 (already defined by the data protocol)

NOTE

This is an example of how to configure an IKD 1 on CAN interface 1. Usually, IKDs may be configured to CAN interface 2 much easier.

Receiving Data from an IKD 1

This is a configuration example for an RPDO configuration. The data received on CAN ID 201h is interpreted as object with the data protocol 65000 (external DIs 1 to 8). For this, RPDO must be configured as follows:

	1st IKD	2nd IKD
COB-ID	201 (hex)	202 (hex)
Selected data protocol	65000	65001
Number of Mapped Objects	0 (already defined by the data protocol)	0 (already defined by the data protocol)

NOTE

This is an example of how to configure an IKD 1 on CAN interface 1. Usually, IKDs may be configured to CAN interface 2 much easier.

Troubleshooting

General

Connected device (Phoenix IO board) cannot be configured

- Are all LEDs at the expansion modules illuminated green (i.e. correctly connected)?
- Are all modules detected (i.e. no blinking expansion module)?

Guidance Level CAN Bus #1

No Data is sent by the easYgen

- Is the unit in operational mode (heartbeat - CAN ID 700 (hex) + Node-ID has the content 5 (hex)?
- Are the TPDOs correctly configured (CAN ID, mapping, parameter)?

No Data is received by the easYgen

- Is the unit in operational mode (heartbeat - CAN ID 700 (hex) + Node-ID has the content 5 (hex)?
- Are the RPDOs correctly configured (CAN ID, mapping, parameter)?

No monitoring bit data is received on the RPDO

- Is the CAN bus connected correctly?
- Is the baud rate configured correctly?
- Is the CAN ID assigned more than once?
- Is the unit in operational mode? If not, start it via an other device or put in NMT Master (parameter 8993).

No SDOs (configuration messages) are received by the unit

- Is the CAN ID assigned more than once?
- Is the CAN ID 600 (hex) + Node-ID of the easYgen already used in a PDO (COB ID)?
- Are RPDOs or TPDOs higher then 580 (hex) or lower than 180 (hex) used?

Chapter 3.
Modbus Communications

General Information

Modbus is a serial communications protocol published by Modicon in 1979 for use with its programmable logic controllers (PLCs). It has become a de facto standard communications protocol in industry, and is now the most commonly available means of connecting industrial electronic devices. The easYgen-2000 Series supports a Modbus RTU Slave module. This means that a Master node needs to poll the easYgen slave node. Modbus RTU can also be multi-dropped, or in other words, multiple Slave devices can exist on one Modbus RTU network, assuming that the serial interface is a RS-485. Detailed Information about the Modbus protocol are available on the following website:
http://www.modbus.org/specs.php

There are also various tools available on the internet. We recommend to use ModScan32 which is a Windows application designed to operate as a Modbus Master device for accessing data points in a connected Modbus Slave device. It is designed primarily as a testing device for verification of correct protocol operation in new or existing systems. It is possible to download a trial version from the following website:
http://www.win-tech.com/html/modscan32.htm

Address Range

The easYgen Modbus Slave module distinguishes between visualization data and configuration & remote control data. The different data is accessible over a split address range and can be read via the "Read Holding Register" function. Furthermore, easYgen parameters and remote control data can be written with the "Preset Single Registers" function or "Preset Multiple Registers" (refer to Table 3-1).

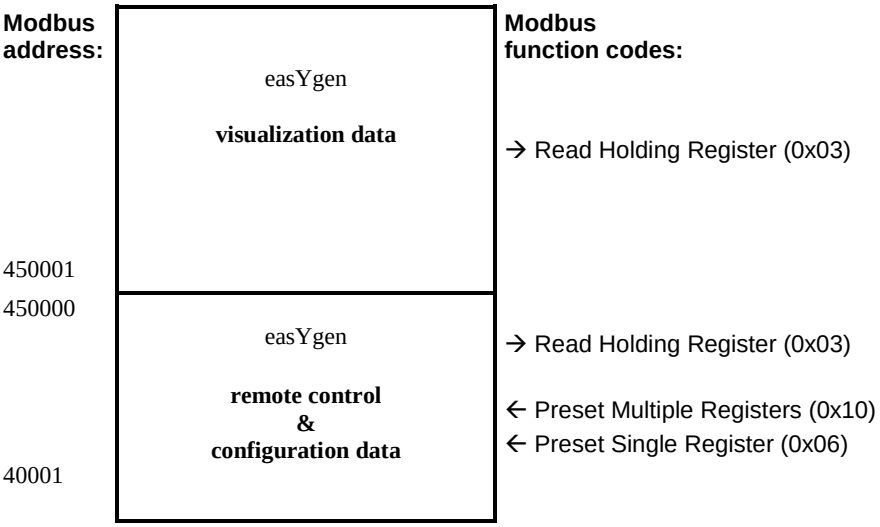


Table 3-1: Modbus - address range

NOTE

All addresses in this document comply with the Modicon address convention. Some PLCs or PC programs use different address conventions depending on their implementation. Then the address must be increased and the leading 4 may be omitted.

Please refer to your PLC or program manual for more information. This determines the address sent over the bus in the Modbus telegram. The Modbus starting address 450001 of the visualization data may become bus address 50000 for example.

Visualization

The visualization over Modbus is provided in a very fast data protocol where important system data like alarm states, AC measurement data, switch states and various other information may be polled. According to the easYgen Modbus addressing range, the visualization protocol can be reached on addresses starting at 450001. On this address range it is possible to do block reads from 1 up to 128 Modbus registers at a time.

Modbus Read Addresses	Description	Multiplier	Units
450001	Protocol-ID, always 5100		--
450002	Pickup speed	1	rpm
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
450200	Exhaust Gas Temp.	0.01	°C

Table 3-2: Modbus - address range block read

NOTE

Table 3-2 is only an excerpt of the data protocol. It conforms to the data protocol 5100 that is also used by CAN bus. Refer to Appendix B: Data Protocol 5100 on page 77 for the complete protocol.

The following ModScan32 screenshot shows the configurations made to read the visualization protocol with a block read of 128 registers.

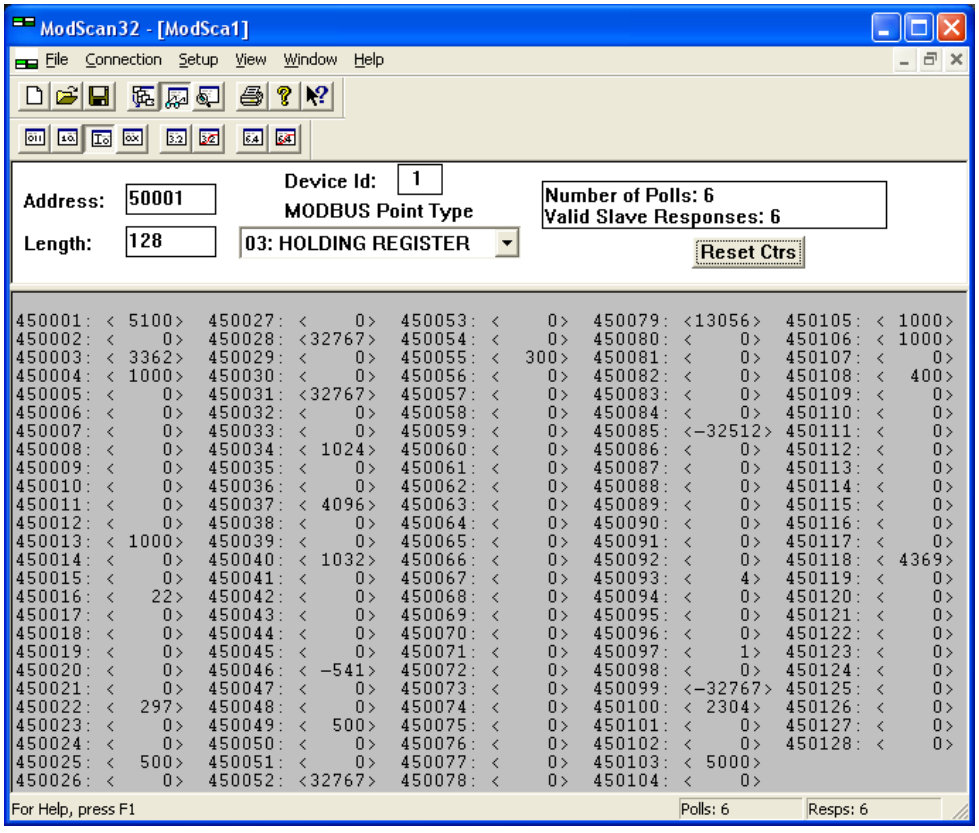


Figure 3-1: Modbus - visualization configurations

Configuration

The Modbus interface can be used to read/write parameters of the easYgen. According to the easYgen Modbus addressing range for the configuration addresses, the range starts at 40001 and ends at 450000. You can always access only one parameter of the system in this address range. The Modbus address can be calculated depending on the parameter ID as illustrated below:

	Parameter ID < 10000	Parameter ID >= 10000
Modbus address =	40000 + (Par. ID+1)	400000 + (Par. ID+1)

Table 3-3: Modbus - address calculation

Block reads in this address range depend on the data type of the parameter. This makes it important to set the correct length in Modbus registers which depends on the data type (UNSIGNED 8, INTEGER 16, etc.). Refer to Table 3-4 for more information.

easYgen types	Modbus registers
UNSIGNED 8	1
UNSIGNED 16	1
INTEGER 16	1
UNSIGNED 32	2
INTEGER 32	2
LOGMAN	7
TEXT/X	X/2

Table 3-4: Modbus - data types

Remote Control via Modbus

Remote Start, Stop, and Acknowledgement via Modbus

The easYgen controller may be configured to perform start/stop/acknowledgement functions remotely through the Modbus. The required procedure is detailed in the following steps.

NOTE

The following descriptions refer to the remote control parameter 503 as described under Remote Control Word 1 - Object 21F7h (Parameter ID 503) on page 103.

It may be necessary to shift the address by 1 depending on the used PC software. In this case, the address would be 504 for example.

Be sure to check both possibilities in case of remote control problems.

Par. ID.	Parameter	Setting range	Data type
503	Remote control word 1	0 to 65535	UNSIGNED 16

Modbus address = 40000 + (Par. ID +1) = 40504
Modbus length = 1 (UNSIGNED 16)

In order to issue a command, the respective bit of object 21F7 (hex), i.e. parameter ID 503, must be enabled. The following bits are used for this:

Bit 0 Start bit – this bit activates the *LogicsManager* command variable [04.13] "Remote request" and enables a remote request command
Bit 1 Stop bit – this bit deactivates the *LogicsManager* command variable [04.13] "Remote request" and disables a remote request command
Bit 4 Acknowledgement bit – this bit activates the *LogicsManager* command variable [04.14] "Remote acknowledge". This bit must be set and reset twice to acknowledge an alarm completely. The first rising edge disables the horn and the second rising edge resets the alarm.

The following Modscan32 screenshot shows the configurations made to remote control parameter ID 503. It is possible to set the format to binary to view single bits using the "display options".

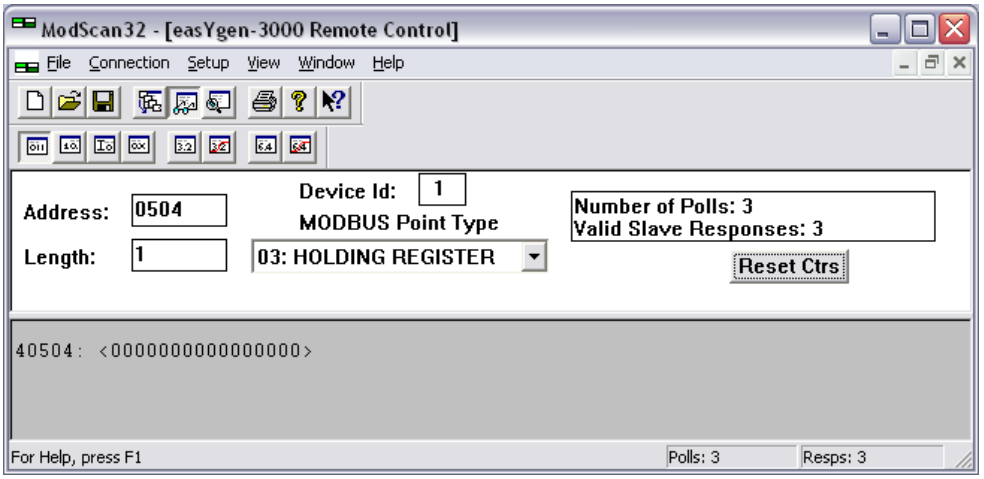


Figure 3-2: Modbus - remote control parameter 503

Example 1: Start Request

By double-clicking the address, a Write Register command may be issued. Figure 3-3 shows how bit 0 is set using the ModScan32 Software.

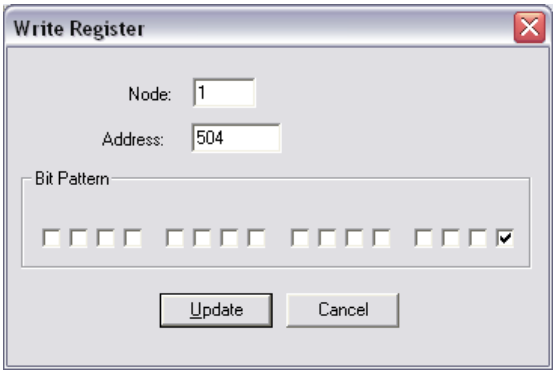


Figure 3-3: Modbus - write register - start request

Example 2: Stop Request

By double-clicking the address, a Write Register command may be issued. Figure 3-3 shows how bit 1 is set using the ModScan32 Software.

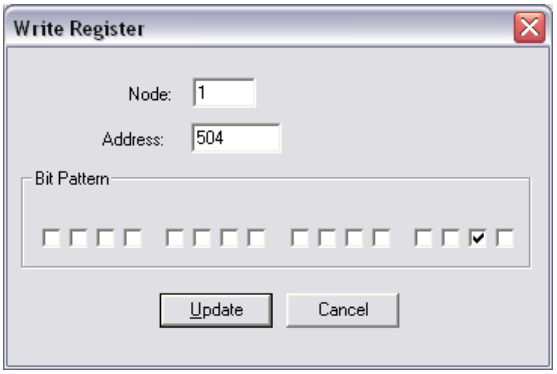


Figure 3-4: Modbus - write register - stop request

Example 3: External Acknowledge

By double-clicking the address, a Write Register command may be issued. Figure 3-3 shows how bit 4 is set using the ModScan32 Software.

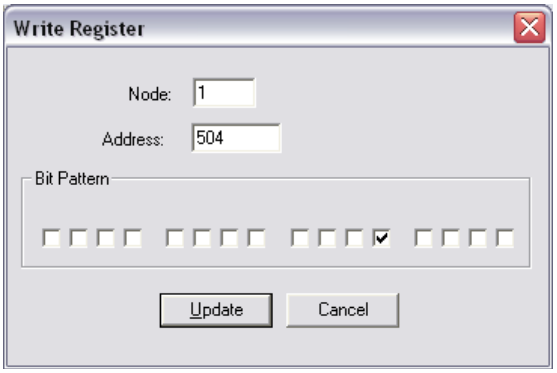


Figure 3-5: Modbus - write register - external acknowledge

Set Point Setting

For a remote setting of the control set points, it is necessary to use the interface set points instead of the internal set points. For example, use data source "[05.06] Interface pwr. setp." in parameter 5539 (Load setpoint 1 source) to transmit a load set point via interface. No password is required to write this value. Figure 3-6 shows an exemplary configuration of the load set point 1 source. All other set point sources are configured accordingly.

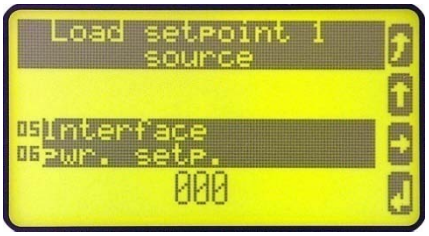


Figure 3-6: Set point source configuration

The interface set points may be set using the objects for active power, power factor, frequency, and voltage (refer to Additional Data Protocol Parameters on page 103 for detailed information).

Par. ID.	Parameter	Setting range	Unit	Data type	Data source
507	Active Power Setpoint	0 to 999999	1/10 [kW]	INTEGER 32	05.06
508	Power Factor Setpoint	-710 to 1000 to 710	-	INTEGER 16	05.12
509	Frequency Setpoint	0 to 7000	1/100 [Hz]	UNSIGNED 16	05.03
510	Voltage Setpoint	50 to 650000	[V]	UNSIGNED 32	05.09

Example 1: Active Power Interface Set Point

The active power set point value must be written to object 21FB (hex), i.e. parameter ID 507

Example: A power value of 50 kw = 500 (dec) =01F4 (hex) is to be transmitted.
Modbus address = 40000 + (Par. ID + 1) = 40508
Modbus length = 2 (INTEGER 32)
The high word is to be written to the lower address and the low word is to be written to the higher address.

Figure 3-7 through Figure 3-10 show how to set the parameter address 507 in ModScan32.

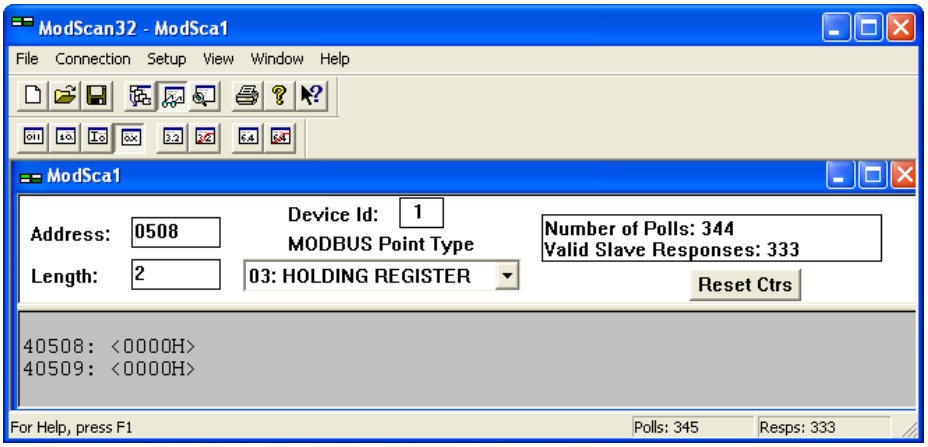


Figure 3-7: Modbus - configuration example 4 - active power

Open the Preset Multiple registers window by selecting Setup -> Extended -> Preset Regs from the menu.

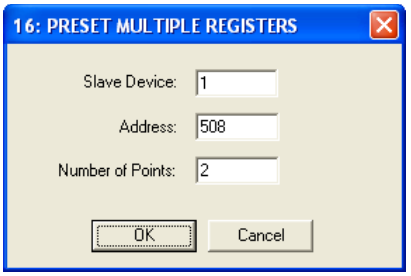


Figure 3-8: Modbus - configuration example 4 - active power

Select OK and enter the desired values.

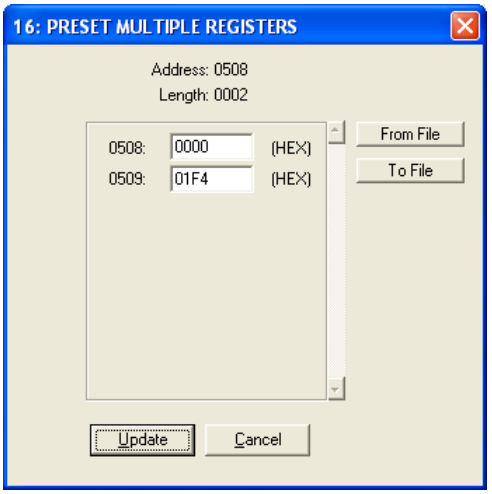


Figure 3-9: Modbus - configuration example 4 - active power

Select Update to take over the entered values.

Figure 3-10: Modbus - configuration example 4 - active power

Example 2: Power Factor Interface Set Point

The power factor set point value must be written to object 21FC (hex), i.e. parameter ID 508

Example: A power factor of 1 = 1000 (dec) =03E8 (hex) is to be transmitted.
Modbus address = 40000 + (Par. ID + 1) = 40509
Modbus length = 1 (UNSIGNED 16)

Figure 3-11 shows the settings made to parameter address 508 in ModScan32.

Figure 3-11: Modbus - configuration example 4 - power factor

Example 3: Frequency Interface Set Point

The frequency set point value must be written to object 21FD (hex), i.e. parameter ID 509

Example: A frequency value of 50.00 Hz = 5000 (dec) =1388 (hex) is to be transmitted.
Modbus address = 40000 + (Par. ID + 1) = 40510
Modbus length = 1 (UNSIGNED 16)

Figure 3-12 shows the settings made to parameter address 509 in ModScan32.

Figure 3-12: Modbus - configuration example 4 - frequency

Example 4: Voltage Interface Set Point

The voltage set point value must be written to object 21FE (hex), i.e. parameter ID 510

Example: A voltage value of 400 V = 400 (dec) =0190 (hex) is to be transmitted.
Modbus address = 40000 + (Par. ID + 1) = 40511
Modbus length = 2 (UNSIGNED 32)
The high word is to be written to the lower address and the low word is to be written to the higher address.

Figure 3-13 shows the settings made to parameter address 510 in ModScan32.

Figure 3-13: Modbus - configuration example 4 - voltage

Remotely Changing the Set Point

It is possible to remotely change the (active power/power factor/frequency/voltage) set points through the Modbus using the parameter ID 504 (refer to Remote Control Word 2 - Object 21F8h (Parameter ID 504) on page 104). The required procedure is detailed in the following steps.

Par. ID.	Parameter	Setting range	Data type
504	Remote control word 2	YES / NO	UNSIGNED 16

In order to enable a set point, the respective bit of object 21F8 (hex), i.e. parameter ID 504, must be enabled. The following bits are used for this:

Bit 4 Request voltage set point 2 – this bit activates the *LogicsManager* command variable [04.37] "Remote voltage set point 2" and is dedicated for switching from voltage set point 1 to voltage set point 2
Bit 5 Request frequency set point 2 – this bit activates the *LogicsManager* command variable [04.38] "Remote frequency set point 2" and is dedicated for switching from frequency set point 1 to frequency set point 2
Bit 6 Request power factor set point 2 – this bit activates the *LogicsManager* command variable [04.39] "Remote PF set point 2" and is dedicated for switching from power factor set point 1 to power factor set point 2
Bit 7 Request active power set point 2 – this bit activates the *LogicsManager* command variable [04.40] "Remote power set point 2" and is dedicated for switching from active power set point 1 to active power set point 2

Example:

The active power set point 2 is to be enabled.
Modbus address = 40000 + (Par. ID + 1) = 40505
Modbus length = 1 (UNSIGNED 16)

Figure 3-14 shows the settings made to parameter ID 504 in ModScan32. It is possible to set the format to binary to view single bits using the "display options".

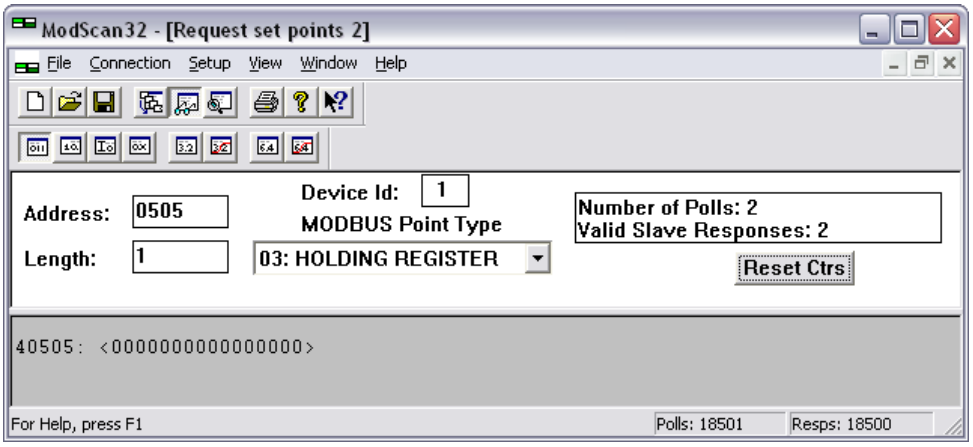


Figure 3-14: Modbus - remote control parameter 504

By double-clicking the address, a Write Register command may be issued. Figure 3-15 shows how bit 7 is set using the ModScan32 Software.

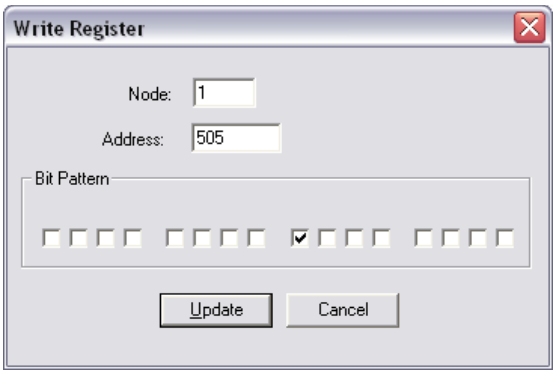


Figure 3-15: Modbus - write register - enable active power set point 2

Figure 3-16 shows how bit 6 would be set to enable the power factor set point 2.

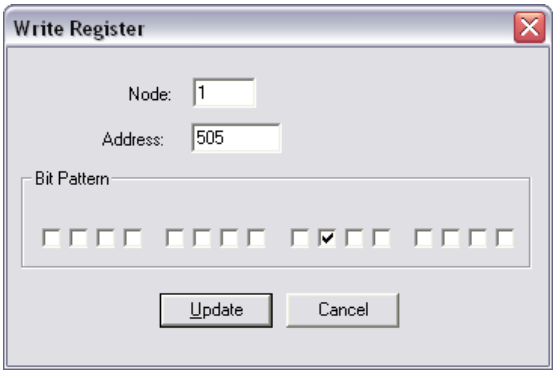


Figure 3-16: Modbus - write register - enable power factor set point 2

Figure 3-17 shows how bit 5 would be set to enable the frequency set point 2.

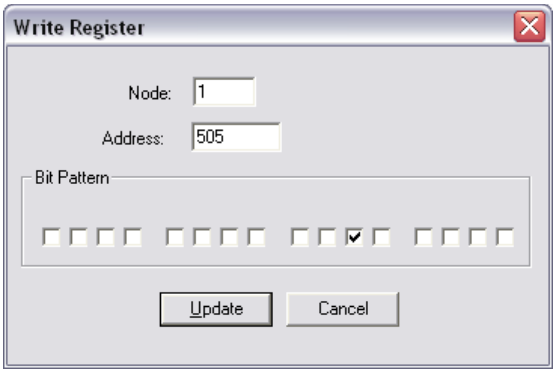


Figure 3-17: Modbus - write register - enable frequency set point 2

Figure 3-17 shows how bit 4 would be set to enable the voltage set point 2.

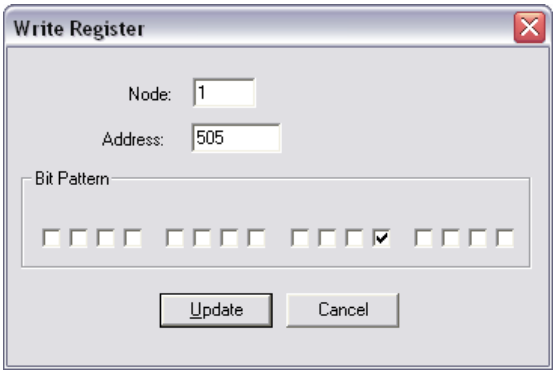


Figure 3-18: Modbus - write register - enable voltage set point 2

Changing Parameter Settings via Modbus

Parameter Setting

NOTE

The example tables below are excerpts of the parameter list in the Configuration Manual 37427. Please refer to this manual for the complete parameter list.

NOTE

Be sure to enter the password for code level 2 or higher for the corresponding interface to get access for changing parameter settings.

NOTE

The new entered value must comply with the parameter setting range when changing the parameter setting.

Example 1: Addressing the password for serial interface1:

Par. ID.	Parameter	Setting range	Data type
10401	Password for serial interface1	0000 to 9999	UNSIGNED 16

Modbus address = 400000 + (Par. ID + 1) = 410402
Modbus length = 1 (UNSIGNED 16)

The following Modscan32 screenshot shows the configurations made to address parameter 10401.

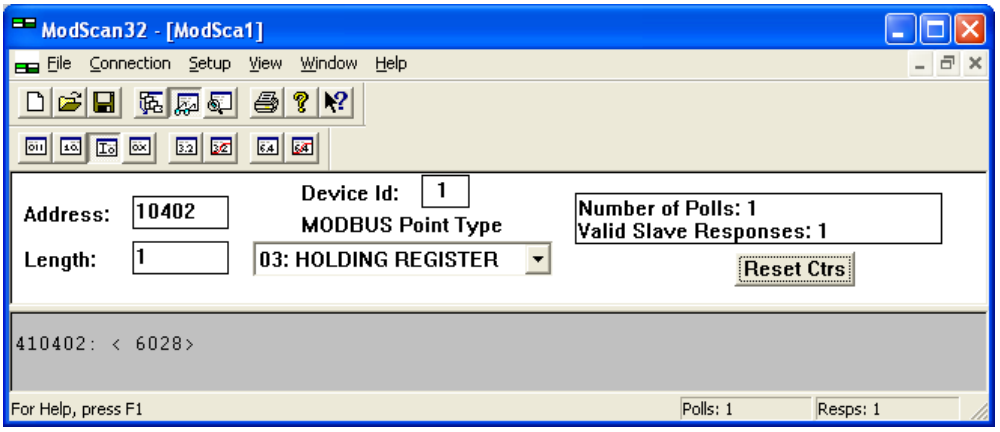


Figure 3-19: Modbus - configuration example 1

Example 2: Addressing the generator rated voltage:

Par. ID.	Parameter	Setting range	Data type
1766	Generator rated voltage	50 to 650000 V	UNSIGNED 32

Modbus address = 40000 + (Par. ID + 1) = 41767
Modbus length = 2 (UNSIGNED 32)

The following Modscan32 screenshot shows the configurations made to address parameter 1766.

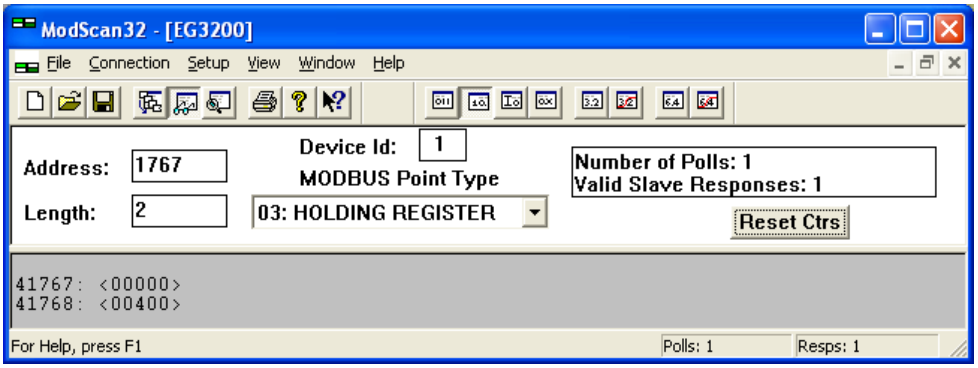


Figure 3-20: Modbus - configuration example 2

Example 3: Addressing the generator voltage measuring:

Par. ID.	Parameter	Setting range	Data type
1851	Generator voltage measuring	3Ph 4W **{0}** 3Ph 3W **{1}** 1Ph 2W **{2}** 1Ph 3W **{3}**	UNSIGNED 16

Modbus address = 40000 + (Par. ID + 1) = 41852
Modbus length = 1 (UNSIGNED 16)

NOTE

If the setting range contains a list of parameter settings like in this example, the parameter settings are numbered and start with 0 for the first parameter setting. The number corresponding with the respective parameter setting must be configured.

The following Modscan32 screenshot shows the configurations made to address parameter 1851, which is configured to "3Ph 4W".

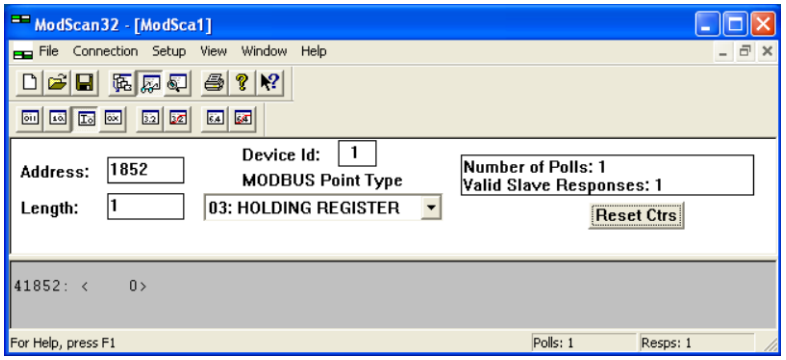


Figure 3-21: Modbus - configuration example 3

Configuration of the *LogicsManager* Functions via Modbus

Besides HMI and ToolKit, it is also possible to configure the *LogicsManager* functions via modbus.

Used *LogicsManager* Functions

The following *LogicsManager* functions are used for remote access:

12120 Start req. in AUTO: this *LogicsManager* function is used for remote request start/stop

12490 Ext. acknowledge: this *LogicsManager* function is used for remote acknowledge

12540 Start w/o load: this *LogicsManager* functionr is used for start without load

12510 Operat. mode AUTO: this *LogicsManager* function is used for AUTOMATIC mode

Modbus Encoding of a *LogicsManager* Function

The following section describes how to configure a *LogicsManager* function via Modbus. A *LogicsManager* function is defined by several parameters, like delays, commands, signs, or operators.

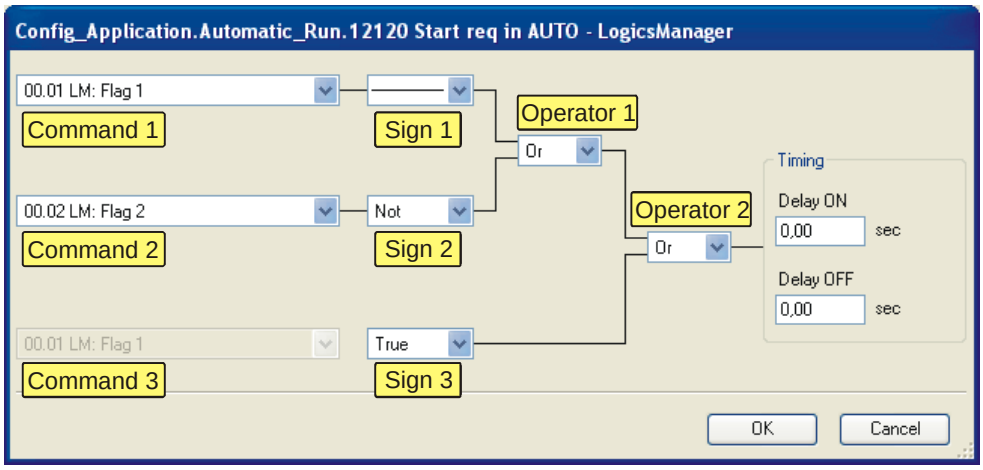


Figure 3-22: LogicsManager - Modbus encoding

The definition for a *LogicsManager* function consists of 7 data words:

Word 0	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Delay ON	Delay OFF	Logic equation 1	Logic equation 2	Command 1	Command 2	Command 3

NOTE

The configuration of a *LogicsManager* function via Modbus requires to reverse the byte order of double-byte words, i.e. low byte before high byte. The following examples show the order after reversing.

The delays are configured as hundredths of a second, i.e. 500 must be configured for a delay of 5 seconds.

The logic equation (0xFFFF) contains the information of one operator in each nibble.

Logic equation 1:

Word 2			
High byte *		Low byte *	
Highest nibble	Second highest nibble	Third highest nibble	Lowest nibble
Sign 1	Operator 1	Sign 2	Operator 2

Logic equation 2:

Word 3			
High byte *		Low byte *	
Highest nibble	Second highest nibble	Third highest nibble	Lowest nibble
Sign 3	not used	not used	not used

* high/low byte order after reversing

Definition of the nibbles:

Signs:

0x00 negate value of this element with 'NOT'
0x10 keep value of this element with '—'
0x20 force value of this element to 'TRUE'
0x30 force value of this element to 'FALSE'

Operators:

0x00 'AND' with following element
0x01 'NAND' with following element
0x02 'OR' with following element
0x03 'NOR' with following element
0x04 'XOR' with following element
0x05 'NOT-XOR' with following element

The commands are defined by configuring the ID of the respective command variable. Refer to the Logical Command Variables section of the *LogicsManager* appendix of the configuration manual 37427 for the command variable IDs.

Example:

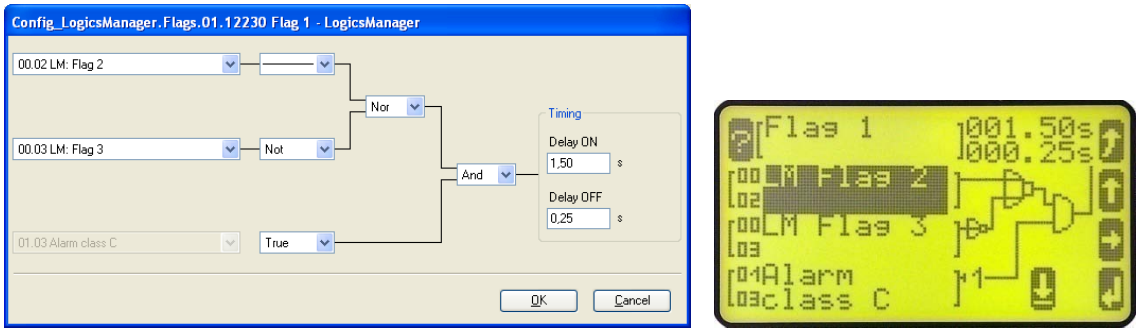


Figure 3-23: LogicsManager - Modbus encoding - example

The definition of above exemplary *LogicsManager* function is as follows:

Word 0	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Delay ON	Delay OFF	Logic equation 1	Logic equation 2	Command 1	Command 2	Command 3
150	25	0x1300	0x2000	1	2	101

Word 2				Word 3			
High byte *		Low byte *		High byte *		Low byte *	
13		00		00		20	
Sign 1	Operator 1	Sign 2	Operator 2	Sign 3	not used	not used	not used
1	3	0	0	2	0	0	0

* high/low byte order after reversing

Operating Modes

Two operating modes may be used with remote control:

1. STOP
2. AUTOMATIC

It is possible to fix the operating mode using the *LogicsManager* function 00.16 "Operat. mode AUTO" (parameter ID 12510).

Configuration of the LogicsManager Operation Mode AUTO

The Operat. mode AUTO *LogicsManager* function (parameter ID 12510) can be configured in two different ways:

1. Automatic operating mode is always enabled
2. Automatic operating mode is enabled via discrete input

Refer to the Performing Remote Start/Stop and Acknowledgement section of the Application Manual 37429 for a detailed configuration of the *LogicsManager* via HMI or ToolKit.

Example:

The Operat. mode AUTO *LogicsManager* function (parameter ID 12510) shall be configured as indicated in Figure 3-24.

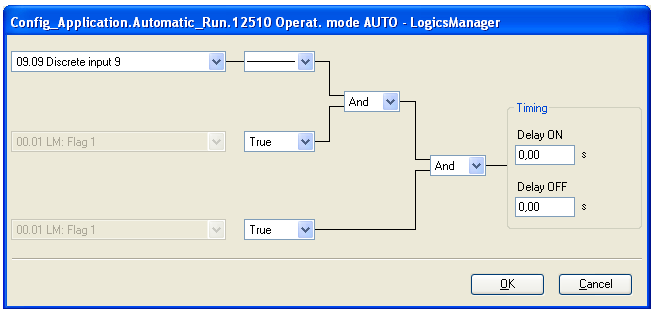


Figure 3-24: Modbus - LogicsManager example - Operat. Mode AUTO

The following Modbus message must be sent to the easYgen to configure the *LogicsManager* function accordingly:

Word 0	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Delay ON	Delay OFF	Logic equation 1	Logic equation 2	Command 1	Command 2	Command 3
0000 (hex)	0000 (hex)	1020 (hex)	2000 (hex)	0F02 (hex)	0000 (hex)	0000 (hex)

The detailed composition of this message is as follows:

Delay ON = 0.00 s -> word 0 = 0000 (hex)
Delay OFF = 0.00 s -> word 1 = 0000 (hex)
Logic eq. 1: sign 1 = '—'; Operator 1 = 'AND'; Sign 2 = 'TRUE', Operator 2 = 'AND' -> word 2 = 1020 (hex)
Logic equation 2: sign 3 = 'TRUE' -> word 3 = 2000 (hex)
Command 1 = 09.09 Discrete Input 9 = 0 (dec) = 0000 (hex) -> word 4 = 0F02 (hex)
Command 2 = 00.01 Flag 1 (default) = 0 (dec) = 0000 (hex) -> word 5 = 0000 (hex)
Command 3 = 00.01 Flag 1 (default) = 0 (dec) = 0000 (hex) -> word 6 = 0000 (hex)

The complete message of 7 words must be copied to address 12511 ff (12510+1) in one step. This is shown in Figure 3-25 using the ModScan32 software.

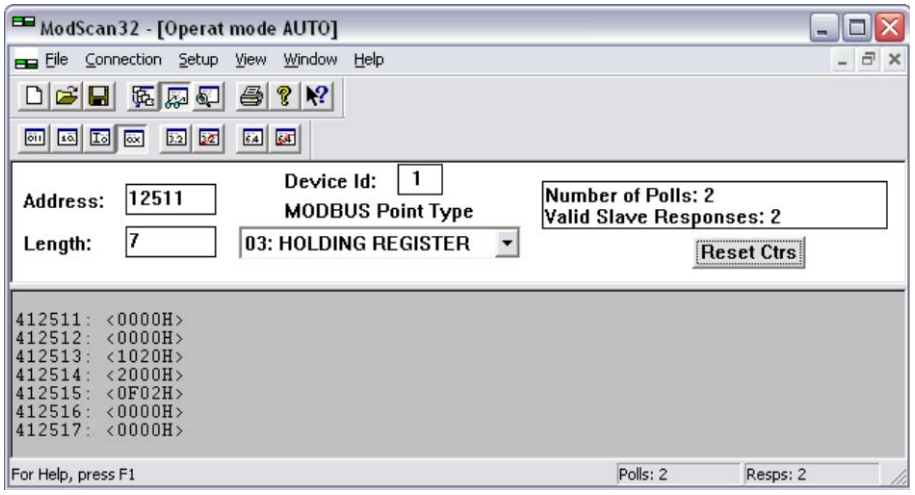


Figure 3-25: Modbus configuration - Operat. mode AUTO

NOTE

If an shutdown alarm of alarm class C through F occurs in AUTOMATIC operating mode, the control does not return to STOP operating mode if the alarm is cleared after acknowledgement. This means that a restart is initiated.

Configuration of Remote Start/Stop and Acknowledgement

Refer to the Performing Remote Start/Stop and Acknowledgement section in the Special Application Examples section of the application manual 37429 for detailed information.

The easYgen may be started, stopped, or acknowledged with CAN/Modbus. Therefore, two logical command variables have to be configured with the *LogicsManager*:

04.13 Remote request
04.14 Remote acknowledge

Configuration of the LogicsManager Function Start Request in AUTO

The Start req. in AUTO *LogicsManager* function (parameter ID 12120) can be configured in a way that a start request in AUTOMATIC operating mode is enabled as soon as a remote request is issued. Refer to the Performing Remote Start/Stop and Acknowledgement section of the Application Manual 37429 for a detailed configuration via HMI or ToolKit.
The remote request may be enabled by setting bit 0 (start) of the remote control word 503 to HIGH and may be disabled by setting bit 1 (stop) of the remote control word 503 to HIGH (refer to Remote Control Word 1 - Object 21F7h (Parameter ID 503) on page 103).

Example:

The Start req. in AUTO *LogicsManager* function (parameter ID 12120) shall be configured as indicated in Figure 3-26.

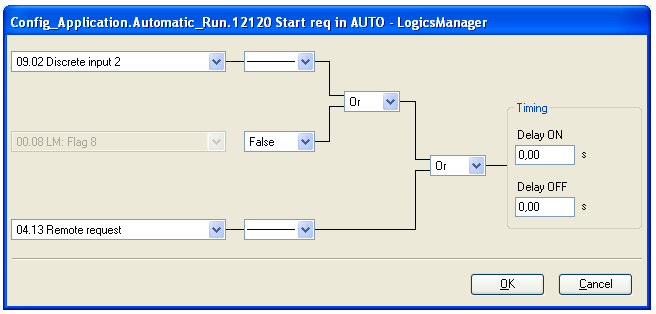


Figure 3-26: Modbus - LogicsManager example - Start req. in AUTO

The following Modbus message must be sent to the easYgen to configure the *LogicsManager* function accordingly:

Word 0	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Delay ON	Delay OFF	Logic equation 1	Logic equation 2	Command 1	Command 2	Command 3
0000 (hex)	0000 (hex)	1232 (hex)	1000 (hex)	0802 (hex)	0700 (hex)	FB00 (hex)

The detailed composition of this message is as follows:

Delay ON = 0.00 s -> word 0 = 0000 (hex)
Delay OFF = 0.00 s -> word 1 = 0000 (hex)
Logic equation 1: sign 1 = '—'; Operator 1 = 'OR'; Sign 2 = 'FALSE', Operator 2 = 'OR' -> word 2 = 1232 (hex)
Logic equation 2: sign 3 = '—' -> word 3 = 1000 (hex)
Command 1 = 09.02 Discrete input 2 = 520 (dec) = 0208 (hex) -> word 4 = 0802 (hex)
Command 2 = 00.08 Flag 8 = 0 (dec) = 0000 (hex) -> word 5 = 0700 (hex)
Command 3 = 04.13 Remote request = 251 (dec) = 00FB (hex) -> word 6 = FB00 (hex)

The complete message of 7 words must be copied to address 12121 ff (12120+1) in one step. This is shown in Figure 3-27 using the ModScan32 software.

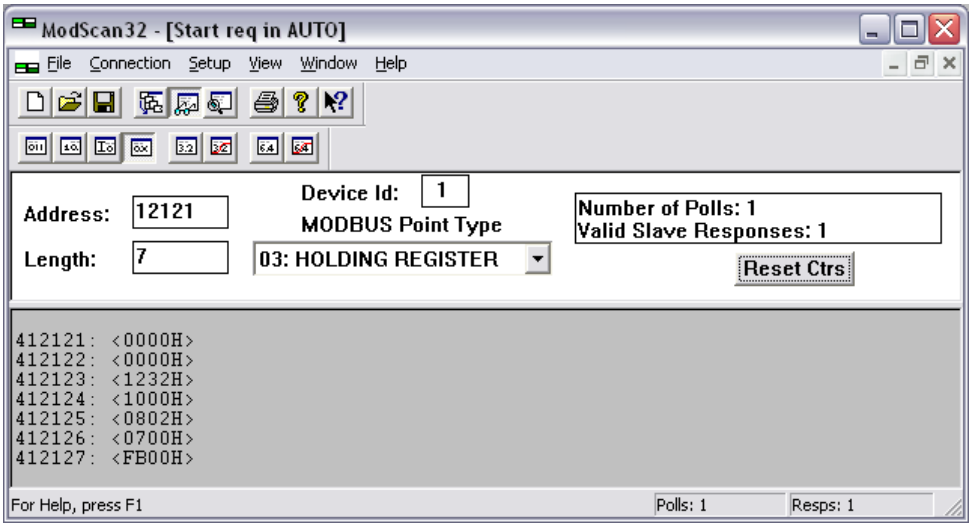


Figure 3-27: Modbus configuration - Start req in AUTO

Configuration of the LogicsManager Function External Acknowledge

The Ext. acknowledge *LogicsManager* function (parameter ID 12490) can be configured in a way that an external acknowledgement is performed as soon as the remote acknowledge signal is enabled. Refer to the Performing Remote Start/Stop and Acknowledgement section of the Application Manual 37429 for a detailed configuration via HMI or ToolKit.
External acknowledge may be enabled by setting bit 4 (external acknowledge) of the remote control word 503 to HIGH (refer to Remote Control Word 1 - Object 21F7h (Parameter ID 503) on page 103).

Example:

The External acknowledge *LogicsManager* function (parameter ID 12490) shall be configured as indicated in Figure 3-26.

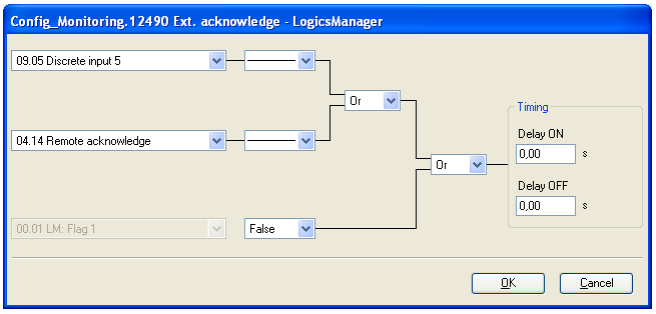


Figure 3-28: Modbus - LogicsManager example - External acknowledge

The following Modbus message must be sent to the easYgen to configure the *LogicsManager* function accordingly:

Word 0	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Delay ON	Delay OFF	Logic equation 1	Logic equation 2	Command 1	Command 2	Command 3
0000 (hex)	0000 (hex)	1212 (hex)	3000 (hex)	0B02 (hex)	FC00 (hex)	0000 (hex)

The detailed composition of this message is as follows:

Delay ON = 0.00 s -> word 0 = 0000 (hex)
Delay OFF = 0.00 s -> word 1 = 0000 (hex)
Logic equation 1: sign 1 = '—'; Operator 1 = 'OR'; Sign 2 = '—', Operator 2 = 'OR' -> word 2 = 1212 (hex)
Logic equation 2: sign 3 = 'FALSE' -> word 3 = 3000 (hex)
Command 1 = 09.05 Discrete input 5 = 523 (dec) = 020B (hex) -> word 4 = 0B02 (hex)
Command 2 = 04.14 Remote acknowledge = 252 (dec) = 00FC (hex) -> word 5 = FC00 (hex)
Command 3 = 00.01 Flag 1 (default) = 0 (dec) = 0000 (hex) -> word 6 = 0000 (hex)

The complete message of 7 words must be copied to address 12491 ff (12490+1) in one step. This is shown in Figure 3-29 using the ModScan32 software.

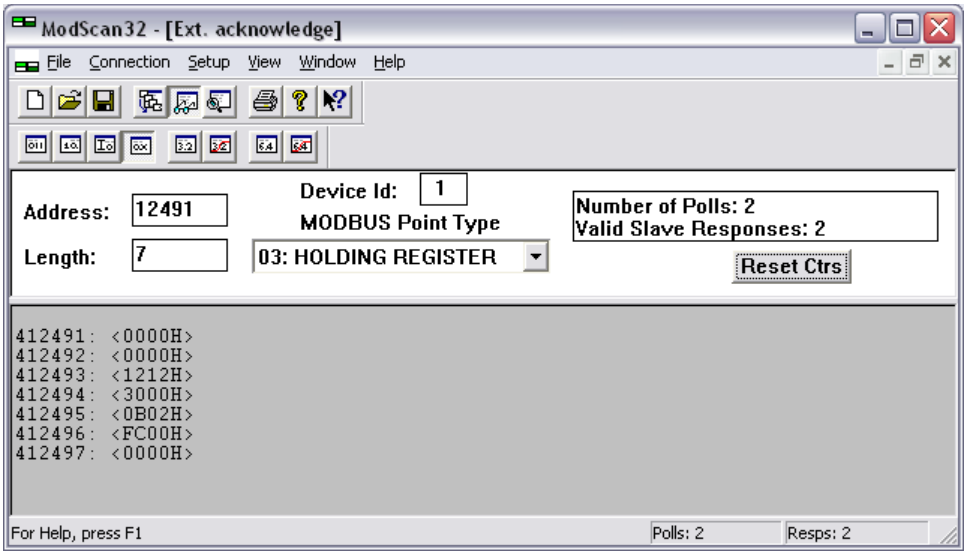


Figure 3-29: Modbus configuration - External acknowledge

Configuration of the LogicsManager Function Start w/o Load

The Start w/o load *LogicsManager* function (parameter ID 12540) can be configured in a way that it is always enabled. Refer to the Performing Remote Start/Stop and Acknowledgement section of the Application Manual 37429 for a detailed configuration via HMI or ToolKit.

Example:

The Start w/o Load *LogicsManager* function (parameter ID 12540) shall be configured as indicated in Figure 3-26.

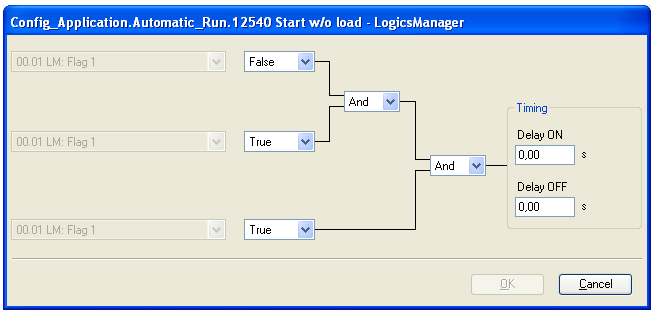


Figure 3-30: Modbus - LogicsManager example - Start w/o Load

The following Modbus message must be sent to the easYgen to configure the *LogicsManager* function accordingly:

Word 0	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Delay ON	Delay OFF	Logic equation 1	Logic equation 2	Command 1	Command 2	Command 3
0000 (hex)	0000 (hex)	2020 (hex)	2000 (hex)	0000 (hex)	0000 (hex)	0000 (hex)

The detailed composition of this message is as follows:

Delay ON = 0.00 s -> word 0 = 0000 (hex)
Delay OFF = 0.00 s -> word 1 = 0000 (hex)
Logic eq. 1: sign 1 = 'TRUE'; Operator 1 = 'AND'; Sign 2 = 'TRUE', Operator 2 = 'AND' -> word 2 = 2020 (hex)
Logic equation 2: sign 3 = 'TRUE' -> word 3 = 2000 (hex)
Command 1 = 00.01 Flag 1 (default) = 0 (dec) = 0000 (hex) -> word 4 = 0000 (hex)
Command 2 = 00.01 Flag 1 (default) = 0 (dec) = 0000 (hex) -> word 5 = 0000 (hex)
Command 3 = 00.01 Flag 1 (default) = 0 (dec) = 0000 (hex) -> word 6 = 0000 (hex)

The complete message of 7 words must be copied to address 12541 ff (12540+1) in one step. This is shown in Figure 3-31 using the ModScan32 software.

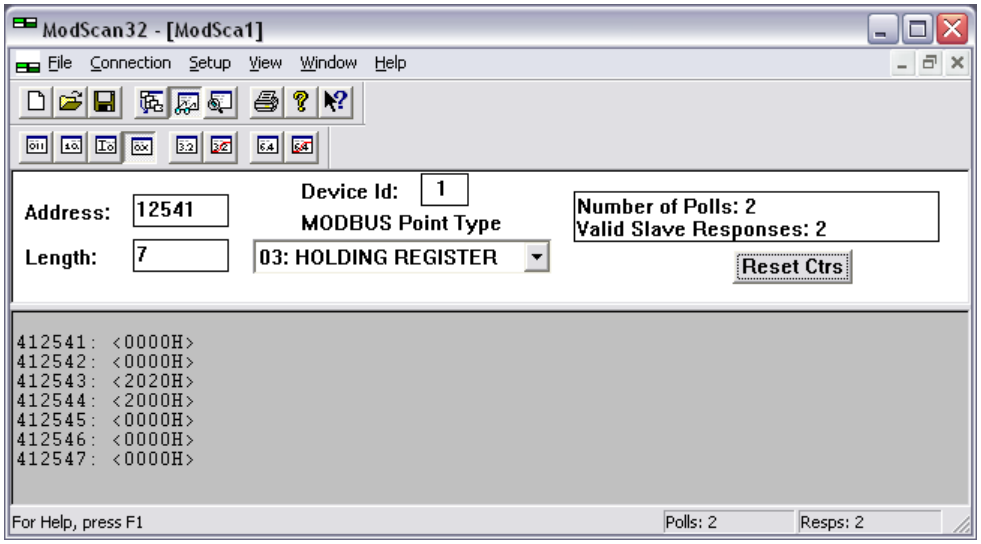


Figure 3-31: Modbus configuration - Start w/o load

Remote Acknowledging Single Alarm Messages

It is possible to remotely acknowledge single alarm messages through the Modbus by sending the respective parameter ID of the alarm to be acknowledged on ID 522. The required procedure is detailed in the following steps.

Par. ID.	Parameter	Setting range	Data type
522	Reset alarm list	0 to 65535	UNSIGNED 16

The parameter ID of the alarm to be acknowledged must be written to object 220A (hex), i.e. parameter ID 522.

Example:

A "Mains undervoltage 1" alarm (parameter ID 3012) is to be acknowledged (refer to Appendix B: Data Protocols starting on page 77 or the alarm list in the Operation Manual 37428).
Modbus address = 40000 + (Par. ID + 1) = 40523
Modbus length = 1 (UNSIGNED 16)

Figure 3-32 shows the settings made to parameter ID 522 in ModScan32. It is possible to set the format to decimal to view the value using the "display options".

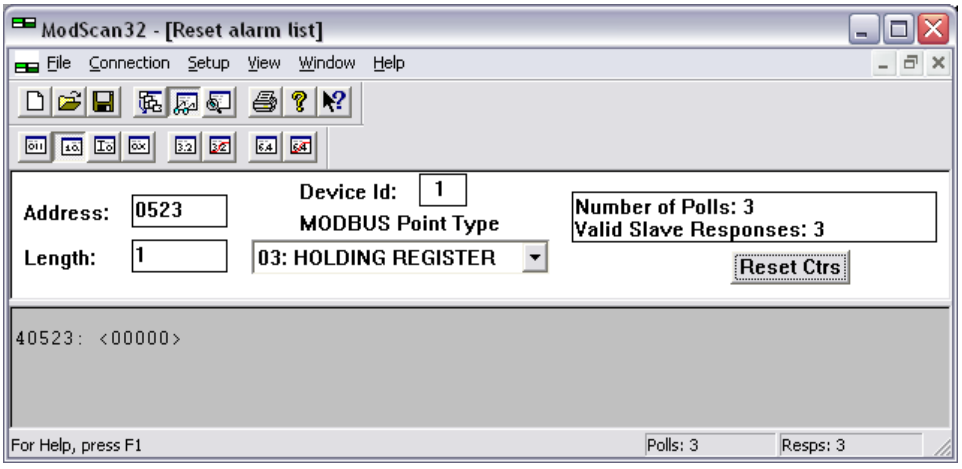


Figure 3-32: Modbus - remote control parameter 522

By double-clicking the address, a Write Register command may be issued. Figure 3-33 shows how the parameter ID of the alarm to be acknowledged is written using the ModScan32 Software.

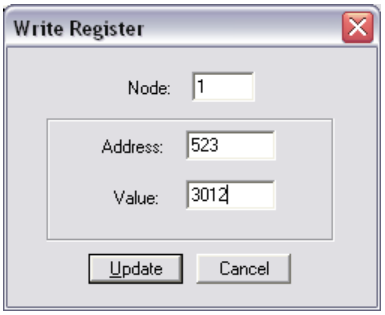


Figure 3-33: Modbus - write register - acknowledge alarm message

Remotely Clearing The Event History

It is possible to remotely clear the event history through the Modbus. The required procedure is detailed in the following steps.

Par. ID.	Parameter	Setting range	Data type
1706	`Clear eventlog`	YES / NO	UNSIGNED 16

In order to clear the event history, bit 0 of object 26AA (hex), i.e. parameter ID 1706, must be enabled.

Example:

The event history is to be cleared.
Modbus address = 40000 + (Par. ID + 1) = 41707
Modbus length = 1 (UNSIGNED 16)

Figure 3-34 shows the settings made to parameter ID 1706 in ModScan32. It is possible to set the format to binary to view single bits using the "display options".

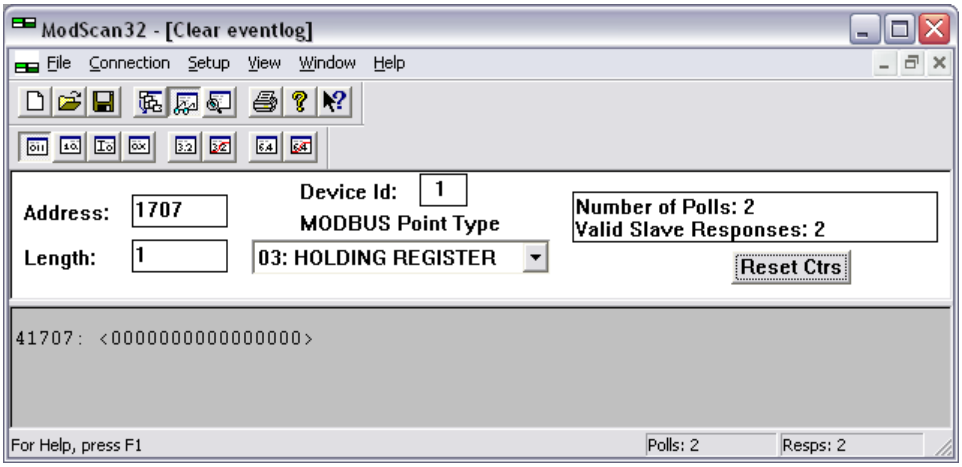


Figure 3-34: Modbus - remote control parameter 1706

By double-clicking the address, a Write Register command may be issued. Figure 3-35 shows how bit 0 is enabled using the ModScan32 Software.

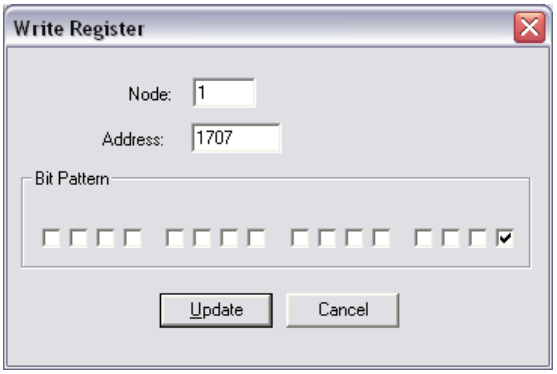


Figure 3-35: Modbus - write register - clear event history

Remotely Resetting the Default Values

Modbus via Serviceport (RS-232)

It is possible to remotely reset the unit to its default values through the Modbus (via RS-232) using the parameter IDs 1704 and 1701. The required procedure is detailed in the following steps.

Par. ID.	Parameter	Setting range	Data type
1704	Factory settings via RS-232	YES / NO	UNSIGNED 16
1701	Reset factory default values	YES / NO	UNSIGNED 16

In order to enable the resetting procedure, parameter ID 1704 must be enabled.

Example:

The resetting procedure via RS-232 is to be enabled.
Modbus address = 40000 + (Par. ID + 1) = 41705
Modbus length = 1 (UNSIGNED 16)

Figure 3-36 shows the settings made to parameter ID 1704 in ModScan32. It is possible to set the format to decimal to view the value using the "display options".

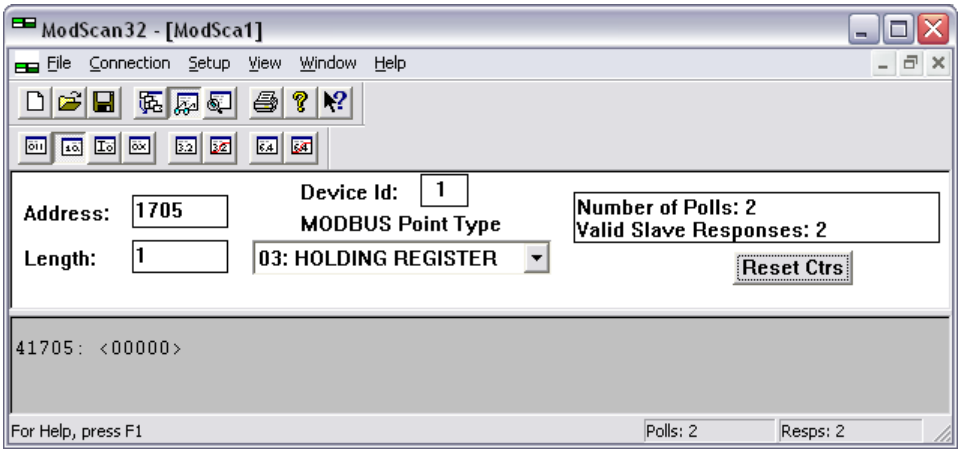


Figure 3-36: Modbus - remote control parameter 1704

By double-clicking the address, a Write Register command may be issued. Figure 3-37 shows how the parameter is enabled using the ModScan32 Software. The value must be set to "1" to enable the parameter.

Figure 3-37: Modbus - write register - enable the resetting procedure via RS-232

In order to reset the default values, parameter ID 1701 must be enabled.

Example:

The default values are to be reset.
Modbus address = 40000 + (Par. ID + 1) = 41702
Modbus length = 1 (UNSIGNED 16)

Figure 3-38 shows the settings made to parameter ID 1701 in ModScan32. It is possible to set the format to decimal to view the value using the "display options".

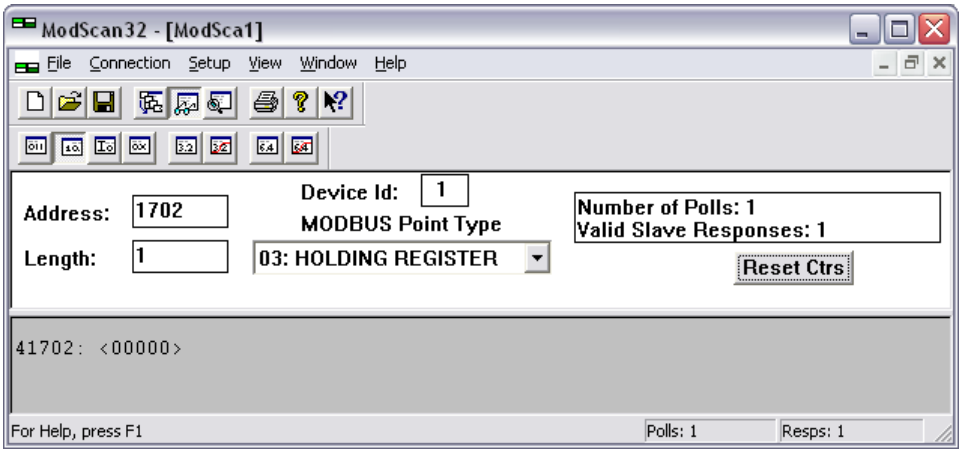


Figure 3-38: Modbus - remote control parameter 1701

By double-clicking the address, a Write Register command may be issued. Figure 3-39 shows how the parameter is enabled using the ModScan32 Software. The value must be set to "1" to enable the parameter.

Figure 3-39: Modbus - write register - resetting the default values

Modbus via RS-485 (easYgen-2500 P1 only)

It is possible to remotely reset the unit to its default values through the Modbus (via RS-485) using the parameter IDs 1743 and 1701. The required procedure is the same as described under Modbus via Serviceport (RS-232 on page 71; however the parameter ID 1743 is used instead of parameter ID 1704.

Par. ID.	Parameter	Setting range	Data type
1743	Factory settings via RS-485	YES / NO	UNSIGNED 16
1701	Reset factory default values	YES / NO	UNSIGNED 16

Exception Responses

The easYgen Modbus interface has multiple exception responses to show that a request could not be executed. Exception responses can be recognized if the response telegram contains the request function code with an offset of 128 (0x80 hex).

Table 3-5 explains possible reasons for an exception response that occurred.

easYgen Modbus Exception Responses		
Code	**Name**	**Reason**
01	ILLEGAL FUNCTION	• The sent request function code is not supported by the easYgen Modbus interface.
02	ILLEGAL ADDRESS	• Permission to read/write the parameter is denied. • The amount of requested registers is wrong to read/write this registers.
03	ILLEGAL DATA VALUE	• The data value exceeds the min. and max. limitations of the parameter upon a write request. • There is no parameter on the requested address.

Table 3-5: Modbus - exception responses

Modbus Parameters

NOTE

The following parameters are available for configuring the Modbus modules on the Serial Interfaces. Refer to the Configuration Manual 37427 for detailed information about all parameters.

Serial Interface 1

Parameter table

ID	Text	Setting range	Default value
Configure RS-232 interfaces: serial interface 1			
3185	ModBus Slave ID	0 to 255	1
3186	Reply delay time	0.00 to 1.00 s	0.00 s

Table 3-6: Modbus - serial interface 1 - parameters

Serial Interface 2

Parameter table

ID	Text	Setting range	Default value
Configure RS-232 interfaces: serial interface 1			
3188	ModBus Slave ID	0 to 255	1
3189	Reply delay time	0.00 to 2.55 s	0.00 s

Table 3-7: Modbus - serial interface 2 - parameters

Appendix A.
Supported J1939 ECUs & Remote Control Messages

The following table lists all ECUs, which are supported by the easYgen beyond the J1939 standard with the appropriate settings. We recommend the standard setting for all ECUs, which are not listed here. All other parameters shall be clarified with the ECU manufacturer.

Setting / ECU	Device type (ID 15102)	J1939 Own address (ID 15106)	Engine control address (ID 15107)	SPN Version (ID 15103)	Comment
Woodward EGS	EGS Woodward	234	0	n/a	
MTU ADEC	ADEC MTU	1	128	n/a	The easYgen is connected with the SAM via CAN. The SAM communicates with the ADEC using an own bus.
Deutz EMR2 Volvo EDC4	EMR2 Deutz	3	0	Version 1	
Volvo EMS2 Volvo EMS1 Volvo EDC3	EMS2 Volvo	17	0	n/a	The rated speed of the EMS1 and EDC3 cannot be switched via the easYgen.
Scania S6	S6 Scania	39	0	n/a	
MAN MFR/EDC7	EDC7 MAN	253	39	n/a	The easYgen is connected with the MFR via CAN. The MFR communicates with the EDC7 using an own bus.
Standard ECUs	Standard	234	0	n/a	
SISU EEM2/3	EEM SISU	n/a	0 / (1)	n/a	
Cummins	Cummins	220	0	n/a	

The following data is only transmitted to the corresponding ECU, if parameter "ECU remote controlled" is configured to "On", and parameter "Device type" is configured to one of the available ECU modes (if "Off" is configured, no J1939 remote control messages will be sent as well).

NOTE

Please note that some ECU manufacturers require that this functionality must be enabled first. In some cases, this is only possible by the manufacturer. Please consider this when ordering the ECU.

Remote control parameter	Woodward EGS	Scania S6	Deutz EMR2 Volvo EDC4	Volvo EMS2	Volvo EMS1/ EDC3	MTU ADEC	MAN EDC7	Standard	SISU EEM 2/3	Cummins	Comment
Engine Start	No	Yes	No	Yes	Yes	Yes	Yes	No	No / Yes	Yes	If an engine start command is initiated by the easYgen, this information is transmitted in the form of a J1939 message bit to an ECU. If ignition speed is reached, this bit will be reset (*LogicsManager* command variable 03.02. "Starter").
Engine Stop	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No / Yes	Yes	This J1939 bit information is set, if a "Stop" command in automatic or manual mode is present in the easYgen. The "Stop" bit information remains set, until ignition speed is fallen below. After ignition speed has been fallen below, the "Stop" bit will be reset (*LogicsManager* command variable 03.27. "Stopping solenoid").
Droop mode	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes / Yes	Yes	This J1939 bit information is set, if a "Start" command in automatic or manual mode is initiated by the easYgen. The bit remains set until the engine has been stopped. **Important:** This message is only sent, if the *LogicsManager* output 00.25 "Frequency droop active" is TRUE.
Idle Mode	No	Yes	No*[1]	Yes	Yes	No	No*[1]	No*[1]	No / No	Yes	This J1939 bit information is set, if "Idle" mode is active (*LogicsManager* command variable 04.15. "Idle run active" is TRUE). The bit will be reset, if "Idle" mode is no longer active (*LogicsManager* command variable 04.15. "Idle run active" is FALSE).
50/60 Hz switch	Yes	Yes	No	Yes*[2]	No	Yes	No*[1]	No	No / No	Yes	The J1939 information for 50 or 60 Hz mode is sent to the ECU depending on the "Rated system frequency" parameter setting (ID 1750) within the easYgen .
Speed bias	Yes	Yes offset	Yes absolute	Yes offset	Yes	Yes absolute	Yes absolute	Yes absolute	Yes / Yes	Yes	Refer to parameter 5537 in the Configuration Manual 37427 for detailed information.
Preglow	No	No	No	Yes	Yes	No	No	No	No / No	No	This J1939 bit information is set, if the easYgen is in "Preglow" mode (*LogicsManager* command variable 03.04. "Preglow/Ignition" is TRUE). The bit will be reset, if the "Preglow" phase has been expired or aborted.
Override	No	Yes	No	Yes	No	Yes	No	Yes	No / No	Yes	This J1939 bit information is set, if the easYgen is in critical mode (*LogicsManager* command variable 04.27. "Critical mode" is TRUE). The bit will be reset, if the critical mode has been expired or aborted.

*[1] Please contact manufacturer to clarify whether both frequencies (50/60 Hz) may be controlled by the speed bias.
*[2] In case the rated speed of the easYgen and the ECU don´t match, please make sure that the CAN connections works and change parameter 1750 of the easYgen once.

Appendix B.
Data Protocols

Data Protocol 5100

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
450001	450000	0	1,2		Protocoll-ID, allways 5100		--
450002	450001	0	3,4	10100	Pickup speed	1	rpm
450003	450002	0	5,6	-	Control mode (STOP/AUTO/MANUALLY)	Mask:000Fh	(enum.)
450004	450003	1	1,2	160	Gen. powerfactor	0.001	
450005	450004	1	3,4,5,6	170	Av. Gen. Wye-Voltage	0.1	V
450007	450006	2	1,2	144	Gen. frequency	0.01	Hz
450008	450007	2	3,4,5,6	171	Av. Gen. Delta-Voltage	0.1	V
450010	450009	3	1,2	147	Mains / Busbar frequency	0.01	Hz
450011	450010	3	3,4,5,6	173	Av. Mains / Busbar Wye-Voltage	0.1	V
450013	450012	4	1,2	208	Mains / Busbar power factor	0.001	
450014	450013	4	3,4,5,6	174	Av. Mains / Busbar Delta-Voltage	0.1	V
450016	450015	5	1,2	2540	Engine, number of start requests	1	
450017	450016	5	3,4,5,6	135	Total gen. power	1	W
450019	450018	6	1,2	10202	Operation modes		(enum.)
450020	450019	6	3,4,5,6	140	Total mains power	1	W
450022	450021	7	1,2	10110	Battery voltage	0.1	V
450023	450022	7	3,4,5,6	207	Av. Mains Current	0.001	A
450025	450024	8	1,2	10111	Analog input 1	changeable	

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
450026	450025	8	3,4,5,6	185	Av. Gen. Current	0.001	A
450028	450027	9	1,2	10112	Analog input 2	changeable	
450029	450028	9	3,4,5,6	161	Meas. ground current	0.001	A
450031	450030	10	1,2	10115	Analog input 3	changeable	
450032	450031	10	3,4,5,6	159	Calculated ground current	0.001	A
450034	450033	11	1,2	4153	Idle mode active (suppresses undervolt, underfreq,...)	Mask: 8000h	Bit
					Idle mode active	Mask: 4000h	Bit
					Start without closing GCB	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					Cooldown is active	Mask: 0200h	Bit
					Auxiliary services gene-rally active	Mask: 0100h	Bit
					Engine Monitoring delay timer has expired	Mask: 0080h	Bit
					Breaker delay timer has expired	Mask: 0040h	Bit
					Engine start is requested	Mask: 0020h	Bit
					Critical mode is active in automatic mode	Mask: 0010h	Bit
					Engine is released (speed governor is enabled)	Mask: 0008h	Bit
					Auxiliary services prerun is active	Mask: 0004h	Bit
					Auxiliary services postrun is active	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450035	450034	11	3,4,5,6	111	Gen. current 1	0.001	A
450037	450036	12	1,2	4154	Crank (Starter) is active	Mask: 8000h	Bit
					Operating Magnet / Gasre-lay is active	Mask: 4000h	Bit
					Preglow / Ignition is ac-tive	Mask: 2000h	Bit
					Mains settling timer is running	Mask: 1000h	Bit
					Emergency mode is current-ly active	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					Stopping Magnet is active	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					The genset runs mains pa-rallel	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					Increment Engine Start Counter	Mask: 0001h	Bit
450038	450037	12	3,4,5,6	112	Gen. current 2	0.001	A
450040	450039	13	1,2	4155	3-Position Controller Freq./Power raise	Mask: 8000h	Bit
					3-Position Controller Freq./Power lower	Mask: 4000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					3-Position Controller Volt./ReactPow raise	Mask: 2000h	Bit
					3-Position Controller Volt./ReactPow lower	Mask: 1000h	Bit
					GCB is closed	Mask: 0800h	Bit
					MCB is closed	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					Synchronisation GCB is active	Mask: 0100h	Bit
					Opening GCB is active	Mask: 0080h	Bit
					Closing GCB is active	Mask: 0040h	Bit
					Synchronisation MCB is active	Mask: 0020h	Bit
					Opening MCB is active	Mask: 0010h	Bit
					Closing MCB is active	Mask: 0008h	Bit
					Unloading generator is active	Mask: 0004h	Bit
					Unloading mains is active	Mask: 0002h	Bit
					Power limited prerun	Mask: 0001h	Bit
450041	450040	13	3,4,5,6	113	Gen. current 3	0.001	A
450043	450042	14	1,2	4156	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					Dead busbar closure request for GCB or MCB	Mask: 0400h	Bit
					Active power load share is acitve	Mask: 0200h	Bit
					Reactive power load share is acitve	Mask: 0100h	Bit
					Generator with a closed GCB is requested	Mask: 0080h	Bit
					LDSS: The Engine is started	Mask: 0040h	Bit
					LDSS: The Engine is stopped	Mask: 0020h	Bit
					LDSS: The Engine is stopped, if possible	Mask: 0010h	Bit
					LDSS: Minimum Running Time is active	Mask: 0008h	Bit
					LDSS: The LDSS function is active	Mask: 0004h	Bit
					The Critical Mode Postrun is active	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450044	450043	14	3,4,5,6	134	Mains current L1	0.001	A
450046	450045	15	1,2	10131	internal	Mask: 0040h	Bit
					Alarm class F latched	Mask: 0020h	Bit
					Alarm class E latched	Mask: 0010h	Bit
					Alarm class D latched	Mask: 0008h	Bit
					Alarm class C latched	Mask: 0004h	Bit
					Alarm class B latched	Mask: 0002h	Bit
					Alarm class A latched	Mask: 0001h	Bit
450047	450046	15	3,4,5,6	136	Total gen. reactive power	1	var

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
450049	450048	16	1,2	10310	Analog output 1	0,01	%
450050	450049	16	3,4,5,6	150	Total mains reactive power	1	var
450052	450051	17	1,2	10311	Analog output 2	0,01	%
450053	450052	17	3,4,5,6	108	Gen. voltage L1-L2	0.1	V
450055	450054	18	1,2	10317	Analog output 3	0,01	%
450056	450055	18	3,4,5,6	114	Gen. voltage L1-N	0.1	V
450058	450057	19	1,2	10318	Analog output 4	0,01	%
450059	450058	19	3,4,5,6	109	Gen. voltage L2-L3	0.1	V
450061	450060	20	1,2	10159	AI Auxiliary excitation D+	0.1	V
450062	450061	20	3,4,5,6	115	Gen. voltage L2-N	0.1	V
450064	450063	21	1,2	2112	Overspeed 1 latched	Mask: 8000h	Bit
				2113	Overspeed 2 latched	Mask: 4000h	Bit
				2162	Underspeed 1 latched	Mask: 2000h	Bit
				2163	Underspeed 2 latched	Mask: 1000h	Bit
				2652	Unintended stop latched	Mask: 0800h	Bit
				2457	Speed/freq.mism. Latched	Mask: 0400h	Bit
				2504	Shutdwn malfunct. latched	Mask: 0200h	Bit
				2603	GCB fail to close latched	Mask: 0100h	Bit
				2604	GCB fail to open latched	Mask: 0080h	Bit
				2623	MCB fail to close latched	Mask: 0040h	Bit
				2624	MCB fail to open latched	Mask: 0020h	Bit
				10017	CAN-Fault J1939 latched	Mask: 0010h	Bit
				3325	Start fail latched	Mask: 0008h	Bit
				2560	Mainten. days exceeded latched	Mask: 0004h	Bit
				2561	Mainten. hours exceeded latched	Mask: 0002h	Bit
				10087	CANopen error at CAN Interface 1	Mask: 0001h	Bit
450065	450064	21	3,4,5,6	110	Gen. voltage L3-L1	0.1	V
450067	450066	22	1,2	3064	GCB syn. timeout latched	Mask: 8000h	Bit
				3074	MCB syn. timeout latched	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
				4056	Charge alt. low voltage (D+) latched	Mask: 1000h	Bit
				2944	Ph.rotation mismatch latched	Mask: 0800h	Bit
					internal	Mask: 0400h	
					internal	Mask: 0200h	
					internal	Mask: 0100h	
					internal	Mask: 0080h	
					internal	Mask: 0040h	
				10088	CANopen error at CAN Interface 2	Mask: 0020h	Bit
				4073	Parameter Alignment	Mask: 0010h	
				4064	Missing members on CAN	Mask: 0008h	Bit
				1714	EEPROM failure latched	Mask: 0004h	Bit
				15125	Red stop lamp latched	Mask: 0002h	Bit
				15126	Amber warning lamp latched	Mask:	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
						0001h	
450068	450067	22	3,4,5,6	116	Gen. voltage L3-N	0.1	V
450070	450069	23	1,2	2558	Hours until next maintenance	1	h
450071	450070	23	3,4,5,6	118	Mains / Busbar voltage L1-L2	0.1	V
450073	450072	24	1,2	1912	Gen.overfreq. 1 latched	Mask: 8000h	Bit
				1913	Gen.overfreq. 2 latched	Mask: 4000h	Bit
				1962	Gen.underfreq. 1 latched	Mask: 2000h	Bit
				1963	Gen.underfreq. 2 latched	Mask: 1000h	Bit
				2012	Gen.overvolt. 1 latched	Mask: 0800h	Bit
				2013	Gen.overvolt. 2 latched	Mask: 0400h	Bit
				2062	Gen.undervolt. 1 latched	Mask: 0200h	Bit
				2063	Gen.undervolt. 2 latched	Mask: 0100h	Bit
				2218	Gen. overcurr. 1 latched	Mask: 0080h	Bit
				2219	Gen. overcurr. 2 latched	Mask: 0040h	Bit
				2220	Gen. overcurr. 3 latched	Mask: 0020h	Bit
				2262	Gen. Rv/Rd pow.1 latched	Mask: 0010h	Bit
				2263	Gen. Rv/Rd pow.2 latched	Mask: 0008h	Bit
				2314	Gen. Overload IOP 1 latched	Mask: 0004h	Bit
				2315	Gen. Overload IOP 2 latched	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450074	450073	24	3,4,5,6	121	Mains / Busbar voltage L1-N	0.1	V
450076	450075	25	1,2	2412	Unbal. load 1 latched	Mask: 8000h	Bit
				2413	Unbal. load 2 latched	Mask: 4000h	Bit
				3907	Gen. Asymmetry latched	Mask: 2000h	Bit
				3263	Ground fault 1 latched	Mask: 1000h	Bit
				3264	Ground fault 2 latched	Mask: 0800h	Bit
				3955	Gen. phase rot. misw. Latched	Mask: 0400h	Bit
				2924	Gen act.pwr mismatch Latched	Mask: 0200h	Bit
				3124	Gen. unloading fault Latched	Mask: 0100h	Bit
				4038	Inv.time ov.curr. Latched	Mask: 0080h	Bit
				2664	Operating range failed, latched	Mask: 0040h	Bit
				2362	Gen. Overload MOP 1 latched	Mask: 0020h	Bit
				2363	Gen. Overload MOP 2 latched	Mask: 0010h	Bit
				2337	Gen. overexcited 1 latched	Mask: 0008h	Bit
				2338	Gen. overexcited 2 latched	Mask: 0004h	Bit
				2387	Gen. underexcited 1 latched	Mask: 0002h	Bit
				2388	Gen. underexcited 2 latched	Mask: 0001h	Bit
450077	450076	25	3,4,5,6	119	Mains / Busbar voltage L2-L3	0.1	V
450079	450078	26	1,2	2862	Mains / Busbar ov.freq. 1 latched	Mask: 8000h	Bit
				2863	Mains / Busbar ov.freq. 2 latched	Mask: 4000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
				2912	Mains / Busbar un.freq. 1 latched	Mask: 2000h	Bit
				2913	Mains / Busbar un.freq. 2 latched	Mask: 1000h	Bit
				2962	Mains / Busbar ov.volt. 1 latched	Mask: 0800h	Bit
				2963	Mains / Busbar ov.volt. 2 latched	Mask: 0400h	Bit
				3012	Mains / Busbar un.volt. 1 latched	Mask: 0200h	Bit
				3013	Mains / Busbar un.volt. 2 latched	Mask: 0100h	Bit
				3057	Mains / Busbar phaseshift latched	Mask: 0080h	Bit
				3114	Mains / Busbar decoupling latched	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
				3975	Mains phase rot. Miswired latched	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450080	450079	26	3,4,5,6	122	Mains / Busbar voltage L2-N	0.1	V
450082	450081	27	1,2		internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
				2934	Mns act.pwr mismatch latched	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450083	450082	27	3,4,5,6	120	Mains / Busbar voltage L3-L1	0.1	V
450085	450084	28	1,2	10608	State Digital Input 8 latched	Mask: 8000h	Bit
				10607	State Digital Input 7 latched	Mask: 4000h	Bit
				10605	State Digital Input 6 latched	Mask: 2000h	Bit
				10604	State Digital Input 5 latched	Mask: 1000h	Bit
				10603	State Digital Input 4 latched	Mask: 0800h	Bit
				10602	State Digital Input 3 latched	Mask: 0400h	Bit
				10601	State Digital Input 2 latched	Mask: 0200h	Bit
				10600	State Digital Input 1	Mask:	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					latched	0100h	
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450086	450085	28	3,4,5,6	123	Mains / Busbar voltage L3-N	0.1	V
450088	450087	29	1,2	10610	State Digital Input 10 latched	Mask: 8000h	Bit
				10609	State Digital Input 9 latched	Mask: 4000h	Bit
					internal	Mask: 3FFFh	
450089	450088	29	3,4,5,6	2520	Gen. real energy	0,01	MWh
450091	450090	30	1,2	16376	State external Digital Input 16 latched	Mask: 8000h	Bit
				16375	State external Digital Input 15 latched	Mask: 4000h	Bit
				16374	State external Digital Input 14 latched	Mask: 2000h	Bit
				16373	State external Digital Input 13 latched	Mask: 1000h	Bit
				16372	State external Digital Input 12 latched	Mask: 0800h	Bit
				16371	State external Digital Input 11 latched	Mask: 0400h	Bit
				16370	State external Digital Input 10 latched	Mask: 0200h	Bit
				16369	State external Digital Input 9 latched	Mask: 0100h	Bit
				16368	State external Digital Input 8 latched	Mask: 0080h	Bit
				16367	State external Digital Input 7 latched	Mask: 0040h	Bit
				16366	State external Digital Input 6 latched	Mask: 0020h	Bit
				16365	State external Digital Input 5 latched	Mask: 0010h	Bit
				16364	State external Digital Input 4 latched	Mask: 0008h	Bit
				16362	State external Digital Input 3 latched	Mask: 0004h	Bit
				16361	State external Digital Input 2 latched	Mask: 0002h	Bit
				16360	State external Digital Input 1 latched	Mask: 0001h	Bit
450092	450091	30	3,4,5,6	2568	Gen. hours of operation	0,01	h
450094	450093	31	1,2	10033	Alarm flexible limit 16 latched	Mask: 8000h	Bit
				10032	Alarm flexible limit 15 latched	Mask: 4000h	Bit
				10031	Alarm flexible limit 14 latched	Mask: 2000h	Bit
				10030	Alarm flexible limit 13 latched	Mask: 1000h	Bit
				10029	Alarm flexible limit 12 latched	Mask: 0800h	Bit
				10028	Alarm flexible limit 11 latched	Mask: 0400h	Bit
				10027	Alarm flexible limit 10 latched	Mask: 0200h	Bit
				10026	Alarm flexible limit 9 latched	Mask: 0100h	Bit
				10025	Alarm flexible limit 8 latched	Mask: 0080h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
				10024	Alarm flexible limit 7 latched	Mask: 0040h	Bit
				10023	Alarm flexible limit 6 latched	Mask: 0020h	Bit
				10022	Alarm flexible limit 5 latched	Mask: 0010h	Bit
				10021	Alarm flexible limit 4 latched	Mask: 0008h	Bit
				10020	Alarm flexible limit 3 latched	Mask: 0004h	Bit
				10019	Alarm flexible limit 2 latched	Mask: 0002h	Bit
				10018	Alarm flexible limit 1 latched	Mask: 0001h	Bit
450095	450094	31	3,4	10117	Analog input 4	changeable	
450096	450095	31	5,6		internal		
450097	450096	32	1,2	10008	Batt.overvolt.2 latched	Mask: 0008h	Bit
				10007	Batt.undervolt.2 latched	Mask: 0004h	Bit
				10006	Batt.overvolt.1 latched	Mask: 0002h	Bit
				10005	Batt.undervolt.1 latched	Mask: 0001h	Bit
450098	450097	32	3,4		internal	Mask: 0001h	Bit
				10014	Analog inp. 1, wire break or shortcut latched	Mask: 0002h	Bit
				10015	Analog inp. 2, wire break or shortcut latched	Mask: 0004h	Bit
				10060	Analog inp. 3, wire break or shortcut latched	Mask: 0008h	Bit
				10061	Analog inp. 4, wire break or shortcut latched	Mask: 0010h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 8000h	Bit
450099	450098	32	5,6	10107	Digital outputs 1 to 6		
					Relay-Output 1 (inverted)	Mask: 8000h	Bit
					Relay-Output 2	Mask: 4000h	Bit
					Relay-Output 3	Mask: 2000h	Bit
					Relay-Output 4	Mask: 1000h	Bit
					Relay-Output 5	Mask: 0800h	Bit
					Relay-Output 6	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450100	450099	33	1,2	10109	Digital outputs 7 to 11		
					Relay-Output 7	Mask: 8000h	Bit
					Relay-Output 8	Mask: 4000h	Bit
					Relay-Output 9	Mask: 2000h	Bit
					Relay-Output 10	Mask: 1000h	Bit
					Relay-Output 11	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450101	450100	33	3,4	8005	Output to external CAN-I/O Relay 16	Mask: 8000h	Bit
					Output to external CAN-I/O Relay 15	Mask: 4000h	Bit
					Output to external CAN-I/O Relay 14	Mask: 2000h	Bit
					Output to external CAN-I/O Relay 13	Mask: 1000h	Bit
					Output to external CAN-I/O Relay 12	Mask: 0800h	Bit
					Output to external CAN-I/O Relay 11	Mask: 0400h	Bit
					Output to external CAN-I/O Relay 10	Mask: 0200h	Bit
					Output to external CAN-I/O Relay 9	Mask: 0100h	Bit
					Output to external CAN-I/O Relay 8	Mask: 0080h	Bit
					Output to external CAN-I/O Relay 7	Mask: 0040h	Bit
					Output to external CAN-I/O Relay 6	Mask: 0020h	Bit
					Output to external CAN-I/O Relay 5	Mask: 0010h	Bit
					Output to external CAN-I/O Relay 4	Mask: 0008h	Bit
					Output to external CAN-I/O Relay 3	Mask: 0004h	Bit
					Output to external CAN-I/O Relay 2	Mask: 0002h	Bit
					Output to external CAN-I/O Relay 1	Mask: 0001h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
450102	450101	33	5,6		internal		
450103	450102	34	1,2	5541	Setpoint frequency	0,01	Hz
450104	450103	34	3,4,5,6	5542	Setpoint active power	0,1	kW
450106	450105	35	1,2	5641	Setpoint power factor	0,001	
450107	450106	35	3,4,5,6	5640	Setpoint voltage	1	V
450109	450108	36	1,2				
450110	450109	36	3,4				
450111	450110	36	5,6				
450112	450111	37	1,2	15109	J1939 MTU ADEC ECU Failure Codes	1	
450113	450112	37	3,4				
450114	450113	37	5,6				
450115	450114	38	1,2	15304	Engine Stop Information (extracted from DEUTZ-specific J1939-Message)	1	(enum.)
450116	450115	38	3,4				
450117	450116	38	5,6				
450118	450117	39	1,2	15305	J1939 DLN2-Message Scania S6		
					Engine Coolant Temperature		
					J1939-Message not available	Mask 8000h	
					Sensor fault	Mask 4000h	
					High Temperature.	Mask 2000h	
					NOT High Temperature	Mask 1000h	
					Engine Oil Pressure		
					J1939-Message not available	Mask 0800h	
					Sensor fault	Mask 0400h	
					Low Pressure	Mask 0200h	
					NOT Low Pressure	Mask 0100h	
					High Engine Oil Level		
					J1939-Message not available	Mask 0080h	
					Sensor fault	Mask 0040h	
					High Level	Mask 0020h	
					NOT High Level	Mask 0010h	
					Low Engine Oil Level		
					J1939-Message not available	Mask 0008h	
					Sensor fault	Mask 0004h	
					Low Level	Mask 0002h	
					NOT Low Level	Mask 0001h	
450119	450118	39	3,4				
450120	450119	39	5,6				
					1. Active Diagnostic Trouble Code (DM1)		
450121	450120	40	1	15401	FMI	Mask FF00h	

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
			2	15402	OC	Mask 00FFh	
450122	450121	40	3,4,5,6	15400	SPN		
					2. Active Diagnostic Trouble Code (DM1)		
450124	450123	41	1	15404	FMI	Mask FF00h	
			2	15405	OC	Mask 00FFh	
450125	450124	41	3,4,5,6	15403	SPN		
					3. Active Diagnostic Trouble Code (DM1)		
450127	450126	42	1	15407	FMI	Mask FF00h	
			2	15408	OC	Mask 00FFh	
450128	450127	42	3,4,5,6	15406	SPN		
					4. Active Diagnostic Trouble Code (DM1)		
450130	450129	43	1	15410	FMI	Mask FF00h	
			2	15411	OC	Mask 00FFh	
450131	450130	43	3,4,5,6	15409	SPN		
					5. Active Diagnostic Trouble Code (DM1)		
450133	450132	44	1	15413	FMI	Mask FF00h	
			2	15414	OC	Mask 00FFh	
450134	450133	44	3,4,5,6	15412	SPN		
					6. Active Diagnostic Trouble Code (DM1)		
450136	450135	45	1	15416	FMI	Mask FF00h	
			2	15418	OC	Mask 00FFh	
450137	450136	45	3,4,5,6	15415	SPN		
					7. Active Diagnostic Trouble Code (DM1)		
450139	450138	46	1	15420	FMI	Mask FF00h	
			2	15421	OC	Mask 00FFh	
450140	450139	46	3,4,5,6	15419	SPN		
					8. Active Diagnostic Trouble Code (DM1)		
450142	450141	47	1	15423	FMI	Mask FF00h	
			2	15424	OC	Mask 00FFh	
450143	450142	47	3,4,5,6	15422	SPN		
					9. Active Diagnostic Trouble Code (DM1)		
450145	450144	48	1	15426	FMI	Mask FF00h	
			2	15427	OC	Mask 00FFh	
450146	450145	48	3,4,5,6	15425	SPN		
					10. Active Diagnostic Trouble Code (DM1)		
450148	450147	49	1	15429	FMI	Mask FF00h	
			2	15430	OC	Mask 00FFh	
450149	450148	49	3,4,5,6	15428	SPN		
					1. Previously Active Diagnostic Trouble Code (DM2)		
450151	450150	50	1	15451	FMI	Mask FF00h	
			2	15452	OC	Mask 00FFh	
450152	450151	50	3,4,5,6	15450	SPN		
					2. Previously Active Diagnostic Trouble Code (DM2)		
450154	450153	51	1	15454	FMI	Mask FF00h	
			2	15455	OC	Mask 00FFh	
450155	450154	51	3,4,5,6	15453	SPN		
					3. Previously Active Diagnostic Trouble Code (DM2)		
450157	450156	52	1	15457	FMI	Mask FF00h	
			2	15458	OC	Mask 00FFh	
450158	450157	52	3,4,5,6	15456	SPN		

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					4. Previously Active Diagnostic Trouble Code (DM2)		
450160	450159	53	1	15460	FMI	Mask FF00h	
			2	15461	OC	Mask 00FFh	
450161	450160	53	3,4,5,6	15459	SPN		
					5. Previously Active Diagnostic Trouble Code (DM2)		
450163	450162	54	1	15463	FMI	Mask FF00h	
			2	15464	OC	Mask 00FFh	
450164	450163	54	3,4,5,6	15462	SPN		
					6. Previously Active Diagnostic Trouble Code (DM2)		
450166	450165	55	1	15466	FMI	Mask FF00h	
			2	15467	OC	Mask 00FFh	
450167	450166	55	3,4,5,6	15465	SPN		
					7. Previously Active Diagnostic Trouble Code (DM2)		
450169	450168	56	1	15469	FMI	Mask FF00h	
			2	15470	OC	Mask 00FFh	
450170	450169	56	3,4,5,6	15468	SPN		
					8. Previously Active Diagnostic Trouble Code (DM2)		
450172	450171	57	1	15472	FMI	Mask FF00h	
			2	15473	OC	Mask 00FFh	
450173	450172	57	3,4,5,6	15471	SPN		
					9. Previously Active Diagnostic Trouble Code (DM2)		
450175	450174	58	1	15475	FMI	Mask FF00h	
			2	15476	OC	Mask 00FFh	
450176	450175	58	3,4,5,6	15474	SPN		
					10. Previously Active Diagnostic Trouble Code (DM2)		
450178	450177	59	1	15478	FMI	Mask FF00h	
			2	15479	OC	Mask 00FFh	
450179	450178	59	3,4,5,6	15477	SPN		
450181	450180	60	1,2	15395	**DM1** Lamp Status		
					Malfunction Lamp		
					internal	Mask 8000h	
					internal	Mask 4000h	
					On	Mask 2000h	
					Off	Mask 1000h	
					Red Stop Lamp		
					internal	Mask 0800h	
					internal	Mask 0400h	
					On	Mask 0200h	
					Off	Mask 0100h	
					Amber Warning Lamp		
					internal	Mask 0080h	
					internal	Mask 0040h	
					On	Mask 0020h	
					Off	Mask 0010h	
					Protect Lamp		
					internal	Mask 0008h	
					internal	Mask 0004h	
					On	Mask 0002h	
					Off	Mask 0001h	
450182	450181	60	3,4	15445	**DM2** Lamp Status		

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
					Malfunction Lamp		
					internal	Mask 8000h	
					internal	Mask 4000h	
					On	Mask 2000h	
					Off	Mask 1000h	
					Red Stop Lamp		
					internal	Mask 0800h	
					internal	Mask 0400h	
					On	Mask 0200h	
					Off	Mask 0100h	
					Amber Warning Lamp		
					internal	Mask 0080h	
					internal	Mask 0040h	
					On	Mask 0020h	
					Off	Mask 0010h	
					Protect Lamp		
					internal	Mask 0008h	
					internal	Mask 0004h	
					On	Mask 0002h	
					Off	Mask 0001h	
450183	450182	60	5,6		internal		
450184	450183	61	1,2	15308	Engine Speed (j1939-EEC1)	1	rpm
450185	450184	61	3,4	15202	Engine Coolant Temperature (J1939-ET1)	1	°C
450186	450185	61	5,6	15205	Engine Oil Pressure (j1939-EFL/P1)	1	kPa
450187	450186	62	1,2	15203	Fuel temperature (j1939-ET1)	1	°C
450188	450187	62	3,4,5,6	15201	Total engine hours (j1939-HOURS)	1	h
450190	450189	63	1,2	15309	Engine Oil Temperature (j1939-ET1)	0,1	°C
450191	450190	63	3,4	15307	Fuel Rate (j1939-LFE)	0,1	L/h
450192	450191	63	5,6	15206	Coolant Level (j1939-EFL/P1)	0,1	%
450193	450192	64	1,2	15207	Throttle position (j1939-EEC2)	0,1	%
450194	450193	64	3,4	15208	Load at current Speed (j1939-EEC2)	1	%
450195	450194	64	5,6	15210	Engine oil level (j1939-EFL/P1)	0,1	%
450196	450195	65	1,2	15214	Boost pressure (j1939-IC1)	1	kPa
450197	450196	65	3,4	15215	Intake Manifold Temp (j1939-IC1)	1	°C
450198	450197	65	5,6	15212	Barometric Pressure (j1939-AMB)	0,1	kPa

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data byte 0 (Mux)	Data byte				
450199	450198	66	1,2	15213	Air inlet temperature (j1939-AMB)	1	°C
450200	450199	66	3,4	15209	Actual engine torque (j1939-EEC1)	1	%
450201	450200	66	5,6	15299	Exhaust Gas Temp.(J1939-IC1)	0,1	°C

Data Protocol 5101

NOTE

Identical to data protocol 5100 only without J1939 data.

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
450001	450000	0	1,2		Protocoll-ID, allways 5101		--
450002	450001	0	3,4	10100	Pickup speed	1	rpm
450003	450002	0	5,6	-	Control mode (STOP/AUTO/MANUALLY)	Mask:000Fh	(enum.)
450004	450003	1	1,2	160	Gen. powerfactor	0.001	
450005	450004	1	3,4,5,6	170	Av. Gen. Wye-Voltage	0.1	V
450007	450006	2	1,2	144	Gen. frequency	0.01	Hz
450008	450007	2	3,4,5,6	171	Av. Gen. Delta-Voltage	0.1	V
450010	450009	3	1,2	147	Mains / Busbar frequency	0.01	Hz
450011	450010	3	3,4,5,6	173	Av. Mains / Busbar Wye-Voltage	0.1	V
450013	450012	4	1,2	208	Mains / Busbar power factor	0.001	
450014	450013	4	3,4,5,6	174	Av. Mains / Busbar Delta-Voltage	0.1	V
450016	450015	5	1,2	2540	Engine, number of start requests	1	
450017	450016	5	3,4,5,6	135	Total gen. power	1	W
450019	450018	6	1,2	10202	Operation modes		(enum.)
450020	450019	6	3,4,5,6	140	Total mains power	1	W
450022	450021	7	1,2	10110	Battery voltage	0.1	V
450023	450022	7	3,4,5,6	207	Av. Mains Current	0.001	A
450025	450024	8	1,2	10111	Analog input 1	changeable	

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
450026	450025	8	3,4,5,6	185	Av. Gen. Current	0.001	A
450028	450027	9	1,2	10112	Analog input 2	changeable	
450029	450028	9	3,4,5,6	161	Meas. ground current	0.001	A
450031	450030	10	1,2	10115	Analog input 3	changeable	
450032	450031	10	3,4,5,6	159	Calculated ground current	0.001	A
450034	450033	11	1,2	4153	Idle mode active (suppresses undervolt, underfreq,...)	Mask: 8000h	Bit
					Idle mode active	Mask: 4000h	Bit
					Start without closing GCB	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					Cooldown is active	Mask: 0200h	Bit
					Auxiliary services generally active	Mask: 0100h	Bit
					Engine Monitoring delay timer has expired	Mask: 0080h	Bit
					Breaker delay timer has expired	Mask: 0040h	Bit
					Engine start is requested	Mask: 0020h	Bit
					Critical mode is active in automatic mode	Mask: 0010h	Bit
					Engine is released (speed governor is enabled)	Mask: 0008h	Bit
					Auxiliary services prerun is active	Mask: 0004h	Bit
					Auxiliary services postrun is active	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450035	450034	11	3,4,5,6	111	Gen. current 1	0.001	A
450037	450036	12	1,2	4154	Crank (Starter) is active	Mask: 8000h	Bit
					Operating Magnet / Gasrelay is active	Mask: 4000h	Bit
					Preglow / Ignition is active	Mask: 2000h	Bit
					Mains settling timer is running	Mask: 1000h	Bit
					Emergency mode is currently active	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					Free PID Controller 2: Raise Command	Mask: 0040h	Bit
					Stopping Magnet is active	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					The genset runs mains parallel	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					Increment Engine Start Counter	Mask: 0001h	Bit
450038	450037	12	3,4,5,6	112	Gen. current 2	0.001	A
450040	450039	13	1,2	4155	3-Position Controller Freq./Power raise	Mask: 8000h	Bit
					3-Position Controller Freq./Power lower	Mask: 4000h	Bit
					3-Position Controller Volt./ReactPow raise	Mask: 2000h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
					3-Position Controller Volt./ReactPow lower	Mask: 1000h	Bit
					GCB is closed	Mask: 0800h	Bit
					MCB is closed	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					Synchronisation GCB is active	Mask: 0100h	Bit
					Opening GCB is active	Mask: 0080h	Bit
					Closing GCB is active	Mask: 0040h	Bit
					Synchronisation MCB is active	Mask: 0020h	Bit
					Opening MCB is active	Mask: 0010h	Bit
					Closing MCB is active	Mask: 0008h	Bit
					Unloading generator is active	Mask: 0004h	Bit
					Unloading mains is active	Mask: 0002h	Bit
					Power limited prerun	Mask: 0001h	Bit
450041	450040	13	3,4,5,6	113	Gen. current 3	0.001	A
450043	450042	14	1,2	4156	internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					Dead busbar closure request for GCB or MCB	Mask: 0400h	Bit
					Active power load share is acitve	Mask: 0200h	Bit
					Reactive power load share is acitve	Mask: 0100h	Bit
					Generator with a closed GCB is requested	Mask: 0080h	Bit
					LDSS: The Engine is started	Mask: 0040h	Bit
					LDSS: The Engine is stopped	Mask: 0020h	Bit
					LDSS: The Engine is stopped, if possible	Mask: 0010h	Bit
					LDSS: Minimum Running Time is active	Mask: 0008h	Bit
					LDSS: The LDSS function is active	Mask: 0004h	Bit
					The Critical Mode Postrun is active	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450044	450043	14	3,4,5,6	134	Mains current L1	0.001	A
450046	450045	15	1,2	10131	internal	Mask: 0040h	Bit
					Alarm class F latched	Mask: 0020h	Bit
					Alarm class E latched	Mask: 0010h	Bit
					Alarm class D latched	Mask: 0008h	Bit
					Alarm class C latched	Mask: 0004h	Bit
					Alarm class B latched	Mask: 0002h	Bit
					Alarm class A latched	Mask: 0001h	Bit
450047	450046	15	3,4,5,6	136	Total gen. reactive power	1	var
450049	450048	16	1,2	10310	Analog output 1	0,01	%
450050	450049	16	3,4,5,6	150	Total mains reactive power	1	var
450052	450051	17	1,2	10311	Analog output 2	0,01	%

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
450053	450052	17	3,4,5,6	108	Gen. voltage L1-L2	0.1	V
450055	450054	18	1,2	10317	Analog output 3	0,01	%
450056	450055	18	3,4,5,6	114	Gen. voltage L1-N	0.1	V
450058	450057	19	1,2	10318	Analog output 4	0,01	%
450059	450058	19	3,4,5,6	109	Gen. voltage L2-L3	0.1	V
450061	450060	20	1,2	10159	AI Auxiliary excitation D+	0.1	V
450062	450061	20	3,4,5,6	115	Gen. voltage L2-N	0.1	V
450064	450063	21	1,2	2112	Overspeed 1 latched	Mask: 8000h	Bit
				2113	Overspeed 2 latched	Mask: 4000h	Bit
				2162	Underspeed 1 latched	Mask: 2000h	Bit
				2163	Underspeed 2 latched	Mask: 1000h	Bit
				2652	Unintended stop latched	Mask: 0800h	Bit
				2457	Speed/freq.mism. Latched	Mask: 0400h	Bit
				2504	Shutdwn malfunct. latched	Mask: 0200h	Bit
				2603	GCB fail to close latched	Mask: 0100h	Bit
				2604	GCB fail to open latched	Mask: 0080h	Bit
				2623	MCB fail to close latched	Mask: 0040h	Bit
				2624	MCB fail to open latched	Mask: 0020h	Bit
				10017	CAN-Fault J1939 latched	Mask: 0010h	Bit
				3325	Start fail latched	Mask: 0008h	Bit
				2560	Mainten. days exceeded latched	Mask: 0004h	Bit
				2561	Mainten. hours exceeded latched	Mask: 0002h	Bit
				10087	CANopen error at CAN Interface 1	Mask: 0001h	Bit
450065	450064	21	3,4,5,6	110	Gen. voltage L3-L1	0.1	V
450067	450066	22	1,2	3064	GCB syn. timeout latched	Mask: 8000h	Bit
				3074	MCB syn. timeout latched	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
				4056	Charge alt. low voltage (D+) latched	Mask: 1000h	Bit
				2944	Ph.rotation mismatch latched	Mask: 0800h	Bit
					internal	Mask: 0400h	
					internal	Mask: 0200h	
					internal	Mask: 0100h	
					internal	Mask: 0080h	
					internal	Mask: 0040h	
				10088	CANopen error at CAN Interface 2	Mask: 0020h	Bit
				4073	Parameter Alignment	Mask: 0010h	
				4064	Missing members on CAN	Mask: 0008h	Bit
				1714	EEPROM failure latched	Mask: 0004h	Bit
				15125	Red stop lamp latched	Mask: 0002h	Bit
				15126	Amber warning lamp latched	Mask: 0001h	Bit
450068	450067	22	3,4,5,6	116	Gen. voltage L3-N	0.1	V
450070	450069	23	1,2	2558	Hours until next maintenance	1	h
450071	450070	23	3,4,5,6	118	Mains / Busbar voltage L1-L2	0.1	V
450073	450072	24	1,2	1912	Gen.overfreq. 1 latched	Mask:	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
						8000h	
				1913	Gen.overfreq. 2 latched	Mask: 4000h	Bit
				1962	Gen.underfreq. 1 latched	Mask: 2000h	Bit
				1963	Gen.underfreq. 2 latched	Mask: 1000h	Bit
				2012	Gen.overvolt. 1 latched	Mask: 0800h	Bit
				2013	Gen.overvolt. 2 latched	Mask: 0400h	Bit
				2062	Gen.undervolt. 1 latched	Mask: 0200h	Bit
				2063	Gen.undervolt. 2 latched	Mask: 0100h	Bit
				2218	Gen. overcurr. 1 latched	Mask: 0080h	Bit
				2219	Gen. overcurr. 2 latched	Mask: 0040h	Bit
				2220	Gen. overcurr. 3 latched	Mask: 0020h	Bit
				2262	Gen. Rv/Rd pow.1 latched	Mask: 0010h	Bit
				2263	Gen. Rv/Rd pow.2 latched	Mask: 0008h	Bit
				2314	Gen. Overload IOP 1 latched	Mask: 0004h	Bit
				2315	Gen. Overload IOP 2 latched	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450074	450073	24	3,4,5,6	121	Mains / Busbar voltage L1-N	0.1	V
450076	450075	25	1,2	2412	Unbal. load 1 latched	Mask: 8000h	Bit
				2413	Unbal. load 2 latched	Mask: 4000h	Bit
				3907	Gen. Asymmetry latched	Mask: 2000h	Bit
				3263	Ground fault 1 latched	Mask: 1000h	Bit
				3264	Ground fault 2 latched	Mask: 0800h	Bit
				3955	Gen. phase rot. misw. Latched	Mask: 0400h	Bit
				2924	Gen act.pwr mismatch Latched	Mask: 0200h	Bit
				3124	Gen. unloading fault Latched	Mask: 0100h	Bit
				4038	Inv.time ov.curr. Latched	Mask: 0080h	Bit
				2664	Operating range failed, latched	Mask: 0040h	Bit
				2362	Gen. Overload MOP 1 latched	Mask: 0020h	Bit
				2363	Gen. Overload MOP 2 latched	Mask: 0010h	Bit
				2337	Gen. overexcited 1 latched	Mask: 0008h	Bit
				2338	Gen. overexcited 2 latched	Mask: 0004h	Bit
				2387	Gen. underexcited 1 latched	Mask: 0002h	Bit
				2388	Gen. underexcited 2 latched	Mask: 0001h	Bit
450077	450076	25	3,4,5,6	119	Mains / Busbar voltage L2-L3	0.1	V
450079	450078	26	1,2	2862	Mains / Busbar ov.freq. 1 latched	Mask: 8000h	Bit
				2863	Mains / Busbar ov.freq. 2 latched	Mask: 4000h	Bit
				2912	Mains / Busbar un.freq. 1 latched	Mask: 2000h	Bit
				2913	Mains / Busbar un.freq. 2 latched	Mask: 1000h	Bit
				2962	Mains / Busbar ov.volt. 1 latched	Mask: 0800h	Bit
				2963	Mains / Busbar ov.volt. 2 latched	Mask: 0400h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
				3012	Mains / Busbar un.volt. 1 latched	Mask: 0200h	Bit
				3013	Mains / Busbar un.volt. 2 latched	Mask: 0100h	Bit
				3057	Mains / Busbar phaseshift latched	Mask: 0080h	Bit
				3114	Mains / Busbar decoupling latched	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
				3975	Mains phase rot. Miswired latched	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450080	450079	26	3,4,5,6	122	Mains / Busbar voltage L2-N	0.1	V
450082	450081	27	1,2		internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
				2934	Mns act.pwr mismatch latched	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450083	450082	27	3,4,5,6	120	Mains / Busbar voltage L3-L1	0.1	V
450085	450084	28	1,2	10608	State Digital Input 8 latched	Mask: 8000h	Bit
				10607	State Digital Input 7 latched	Mask: 4000h	Bit
				10605	State Digital Input 6 latched	Mask: 2000h	Bit
				10604	State Digital Input 5 latched	Mask: 1000h	Bit
				10603	State Digital Input 4 latched	Mask: 0800h	Bit
				10602	State Digital Input 3 latched	Mask: 0400h	Bit
				10601	State Digital Input 2 latched	Mask: 0200h	Bit
				10600	State Digital Input 1 latched	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask:	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
						0010h	
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450086	450085	28	3,4,5,6	123	Mains / Busbar voltage L3-N	0.1	V
450088	450087	29	1,2	10610	State Digital Input 10 latched	Mask: 8000h	Bit
				10609	State Digital Input 9 latched	Mask: 4000h	Bit
					internal	Mask: 3FFFh	
450089	450088	29	3,4,5,6	2520	Gen. real energy	0,01	MWh
450091	450090	30	1,2	16376	State external Digital Input 16 latched	Mask: 8000h	Bit
				16375	State external Digital Input 15 latched	Mask: 4000h	Bit
				16374	State external Digital Input 14 latched	Mask: 2000h	Bit
				16373	State external Digital Input 13 latched	Mask: 1000h	Bit
				16372	State external Digital Input 12 latched	Mask: 0800h	Bit
				16371	State external Digital Input 11 latched	Mask: 0400h	Bit
				16370	State external Digital Input 10 latched	Mask: 0200h	Bit
				16369	State external Digital Input 9 latched	Mask: 0100h	Bit
				16368	State external Digital Input 8 latched	Mask: 0080h	Bit
				16367	State external Digital Input 7 latched	Mask: 0040h	Bit
				16366	State external Digital Input 6 latched	Mask: 0020h	Bit
				16365	State external Digital Input 5 latched	Mask: 0010h	Bit
				16364	State external Digital Input 4 latched	Mask: 0008h	Bit
				16362	State external Digital Input 3 latched	Mask: 0004h	Bit
				16361	State external Digital Input 2 latched	Mask: 0002h	Bit
				16360	State external Digital Input 1 latched	Mask: 0001h	Bit
450092	450091	30	3,4,5,6	2568	Gen. hours of operation	0,01	h
450094	450093	31	1,2	10033	Alarm flexible limit 16 latched	Mask: 8000h	Bit
				10032	Alarm flexible limit 15 latched	Mask: 4000h	Bit
				10031	Alarm flexible limit 14 latched	Mask: 2000h	Bit
				10030	Alarm flexible limit 13 latched	Mask: 1000h	Bit
				10029	Alarm flexible limit 12 latched	Mask: 0800h	Bit
				10028	Alarm flexible limit 11 latched	Mask: 0400h	Bit
				10027	Alarm flexible limit 10 latched	Mask: 0200h	Bit
				10026	Alarm flexible limit 9 latched	Mask: 0100h	Bit
				10025	Alarm flexible limit 8 latched	Mask: 0080h	Bit
				10024	Alarm flexible limit 7 latched	Mask: 0040h	Bit
				10023	Alarm flexible limit 6 latched	Mask: 0020h	Bit
				10022	Alarm flexible limit 5 latched	Mask: 0010h	Bit
				10021	Alarm flexible limit 4 latched	Mask: 0008h	Bit
				10020	Alarm flexible limit 3 latched	Mask: 0004h	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
				10019	Alarm flexible limit 2 latched	Mask: 0002h	Bit
				10018	Alarm flexible limit 1 latched	Mask: 0001h	Bit
450095	450094	31	3,4	10117	Analog input 4	changeable	
450096	450095	31	5,6		internal		
450097	450096	32	1,2	10008	Batt.overvolt.2 latched	Mask: 0008h	Bit
				10007	Batt.undervolt.2 latched	Mask: 0004h	Bit
				10006	Batt.overvolt.1 latched	Mask: 0002h	Bit
				10005	Batt.undervolt.1 latched	Mask: 0001h	Bit
450098	450097	32	3,4		internal	Mask: 0001h	Bit
				10014	Analog inp. 1, wire break or shortcut latched	Mask: 0002h	Bit
				10015	Analog inp. 2, wire break or shortcut latched	Mask: 0004h	Bit
				10060	Analog inp. 3, wire break or shortcut latched	Mask: 0008h	Bit
				10061	Analog inp. 4, wire break or shortcut latched	Mask: 0010h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 8000h	Bit
450099	450098	32	5,6	10107	Digital outputs 1 to 6		
					internal	Mask: 8000h	Bit
					internal	Mask: 4000h	Bit
					internal	Mask: 2000h	Bit
					internal	Mask: 1000h	Bit
					internal	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					Relay-Output 6	Mask: 0020h	Bit
					Relay-Output 5	Mask: 0010h	Bit
					Relay-Output 4	Mask: 0008h	Bit
					Relay-Output 3	Mask: 0004h	Bit
					Relay-Output 2	Mask: 0002h	Bit
					Relay-Output 1	Mask:	Bit

Modbus		CAN		Parameter ID	Description	Multiplier	Units
Modicon start addr.	Start addr. (*1)	Data Byte 0 (Mux)	Data Byte				
					(inverted)	0001h	
450100	450099	33	1,2	10109	Digital outputs 7 to 11		
					Relay-Output 7	Mask: 8000h	Bit
					Relay-Output 8	Mask: 4000h	Bit
					Relay-Output 9	Mask: 2000h	Bit
					Relay-Output 10	Mask: 1000h	Bit
					Relay-Output 11	Mask: 0800h	Bit
					internal	Mask: 0400h	Bit
					internal	Mask: 0200h	Bit
					internal	Mask: 0100h	Bit
					internal	Mask: 0080h	Bit
					internal	Mask: 0040h	Bit
					internal	Mask: 0020h	Bit
					internal	Mask: 0010h	Bit
					internal	Mask: 0008h	Bit
					internal	Mask: 0004h	Bit
					internal	Mask: 0002h	Bit
					internal	Mask: 0001h	Bit
450101	450100	33	3,4	8005	Output to external CAN-I/O Relay 16	Mask: 8000h	Bit
					Output to external CAN-I/O Relay 15	Mask: 4000h	Bit
					Output to external CAN-I/O Relay 14	Mask: 2000h	Bit
					Output to external CAN-I/O Relay 13	Mask: 1000h	Bit
					Output to external CAN-I/O Relay 12	Mask: 0800h	Bit
					Output to external CAN-I/O Relay 11	Mask: 0400h	Bit
					Output to external CAN-I/O Relay 10	Mask: 0200h	Bit
					Output to external CAN-I/O Relay 9	Mask: 0100h	Bit
					Output to external CAN-I/O Relay 8	Mask: 0080h	Bit
					Output to external CAN-I/O Relay 7	Mask: 0040h	Bit
					Output to external CAN-I/O Relay 6	Mask: 0020h	Bit
					Output to external CAN-I/O Relay 5	Mask: 0010h	Bit
					Output to external CAN-I/O Relay 4	Mask: 0008h	Bit
					Output to external CAN-I/O Relay 3	Mask: 0004h	Bit
					Output to external CAN-I/O Relay 2	Mask: 0002h	Bit
					Output to external CAN-I/O Relay 1	Mask: 0001h	Bit
450102	450101	33	5,6		internal		
450103	450102	34	1,2	5541	Setpoint frequency	0,01	Hz
450104	450103	34	3,4,5,6	5542	Setpoint active power	0,1	kW
450106	450105	35	1,2	5641	Setpoint power factor	0,001	
450107	450106	35	3,4,5,6	5640	Setpoint voltage	1	V
450109	450108	36	1,2				
450110	450109	36	3,4				
450111	450110	36	5,6				

Data Protocol 6000 (Load Share Message)

General

The load share message contains all data, which is required for load/var sharing, load-dependent start/stop and dead bus detection.
Further data, which are to be exchanged between the control units concern time synchronization and parameter alignment. Parameter alignment is intended for those parameters, which must be configured identically for all units participating in load sharing, to ensure a proper operation of load sharing or load-dependent start/stop.

In order to lower the bus load, the messages are divided into "fast", "normal", and "slow" refreshed data. The mux is identified accordingly with "F", "N", and "S" (refer to the following tables). The load share message contains one fast, two normal, and four slow messages, which are made up as shown in Table 3-8.

Timing

The time interval between two fast messages (T_{Fast} , i.e. the time for refreshing a fast message) is configured with the parameter "Transfer rate LS fast message" (parameter 9921). The time intervals between refreshing a normal or slow messages depend on this parameter as well according to the following sequence:

S0 – F – N0 – F – N1 – F – S1 – F – N0 – F – N1 – F – S2 – F – N0 – F – N1 – F – S3 – F – N0 – F – N1 – F

T_{Fast} = time interval between refreshing the fast message
T_{Normal} = time interval between refreshing a normal message = 3 x T_{Fast}
T_{Slow} = time interval between refreshing a slow message = 12 x T_{Fast}

Example:
The parameter "Transfer rate LS fast message" (parameter 9921) is configured to "0.10 s".
The sequence of the sent messages for T_{Fast} = 100 ms (i.e. 0.10 s) is shown in Table 3-8. This means that a new message is sent every 50 ms.

Time [ms]	0	50	100	150	200	250	300	350	400	450	500	550
Sent message	S0	F	N0	F	N1	F	S1	F	N0	F	N1	F
Mux #	0	3	1	3	2	3	4	3	1	3	2	3
Time [ms]	600	650	700	750	800	850	900	950	1000	1050	1100	1150
Sent message	S2	F	N0	F	N1	F	S3	F	N0	F	N1	F
Mux #	5	3	1	3	2	3	6	3	1	3	2	3

Table 3-8: Load share message - example

The maximum length of the CAN bus load share line depends on this parameter as well. The values in Table 3-9 are valid for 32 participants and a bus load of approx. 30 %.

T_{Fast} [ms]	**T_{Normal} [ms]**	**T_{Slow} [ms]**	**Baud rate**	**Distance**
100	300	1200	250 kBaud	250 m
200	600	2400	125 kBaud	500 m
300	900	3800	50 kBaud	1000 m

Table 3-9: Load share line - max. length

Load share bus communication - "fast" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
F	0		**3**	Mux identifier
	1		Generator real load capacity utilization rate, L-Byte	Integer [‰], unsigned
	2		Generator real load capacity utilization rate, H-Byte	
	3		Generator reactive load capacity utilization rate, L-Byte	Integer [‰], unsigned
	4		Generator reactive load capacity utilization rate, H-Byte	
	5	0	Active power load sharing is enabled	
		1	Reactive power load sharing is enabled	
		2	GCB is closed	
		3	MCB is closed	
		4	GGB (generator group breaker) is closed	
		5	Dead bus closure request is active	Dead bus detection
		6	Mains settling time is running	Back synchronization to mains
		7	Shutdown alarm is active (alarm class C,D,E,F)	
	6	0-4	Bus segment / node	Max. 32 nodes possible
		5	Not used	
		6	LDSS: add-on request enabled	Load dependent start / stop
		7	LDSS: add-off request enabled (reserved)	Load dependent start / stop
	7		Not used	

Load share bus communication - "normal" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
N0	0		1	Mux identifier
	1		Generator real load, L-Byte, L-Word	Long [W]
	2		Generator real load, H-Byte, L-Word	
	3		Generator real load, L-Byte, H-Word	
	4		Generator real load, H-Byte, H-Word	
	5	0-3	Real load control state	2: Static 3: Isochronous 4: Base load control 5: Export/import control 10:Load share 0, 1, 6, 7, 8, 9, 11, … : internal
		4-7	Reactive load control state	2: Static 3: Isochronous 4: Reactive load control 5: Import/export reactive load 10:Reactive load share 0, 1, 6, 7, 8, 9, 11, … : internal
	6	0-3	Engine state	1: Locked out 2: Off 3: Preglow 4: Crank 5: Run 6: Cool down 7: Spin down 8: Start pause 9: Idle 0, 10, 11, … : internal
		4,5	Operating mode	0: Not available 1: STOP 2: MANUAL 3: AUTOMATIC
		6	Generator request	Generator is in AUTOMATIC mode and able to produce rated active power
		7	Not used	
	7		Not used	

Load share bus communication - "normal" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
N1	0		**2**	Mux identifier
	1		Generator reactive load, L-Byte, L-Word	Long [var]
	2		Generator reactive load, H-Byte, L-Word	
	3		Generator reactive load, L-Byte, H-Word	
	4		Generator reactive load, H-Byte, H-Word	
	5	0	Generator voltage and frequency ok	
		1	Busbar voltage and frequency ok	
		2	Mains voltage and frequency ok	
		3	Fourth system voltage and frequency ok	
		4	Not used	
		5	Not used	
		6	Not used	
		7	Not used	
	6		Not used	
	7		Not used	

Load share bus communication - "slow" refreshed data				
Mux	**Byte**	**Bit**	**Function**	**Remark**
S0	0		0	Mux identifier
	1		Protocol-Identifier	
	2			
	3		Generator rated real power, L-Byte, L-Word	Long [0.1 kW]
	4		Generator rated real power, H-Byte, L-Word	
	5		Generator rated real power, L-Byte, H-Word	
	6		Generator rated real power, H-Byte, H-Word	
	7		Not used	
S1	0		4	Mux identifier
	1		Generator rated reactive power, L-Byte, L-Word	Long [0.1 kvar]
	2		Generator rated reactive power, H-Byte, L-Word	
	3		Generator rated reactive power, L-Byte, H-Word	
	4		Generator rated reactive power, H-Byte, H-Word	
	5		Not used	
	6	0-4	Priority	Up to 16
		5-7	Not used	
	7		Not used	
S2	0		5	Mux identifier
	1		Operating hours L-Byte, L-Word	Long [0.01 h] 0 - 99999999
	2		Operating hours H-Byte, L-Word	
	3		Operating hours L-Byte, H-Word	
	4		Operating hours H-Byte, H-Word	
	5	0	Alarm class A occurred	
		1	Alarm class B occurred	
		2	Alarm class C occurred	
		3	Alarm class D occurred	
		4	Alarm class E occurred	
		5	Alarm class F occurred	
		6	Warning alarm class occurred	
		7	Not used	
	6		Not used	
	7		Not used	
S3	0		6	Mux identifier
	1		Remaining days before maintenance, L-Byte	Integer [d] 0 - 999
	2		Remaining days before maintenance, H-Byte	
	3		Remaining operating hours before maintenance, L-Byte	Integer [h] 0 - 9999
	4		Remaining operating hours before maintenance, H-Byte	
	5		Checksum parameters L-Byte	Load share and load-dependent start / stop parameters
	6		Checksum parameters H-Byte	
	7		Not used	

Data Protocol 65000

CAN Data byte 0 (Mux)	Data byte	Parameter ID	Description	Multiplier	Units
1	1	-	Discrete Inputs/Outputs 1 to 8		--
			0: Discrete I/O 1		Bit
			1: Discrete I/O 2		Bit
			2: Discrete I/O 3		Bit
			3: Discrete I/O 4		Bit
			4: Discrete I/O 5		Bit
			5: Discrete I/O 6		Bit
			6: Discrete I/O 7		Bit
			7: Discrete I/O 8		Bit
	2	-	internal		
	3,4,5,6	-	internal		

NOTE

If this data protocol is addressed to an expansion board, it is used to issue a command to energize a discrete output of the expansion board (parameter ID 8005 is written).

If this data protocol is addressed to an easYgen, it is used to transmit the state of a discrete input of an expansion board (parameter ID 8014 is written).

Data Protocol 65001

CAN Data byte 0 (Mux)	Data byte	Parameter ID	Description	Multiplier	Units
1	1	-	Discrete Inputs/Outputs 9 to 16		--
			0: Discrete I/O 9		Bit
			1: Discrete I/O 10		Bit
			2: Discrete I/O 11		Bit
			3: Discrete I/O 12		Bit
			4: Discrete I/O 13		Bit
			5: Discrete I/O 14		Bit
			6: Discrete I/O 15		Bit
			7: Discrete I/O 16		Bit
	2	-	internal		
	3,4,5,6	-	internal		

NOTE

If this data protocol is addressed to an expansion board, it is used to issue a command to energize a discrete output of the expansion board (parameter ID 8005 is written).

If this data protocol is addressed to an easYgen, it is used to transmit the state of a discrete input of an expansion board (parameter ID 8014 is written).

Additional Data Protocol Parameters

Remote Control Word 1 - Object 21F7h (Parameter ID 503)

This object is required for remote control. The data type is UNSIGNED16.

The internal parameter 503 of the easYgen must be set to react on the remote control instructions. This is performed by sending rising signals for the respective bits (refer to Figure 3-40 for the priority of start and stop signals).

Parameter no.	Object ID	Name		Unit	Data type	Note
503	21F7h	Control word 1		Bit field	unsigned16	
		Bit 15	Not used			
		Bit 14	Not used			
		Bit 13	Not used			
		Bit 12	Not used			
		Bit 11	Not used			
		Bit 10	Not used			
		Bit 9	Not used			
		Bit 8	Not used			
		Bit 7	Not used			
		Bit 6	Not used			
		Bit 5	Not used			
		Bit 4	Ext. Acknowledge (rising edge) Must be set twice to acknowledge			To acknowledge, a 0 must be written and then a 1
		Bit 3	Must always be set to 0			
		Bit 2	Must always be set to 0			
		Bit 1	Stop bit (rising edge)			To stop, a 0 must be written and then a 1
		Bit 0	Start bit (rising edge)			To start, a 0 must be written and then a 1

Table 3-10: Remote control telegram

Bit 0 Start bit
With the rising edge of the bit, the easYgen activates the remote request command (*LogicsManager* input command variable 04.13). The condition of the start command will be stored and may be used as command variable for the *LogicsManager*.

Bit 1 Stop bit
With the rising edge of the bit, the easYgen deactivates the remote request command (*LogicsManager* input command variable 04.13). The condition of the start command will be stored and may be used as command variable for the *LogicsManager*.

Bit 4 "Reset alarms"
This bit controls the *LogicsManager* input command variable 04.14. The remote acknowledge bit must be set and reset twice to acknowledge an alarm completely. The first rising edge disables the horn and the second rising edge resets the alarm.

Remote start /stop: The command variable "04.13 Remote request" changes to "1" (high) if the start bit is enabled and changes back to "0" (low) if the stop bit is enabled.

Ext. Acknowledge: The command variable "04.14 Remote acknowledge" is the reflection of the control bit. The easYgen deactivates the horn with the first change from "0" to "1" of the logical output "External acknowledge", and acknowledges all alarm messages, which have occurred and are no longer active, with the second change from "0" to "1".

Figure 3-40 shows the reaction of the command variable on the various status changes of the bits:

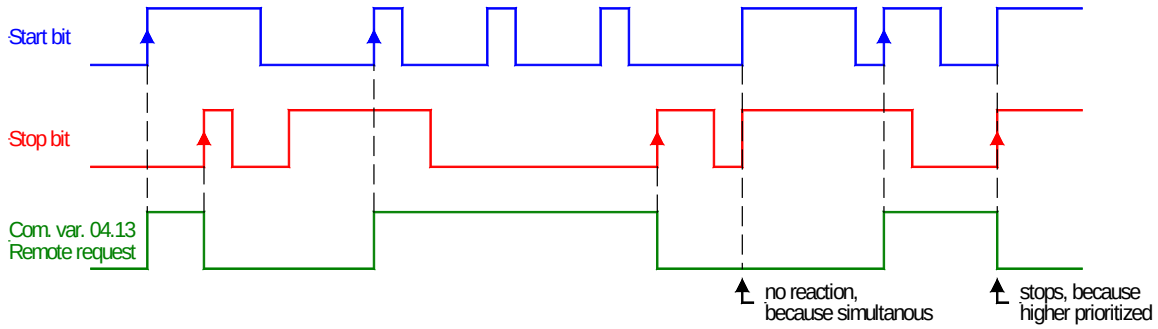


Figure 3-40: Remote control - start/stop priority

ATTENTION

The easYgen does NOT react on the disabling of the start bit, but only on the enabling of the stop bit. This has the advantage that it is not required to maintain the connection established for the whole time in case of a remote start via a modem.

Remote Control Word 2 - Object 21F8h (Parameter ID 504)

This object is required for remote control. The data type is UNSIGNED16.

Bit 15 = 1	
Bit 14 = 1	
Bit 13 = 1	
Bit 12 = 1	
Bit 11 = 1	
Bit 10 = 1	
Bit 9 = 1	
Bit 8 = 1	
Bit 7 = 1	Request active power set point 2 – this bit activates the *LogicsManager* command variable [04.40] "Remote power set point 2" and is dedicated for switching from active power set point 1 to active power set point 2
Bit 6 = 1	Request power factor set point 2 – this bit activates the *LogicsManager* command variable [04.39] "Remote PF set point 2" and is dedicated for switching from power factor set point 1 to power factor set point 2
Bit 5 = 1	Request frequency set point 2 – this bit activates the *LogicsManager* command variable [04.38] "Remote frequency set point 2" and is dedicated for switching from frequency set point 1 to frequency set point 2
Bit 4 = 1	Request voltage set point 2 – this bit activates the *LogicsManager* command variable [04.37] "Remote voltage set point 2" and is dedicated for switching from voltage set point 1 to voltage set point 2
Bit 3 = 1	
Bit 2 = 1	
Bit 1 = 1	
Bit 0 = 1	

Remote Control Word 3 - Object 21F9h (Parameter ID 505)

This object is required for remote control. These remote control bits can be used by a PLC to send control signals via SDO or PDO, which can then be used as command variables in the *LogicsManager* to control the easYgen. The data type is UNSIGNED16.

Bit 15 = 1	Remote control bit 16 (command variable 04.59)
Bit 14 = 1	Remote control bit 15 (command variable 04.58)
Bit 13 = 1	Remote control bit 14 (command variable 04.57)
Bit 12 = 1	Remote control bit 13 (command variable 04.56)
Bit 11 = 1	Remote control bit 12 (command variable 04.55)
Bit 10 = 1	Remote control bit 11 (command variable 04.54)
Bit 9 = 1	Remote control bit 10 (command variable 04.53)
Bit 8 = 1	Remote control bit 9 (command variable 04.52)
Bit 7 = 1	Remote control bit 8 (command variable 04.51)
Bit 6 = 1	Remote control bit 7 (command variable 04.50)
Bit 5 = 1	Remote control bit 6 (command variable 04.49)
Bit 4 = 1	Remote control bit 5 (command variable 04.48)
Bit 3 = 1	Remote control bit 4 (command variable 04.47)
Bit 2 = 1	Remote control bit 3 (command variable 04.46)
Bit 1 = 1	Remote control bit 2 (command variable 04.45)
Bit 0 = 1	Remote control bit 1 (command variable 04.44)

Remote Active Power Set Point - Object 21FBh (Parameter ID 507)

This value may be used as data source "[05.06] Interface pwr. setp." via the Analog Manager. No password is required to write this value. This object is required to transmit the active power set point for active power control. The data type is INTEGER32. The value is scaled in [kW * 10].
Example: 100 kW = 1000 = 03E8h

Remote Power Factor Set Point - Object 21FCh (Parameter ID 508)

This value may be used as data source "[05.12] Interface PF setp." via the Analog Manager. No password is required to write this value. This object is required to transmit the power factor set point for power factor control. The data type is INTEGER16. The valid range for this value is [-710 to 1000 to 710].
Example: PF (cosphi) = c0.71 (capacitive) = -710 = FD3Ah
PF (cosphi) = 1.00 = 1000 = 03E8h
PF (cosphi) = i0.71 (inductive) = 710 = 02C6h

Remote Frequency Set Point - Object 21FDh (Parameter ID 509)

This value may be used as data source "[05.03] Interface freq.setp." via the Analog Manager. No password is required to write this value. This object is required to transmit the frequency set point for frequency control. The data type is UNSIGNED16. The value is scaled in [Hz * 100].
Example: 50.00 Hz = 5000 = 1388h

Remote Voltage Set Point - Object 21FEh (Parameter ID 510)

This value may be used as data source "[05.09] Interface volt.setp." via the Analog Manager. No password is required to write this value. This object is required to transmit the voltage set point for voltage control. The data type is UNSIGNED32. The value is scaled in [V].
Example: 400 V = 400 = 190h
10000 V = 10000 = 2710h

Remote External DO Control - Object 34F5h (Parameter ID 8005)

This object is required to control the external outputs (relays) 1 to 16 (e.g. of a Phoenix expansion card). The data data type is UNSIGNED16.

Bit 15	External discrete output 16 [Rex16]
Bit 14	External discrete output 15 [Rex15]
Bit 13	External discrete output 14 [Rex14]
Bit 12	External discrete output 13 [Rex13]
Bit 11	External discrete output 12 [Rex12]
Bit 10	External discrete output 11 [Rex11]
Bit 9	External discrete output 10 [Rex10]
Bit 8	External discrete output 9 [Rex09]
Bit 7	External discrete output 8 [Rex08]
Bit 6	External discrete output 7 [Rex07]
Bit 5	External discrete output 6 [Rex06]
Bit 4	External discrete output 5 [Rex05]
Bit 3	External discrete output 4 [Rex04]
Bit 2	External discrete output 3 [Rex03]
Bit 1	External discrete output 2 [Rex02]
Bit 0	External discrete output 1 [Rex01]

Remote External DI Request - Object 3F4Dh (Parameter ID 8014)

This object is required to receive the state of the external discrete inputs 1 to 16 (e.g. of a Phoenix expansion card). The data type is UNSIGNED16.

Bit 15	External discrete input 16 [DIex16]
Bit 14	External discrete input 15 [DIex15]
Bit 13	External discrete input 14 [DIex14]
Bit 12	External discrete input 13 [DIex13]
Bit 11	External discrete input 12 [DIex12]
Bit 10	External discrete input 11 [DIex11]
Bit 9	External discrete input 10 [DIex10]
Bit 8	External discrete input 9 [DIex09]
Bit 7	External discrete input 8 [DIex08]
Bit 6	External discrete input 7 [DIex07]
Bit 5	External discrete input 6 [DIex06]
Bit 4	External discrete input 5 [DIex05]
Bit 3	External discrete input 4 [DIex04]
Bit 2	External discrete input 3 [DIex03]
Bit 1	External discrete input 2 [DIex02]
Bit 0	External discrete input 1 [DIex01]

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