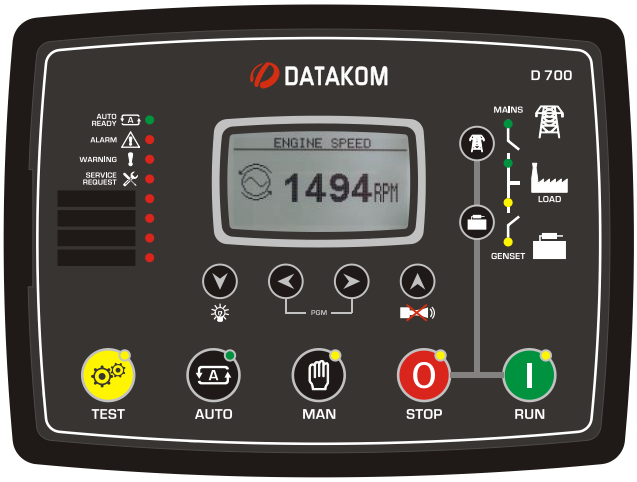
DATAKOM

MODBUS APPLICATION MANUAL

D-300 / D-500 / D-700



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ABOUT THIS DOCUMENT

This document describes minimum required details for the successfull interfacing of the D-500/700 family units to 3rd party Modbus and Modbus-TCP/IP based applications.

Follow carefully advices given in the document. These are often good practices for the installation of genset control units which reduce future issues.

For all technical queries please contact Datakom at below e-mail address:

datakom@datakom.com.tr

SCOPE OF THIS DOCUMENT

This document will apply to both Modbus through RS-485 and Modbus-TCP/IP communications.

RELATED DOCUMENTS

FILENAME	DESCRIPTION
500-USER	D-500 D-700 User Manual
500-Ethernet Configuration	Ethernet Configuration Guide for D-500 D-700
500-GSM Configuration	GSM Configuration Guide for D-500 D-700

REVISION HISTORY

REVISION	DATE	AUTHOR	DESCRIPTION
01	10.07.2012	MH	First issue, firmware version 2.8
02	01.10.2012	MH	Updated for firmware version 3.2
03	10.09.2015	MH	Updated for firmware version 5.6 and D-300 product

TERMINOLOGY

CAUTION: Potential risk of injury or death.

WARNING: Potential risk of malfunction or material damage.

ATTENTION: Useful hints for the understanding of device operation.

MODBUS COMMUNICATION BASICS

The Modbus communication is widely used in the connection of industrial control units to various management systems for remote monitoring and control. It has begun the basic industry standard in the last decades.

D-series units offer the possibility of MODBUS communication through below carriers:

- -RS485 serial port, with adjustable baud rate between 2400 and 115200 bauds
- -RS232 serial port, with adjustable baud rate between 2400 and 57600/115200 bauds
- -MODBUS-TCP/IP through Ethernet port (10/100Mb)
- -MODBUS-TCP/IP through GSM-GPRS modem. (85kb/s)

Detailed description about the MODBUS protocol is found in the document "**Modicon Modbus Protocol Reference Guide"**. This document may be downloaded at: www.modbus.org/docs/PI_MBUS_300.pdf

Detailed description about the MODBUS-TCP/IP protocol is found in the document "**MODBUS APPLICATION PROTOCOL SPECIFICATION"**. This document may be downloaded at: http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf

The MODBUS properties of the unit are:

- -Data transfer mode: RTU
- -Serial data: selectable baud rate, 8 bit data, no parity, 1 bit stop
- -Modbus-TCP/IP: Ethernet 10/100Mb or GPRS Class 12.
- -Supported functions:
  - -Function 3 (Read multiple registers)
  - -Function 6 (Write single register)
  - -Function 16 (Write multiple registers)

Each register consists of 2 bytes (16 bits). A larger data structure will contain multiple registers.

MODBUS CONFIGURATION

The Modbus communications requires a slave address to be assigned to each device in the Modbus network. This address ranges between 1 and 240 and allows the addressing of different slave devices in the same network.

Each device in the same RS-485 serial network must be assigned a different slave address. Otherwise the Modbus communications will not be performed.

Devices using Modbus-TCP/IP with different IP or port addresses may use any slave address. It is advised to set these slave addresses to the default setting which is 1.

Parameters required for RS-485/232 Modbus operation

Modbus Slave Address: may be set between 1 and 240
RS-485 Enable: must be set to 1 (or checkbox enabled)
RS-485 Baud Rate: selectable between 2400 and 115200 bauds. All devices in the same network must use the same Baud Rate.

The complete RS-485 and RS-232 port specifications are found in the **D-500/700 User Manual**.
Selecting a higher baud rate will allow faster communication, but will reduce the communication distance.
Selecting a lower baud rate will increase the communication distance, but will cause slower response times.
Typically 9600 bauds will allow 1200m distance with special balanced 120 ohms low capacitance cable.

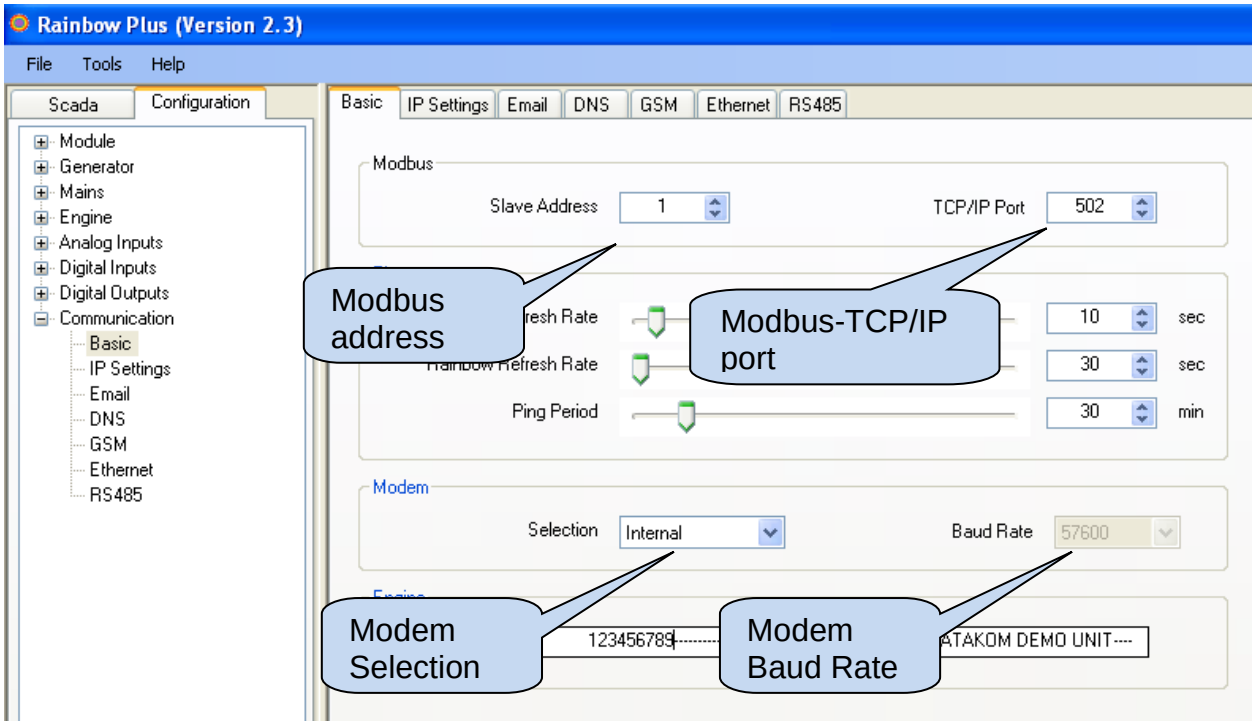
Parameters required for Modbus-TCP/IP through Ethernet port

Modbus Slave Address: may be set between 1 and 240. If only one unit is available in the same IP address, it is advised to keep the default address (1).
Ethernet Enable: This parameter should be set to 1 (or checked) in order to enable the ethernet port.
Modbus TCP/IP Port: The usual setting is 502. However the unit is able to work on any port address.
User IP Mask: There are 3 mask registers available. The use of the registers are emphasized in the D-500/700 User Manual. Please set the first mask as 255.255.255.0 for the proper operation.
Ethernet Network IP: May be left as 0.0.0.0 for automatic address claim or set to a value in order to claim a defined address.
Ethernet Gateway IP: Should be set in accordance with your local switch configuration.
Ethernet Subnet Mask: Should be set in accordance with your local switch configuration.

The complete Ethernet port specifications are found in the **D-500/700 User Manual**.
Please rewiev the document **Ethernet Configuration Guide for D-500/700** for more details about the ethernet port setup.

Parameters required for Modbus-TCP/IP through GSM_GPRS Modem

Modbus Slave Address: may be set between 1 and 240. If only one unit is available in the same IP address, it is advised to keep the default address (1).
Modem Selection: Internal or external following your configuration.
Modem Baud Rate: Selectable only for external modem. 115200 bauds advised. Selecting a lower baud rate will slow down communication between the controller and the modem.
GPRS Connection Enable: This parameter should be set to 1 (or checked).
Modbus TCP/IP Port: Set this value to 80.
User IP Mask: There are 3 mask registers available. The use of the registers are emphasized in the D-500/700 User Manual. Please set the first mask as 255.255.255.0 for the proper operation.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Tools
Help
Scada
Configuration
Module
Generator
Mains
Engine
Analog Inputs
Digital Inputs
Digital Outputs
Communication
Basic
IP Settings
Email
DNS
GSM
Ethernet
RS485
Basic
IP Settings
Email
DNS
GSM
Ethernet
RS485
Modbus
Slave Address
1
TCP/IP Port
502
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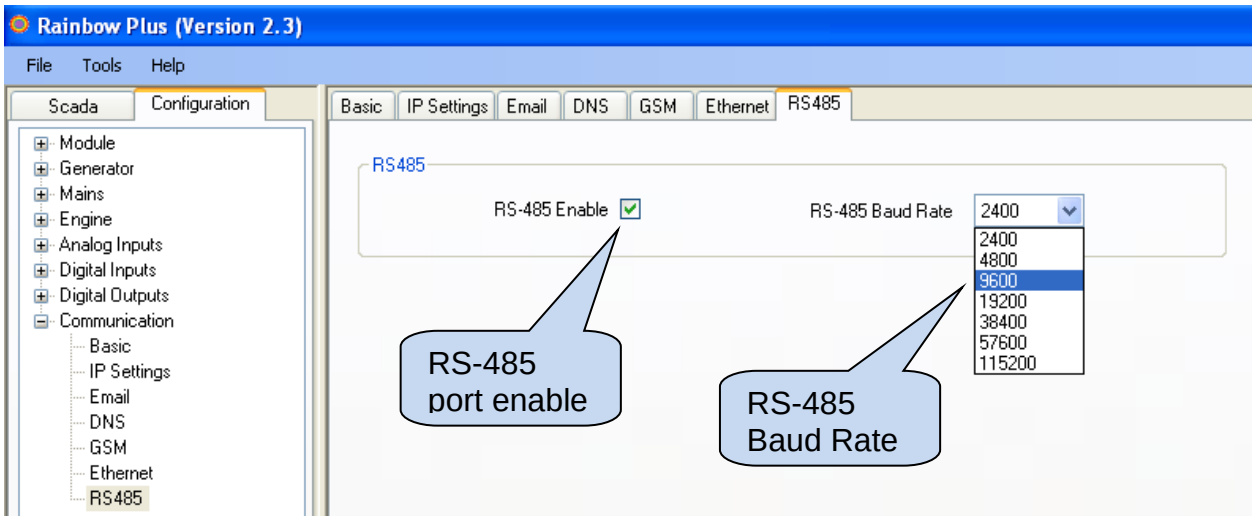
ATAKOM DEMO UNIT
Modbus address
Modbus-TCP/IP port
Modem Selection
Modem Baud Rate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File
Tools
Help
Scada
Configuration
Module
Generator
Mains
Engine
Analog Inputs
Digital Inputs
Digital Outputs
Communication
Basic
IP Settings
Email
DNS
GSM
Ethernet
RS485
Basic
IP Settings
Email
DNS
GSM
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RS485
RS-485 Enable
RS-485 Baud Rate
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4800
9600
19200
38400
57600
115200
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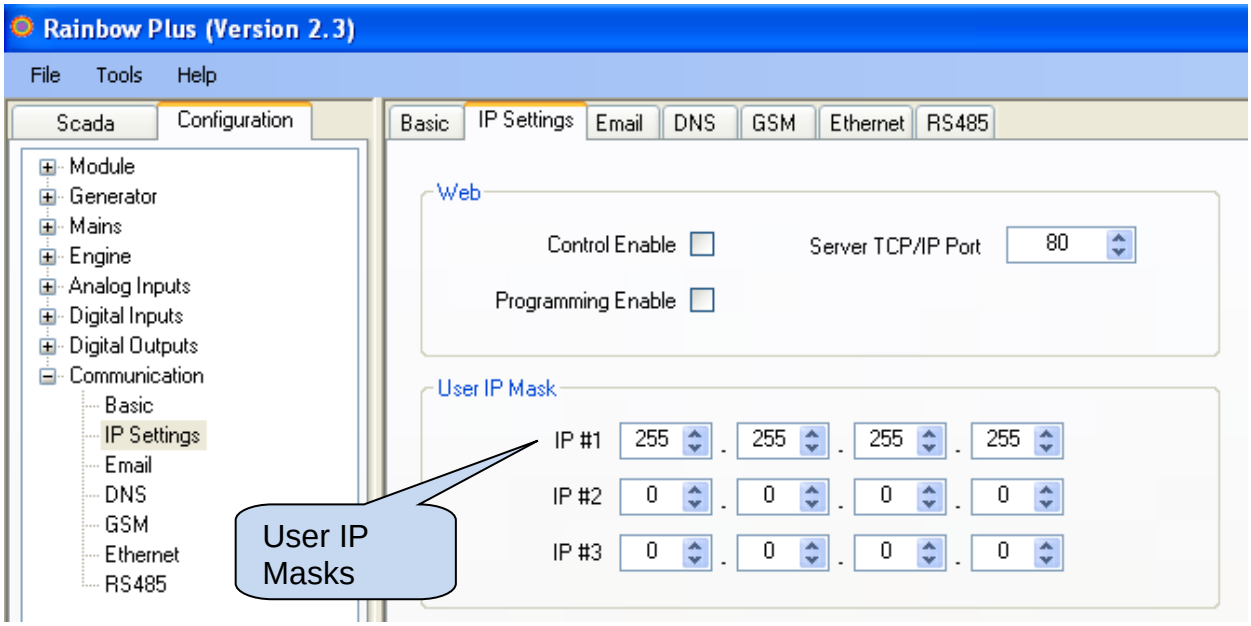
RS-485 Baud Rate


Rainbow Plus (Version 2.3)
File Tools Help
Scada Configuration
Module
Generator
Mains
Engine
Analog Inputs
Digital Inputs
Digital Outputs
Communication
Basic
IP Settings
Email
DNS
GSM
Ethernet
RS485
Basic IP Settings Email DNS GSM Ethernet RS485
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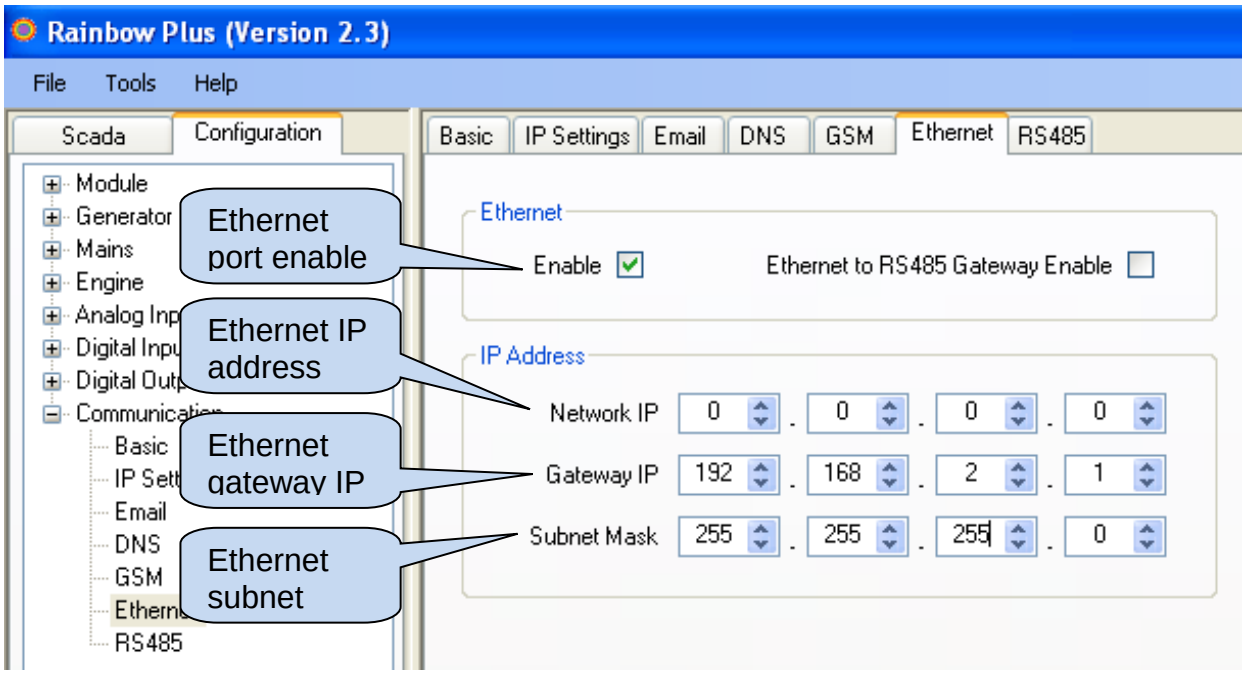
Server TCP/IP Port 80
Programming Enable
User IP Mask
IP #1 255 255 255 255
IP #2 0 0 0 0
IP #3 0 0 0 0
User IP Masks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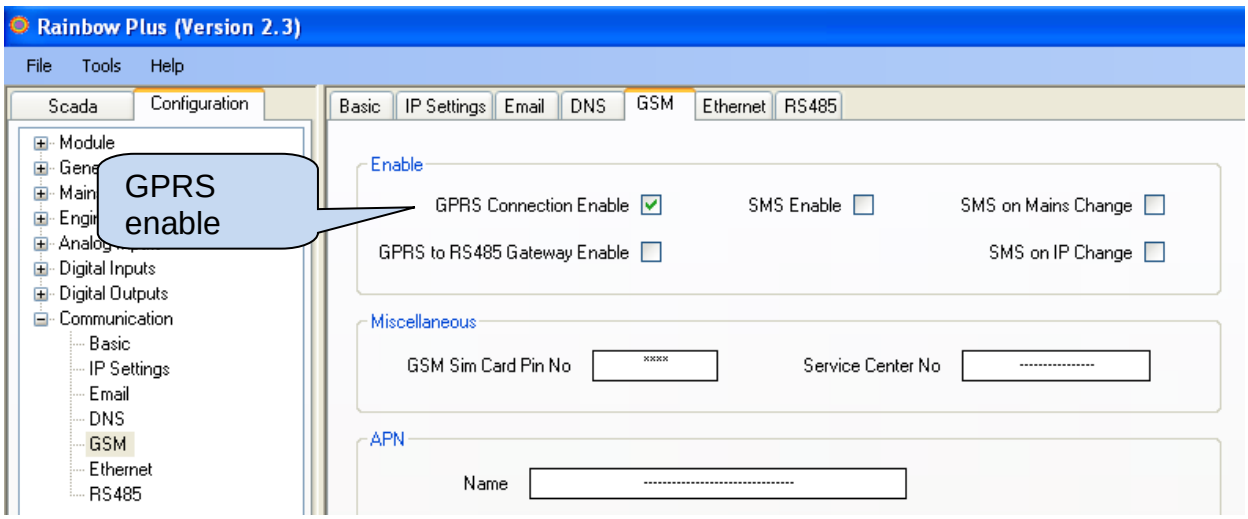
File Tools Help
Scada Configuration
Basic IP Settings Email DNS GSM Ethernet RS485
Ethernet port enable
Ethernet IP address
Ethernet gateway IP
Ethernet subnet
Ethernet
Enable
Ethernet to RS485 Gateway Enable
IP Address
Network IP 0 0 0 0
Gateway IP 192 168 2 1
Subnet Mask 255 255 255 0


Rainbow Plus (Version 2.3)
File Tools Help
Scada Configuration
Basic IP Settings Email DNS GSM Ethernet RS485
GPRS enable
Enable
GPRS Connection Enable
SMS Enable
SMS on Mains Change
GPRS to RS485 Gateway Enable
SMS on IP Change
Miscellaneous
GSM Sim Card Pin No
Service Center No
APN
Name

DATA READING

The function 03 (read multiple registers) will be used for data reading. The MODBUS master will send a query. The answer will be one of the below:

-A response containing the requested data

-An exceptional response indicating a read error.

The maximum number of registers read in one message is 16. If more registers are requested, the unit will send only the first 16 registers.

The query message specifies the starting register and quantity of registers to be read. The message structure is below:

Byte	Description	Value
0	Controller address	1 to 240
1	Function code	3
2	Starting address high	See below the description of available registers
3	Starting address low	
4	Number of registers high	always 0
5	Number of registers low	max 10h (16 decimal)
6	CRC low byte	See below for the checksum calculation
7	CRC high byte	

Here is the sequence to read 16 registers starting from address 20h (32 decimal):

01 03 00 20 00 10 45 CC (each byte is expressed as 2 hexadecimal characters)

The checksum value in the above message may be used for the verification of checksum calculation algorithm.

The normal response will be:

Byte	Description	Value
0	Controller address	same as in the query
1	Function code	3
2	Data lenght in **bytes** (L)	number of registers * 2
3	High byte of 1st register	
4	Low byte of 1st register	
5	High byte of 2nd register	
6	Low byte of 2nd register	
....		
L+1	High byte of the last register	
L+2	Low byte of the last register	
L+3	CRC low byte	See below for the checksum calculation
L+4	CRC high byte	

The exceptional response will be:

Byte	Description	Value
0	Controller address	same as in the query
1	Function code	131 (function code + 128)
2	Exception code	2 (illegal address)
3	CRC low byte	See below for the checksum calculation
4	CRC high byte	

DATA WRITING (SINGLE REGISTER)

The function 06 (write single register) and the function 16 (write multiple registers) are used for data writing.
The MODBUS master will send a query containing data to be written. The answer will be one of the below:

-A normal response confirming successful write,
-An exceptional response indicating a write error.

Only some of the available registers are authorized to be written. An attempt to write a write protected register will result to the exceptional response.

The query message specifies the register address and data. The message structure is below:

Byte	Description	Value
0	Controller address	1 to 240
1	Function code	6
2	Register address high	See below the description of available registers
3	Register address low	
4	Data high byte	
5	Data low byte	
6	CRC low byte	See below for the checksum calculation
7	CRC high byte	

Here is the sequence to write the value 0010h to the register 40h (64 decimal):

01 06 00 40 00 10 89 D2 (each byte is expressed as 2 hexadecimal characters)

The checksum value in the above message may be used for the verification of checksum calculation algorithm

The normal response will be the same as the query:

Byte	Description	Value
0	Controller address	1 to 240
1	Function code	6
2	Register address high	See below the description of available registers
3	Register address low	
4	Data high byte	
5	Data low byte	
6	CRC low byte	See below for the checksum calculation
7	CRC high byte	

The exceptional response will be:

Byte	Description	Value
0	Controller address	same as in the query
1	Function code	134 (function code + 128)
2	Exception code	2 (illegal address) or 10 (write protection)
3	CRC low byte	See below for the checksum calculation
4	CRC high byte	

DATA WRITING (MULTIPLE REGISTERS)

The function 06 (write single register) and the function 16 (write multiple registers) are used for data writing.
The MODBUS master will send a query containing data to be written. The answer will be one of the below:

-A normal response confirming successful write,
-An exceptional response indicating a write error.

Only some of the available registers are authorized to be written. An attempt to write a write protected register will result to the exceptional response.

The query message specifies the register address and data. The message structure is below:

Byte	Description	Value
0	Controller address	1 to 240
1	Function code	16
2	Starting address high	See below the description of available registers
3	Starting address low	
4	Number of registers high	always 0
5	Number of registers low	max ??
6	Data lenght in **bytes** (L)	number of registers * 2
7	High byte of 1st register	
8	Low byte of 1st register	
9	High byte of 2nd register	
10	Low byte of 2nd register	
....		
L+5	High byte of the last register	
L+6	Low byte of the last register	
L+7	CRC low byte	See below for the checksum calculation
L+8	CRC high byte	

The normal response is below:

Byte	Description	Value
0	Controller address	1 to 240
1	Function code	16
2	Starting address high	See below the description of available registers
3	Starting address low	
4	Number of registers high	always 0
5	Number of registers low	max ??
6	CRC low byte	See below for the checksum calculation
7	CRC high byte	

The exceptional response will be:

Byte	Description	Value
0	Controller address	same as in the query
1	Function code	144 (function code + 128)
2	Exception code	2 (illegal address) or 10 (write protection)
3	CRC low byte	See below for the checksum calculation
4	CRC high byte	

CRC CALCULATION

Here is a procedure for generating a CRC:

1) Load a 16–bit register with FFFF hex (all 1's). Call this the CRC register.

2) Exclusive OR the first 8–bit byte of the message (the function code byte) with the low–order byte of the 16–bit CRC register, putting the result in the CRC register.

3) Shift the CRC register one bit to the right (toward the LSB), zero–filling the MSB. Extract and examine the LSB. The LSB is the least significant bit of the CRC **before** the shift operation.

4) If the LSB is 1: Exclusive OR the CRC register with the polynomial value A001 hex.

5) Repeat Steps 3 and 4 until 8 shifts have been performed. Thus, a complete 8–bit byte will be processed.

6) Repeat Steps 2 through 5 for the next 8–bit byte of the message. Continue doing this until all bytes have been processed.

7) The final contents of the CRC register is the CRC value.

8) Place the CRC into the message such that the low byte is transmitted first. The algorithm should give the correct CRC for below messages:

01 03 00 20 00 10 45 CC
01 06 00 40 00 10 89 D2

Error codes

Only 3 error codes are used:
01: illegal function code
02: illegal address
10: write protection (attempt to write a read_only register)

Data types

Each register consists of 16 bits (2 bytes)
If the data type is a byte, only the low byte will contain valid data. High byte is don't care.
For data type longer than 16 bits, consecutive registers are used. The least significant register comes first.

DATA FORMATS

16bit variables: These variables are stored in a single register. Bit_0 denotes the LSB and bit 15 denotes the MSB.

32 bit variables: These variables are stored in 2 consecutive registers. The high order 16 bits are in the first register and the low order 16 bits are in the second register

Bit arrays: Arrays larger than 16 bits are stored in multiple registers. The LSB of the first register is bit_0. The MSB of the first register is bit_15. The LSB of the second register is bit_16. The MSB of the second register is bit_31, and so on.

REGISTER DEFINITIONS

ADDRESS (decimal)	R / W	DATA SIZE	COEFF.	DESCRIPTION
8193	W	16bit	x10	Pushbutton simulation BIT 0.Simulate Stop button BIT 1.Simulate Manual button (D700) BIT 1.Simulate Run button (D500) BIT 2.Simulate Auto button BIT 3.Simulate Test button BIT 4.Simulate Run button (D700) BIT 5.Simulate GCB button BIT 6.Simulate MCB button BIT 7.Simulate Menu+ button BIT 8.Simulate Menu- button BIT 9.Simulate Up button BIT10.Simulate Down button BIT14.Button Long pressed BIT15.Button Very Long Pressed
8194	W	16bit	x1	Select channel for harmonic analysis and scopemeter display 00:Mains voltage L1 01:Mains voltage L2 02:Mains voltage L3 03:Genset voltage L1 04:Genset voltage L2 05:Genset voltage L3 06:Mains voltage L1-L2 07:Mains voltage L2-L3 08:Mains voltage L3-L1 09:Genset voltage L1-L2 10:Genset voltage L2-L3 11:Genset voltage L3-L1 12:Mains current L1 13:Mains current L2 14:Mains current L3 15:Genset current L1 16:Genset current L2 17:Genset current L3 18:Mains neutral current 19:Genset neutral current
8210	W	16bit	x1	If the value of “14536d” is written to this register, the unit will get a hard reset.
10240	R	32bit	x10	Mains phase L1 voltage
10242	R	32bit	x10	Mains phase L2 voltage
10244	R	32bit	x10	Mains phase L3voltage
10246	R	32bit	x10	Genset phase L1 voltage
10248	R	32bit	x10	Genset phase L2 voltage
10250	R	32bit	x10	Genset phase L3 voltage
10252	R	32bit	x10	Mains phase L1-L2 voltage
10254	R	32bit	x10	Mains phase L2-L3 voltage
10256	R	32bit	x10	Mains phase L3-L1voltage
10258	R	32bit	x10	Genset phase L1-L2 voltage
10260	R	32bit	x10	Genset phase L2-L3 voltage
10262	R	32bit	x10	Genset phase L3-L1 voltage
10264	R	32bit	x10	Mains phase L1 current
10266	R	32bit	x10	Mains phase L2 current
10268	R	32bit	x10	Mains phase L3 current

ADDRESS (decimal)	R / W	DATA SIZE	COEFF.	DESCRIPTION
10270	R	32bit	x10	Genset phase L1 current
10272	R	32bit	x10	Genset phase L2 current
10274	R	32bit	x10	Genset phase L3 current
10276	R	32bit	x10	Mains neutral current
10278	R	32bit	x10	Genset neutral current
10280	R	32bit	x10	Mains phase L1 active power
10282	R	32bit	x10	Mains phase L2active power
10284	R	32bit	x10	Mains phase L3active power
10286	R	32bit	x10	Genset phase L1 active power
10288	R	32bit	x10	Genset phase L2 active power
10290	R	32bit	x10	Genset phase L3 active power
10292	R	32bit	x10	Mains total active power
10294	R	32bit	x10	Genset total active power
10296	R	32bit	x10	Mains phase L1 reactive power
10298	R	32bit	x10	Mains phase L2reactive power
10300	R	32bit	x10	Mains phase L3reactive power
10302	R	32bit	x10	Genset phase L1 reactive power
10304	R	32bit	x10	Genset phase L2 reactive power
10306	R	32bit	x10	Genset phase L3 reactive power
10308	R	32bit	x10	Mains total reactive power
10310	R	32bit	x10	Genset total reactive power
10312	R	32bit	x10	Mains phase L1 apparent power
10314	R	32bit	x10	Mains phase L2apparent power
10316	R	32bit	x10	Mains phase L3apparent power
10318	R	32bit	x10	Genset phase L1 apparent power
10320	R	32bit	x10	Genset phase L2 apparent power
10322	R	32bit	x10	Genset phase L3 apparent power
10324	R	32bit	x10	Mains total apparent power
10326	R	32bit	x10	Genset total apparent power
10328	R	16bit	x10	Mains phase L1 power factor
10329	R	16bit	x10	Mains phase L2power factor
10330	R	16bit	x10	Mains phase L3power factor
10331	R	16bit	x10	Genset phase L1 power factor
10332	R	16bit	x10	Genset phase L2 power factor
10333	R	16bit	x10	Genset phase L3 power factor
10334	R	16bit	x10	Mains total power factor
10335	R	16bit	x10	Genset total power factor
10336	R	16bit	-	-
10337	R	16bit	-	-
10338	R	16bit	x100	Mains frequency
10339	R	16bit	x100	Genset frequency
10340	R	16bit	x100	Charge Input voltage
10341	R	16bit	x100	Battery voltage
10342	R	16bit	-	-
10343	R	16bit	x100	Charge Input_2 voltage
10344	R	16bit	x100	Battery_2 voltage
10345	R	16bit	x1	Analog input 1 ohm value
10346	R	16bit	x1	Analog input 2 ohm value
10347	R	16bit	x1	Analog input 3 ohm value
10348	R	16bit	x1	Analog input 4 ohm value
10349	R	16bit	x1	Analog input 5 ohm value
10350	R	16bit	x1	Analog input 6 ohm value
10351	R	16bit	x1	Analog input 7 reading
10352	R	16bit	x1	Analog input 8 reading

ADDRESS (decimal)	R / W	DATA SIZE	COEFF.	DESCRIPTION	
10353-60	R	16bit	-	-	
10361	R	16bit	x10	Oil pressure in bars (multiply by 14.50 to for psi)	
10362	R	16bit	x10	Engine temp in °C (multiply by 1.8 then add 32 for °F)	
10363	R	16bit	x10	Fuel level in %	
10364	R	16bit	x10	Oil temp in °C (multiply by 1.8 then add 32 for °F)	
10365	R	16bit	x10	Canopy temp in °C (multiply by 1.8 then add 32 for °F)	
10366	R	16bit	x10	Ambient temp in °C (multiply by 1.8 then add 32 for °F)	
10367	R	16bit	x10	Oil pressure_2 in bars (multiply by 14.50 for psi)	
10368	R	16bit	x10	Engine temp_2 in °C (multiply by 1.8 then add 32 for °F)	
10369	R	16bit	x10	Fuel level_2 in %	
10370	R	16bit	x10	Oil temp_2 in °C (multiply by 1.8 then add 32 to convert to °F)	
10371	R	16bit	x10	Canopy temp_2 in °C (multiply by 1.8 then add 32 for °F)	
10372	R	16bit	x10	Ambient temp_2 in °C (multiply by 1.8 then add 32 for °F)	
10373-74	R	32bit	-	On board digital input statuses. Each input is defined by 2 bits.	
10375	R	16bit	x1	Magnetic pickup input reading (rpm)	
10376	R	16bit	x1	Engine rpm	
10377	R	32bit	x10	Genset average voltage	
10379	R	32bit	x10	Genset average current	
10381	R	32bit	x10	Mains average voltage	
10383	R	32bit	x10	Mains average current	
10385	R	16bit	x100	Minimum battery voltage, measured during cranking.	
10386	R	16bit	x100	Selected channel's Total Harmonic Distortion level	
10387	R	16bit	x100	Selected channel's fundamental level	
10388	R	16bit	x100	Selected channel's harmonic 03 level	
10389	R	16bit	x100	Selected channel's harmonic 05 level	
10390	R	16bit	x100	Selected channel's harmonic 07 level	
10391	R	16bit	x100	Selected channel's harmonic 09 level	
10392	R	16bit	x100	Selected channel's harmonic 11 level	
10393	R	16bit	x100	Selected channel's harmonic 13 level	
10394	R	16bit	x100	Selected channel's harmonic 15 level	
10395	R	16bit	x100	Selected channel's harmonic 17 level	
10396	R	16bit	x100	Selected channel's harmonic 19 level	
10397	R	16bit	x100	Selected channel's harmonic 21 level	
10398	R	16bit	x100	Selected channel's harmonic 23 level	
10399	R	16bit	x100	Selected channel's harmonic 25 level	
10400	R	16bit	x100	Selected channel's harmonic 27 level	
10401	R	16bit	x100	Selected channel's harmonic 29 level	
10402	R	16bit	x100	Selected channel's harmonic 31 level	
10403	R	16bit	x1	Selected channel for harmonic analysis and scopemeter display	
				00:Mains voltage L1 01:Mains voltage L2 02:Mains voltage L3 03:Genset voltage L1 04:Genset voltage L2 05:Genset voltage L3 06:Mains voltage L1-L2 07:Mains voltage L2-L3 08:Mains voltage L3-L1 09:Genset voltage L1-L2	10:Genset voltage L2-L3 11:Genset voltage L3-L1 12:Mains current L1 13:Mains current L2 14:Mains current L3 15:Genset current L1 16:Genset current L2 17:Genset current L3 18:Mains neutral current 19:Genset neutral current
10404-10503	R	16bit	x1	Scopemeter dataof the channel selected by register 10403. Each register represents one point in the X axis of the scopemeter. The complete waveform is represented at 100 horizontal points. The register value is a signed integer.	

ADDRESS (decimal)	R / W	DATA SIZE	COEFF.	DESCRIPTION	
10504-10519	R	256bit	-	Shutdown alarm bits. Bit definitions are given at the end of the document.	
10520-10535	R	256bit	-	Loaddump alarm bits. Bit definitions are given at the end of the document.	
10536-10551	R	256bit	-	Warning alarm bits. Bit definitions are given at the end of the document.	
10594	R	32 bit		Latitude from GPS/GSM	
10596	R	32 bit		Longitude from GPS/GSM	
10598	R	32 bit		Altitude from GPS/GSM	
10604	R	16bit	-	Unit operation status 0= genset at rest 1= wait before fuel 2= engine preheat 3= wait oil flash off 4=crank rest 5=cranking 6= engine run idle speed 7= engine heating 8= running off load 9= synchronizing to mains 10= load transfer to genset 11= gen cb activation 12= genset cb timer	13= master genset on load, 14= peak lopping 15= power exporting 16= slave genset on load 17= synchronizing back to mains 18= load transfer to mains 19= mains cb activation 20= mains cb timer 21= stop with cooldown 22= cooling down 23= engine stop idle speed 24= immediate stop 25= engine stopping
10605	R	16bit	-	Unit mode 1= STOP mode 2= MANUAL mode (D700) 2= RUN mode (D500) 4= AUTO mode 8= TEST mode	
10606	R	16bit	x1	Genset operation timer. In various wait statuses, the genset operation status will change at the expiration of this timer.	
10607	R	16bit	x10	GOV control output %	
10608	R	16bit	x10	AVR control output %	
10609	R	16bit	-	Device identity information. (0xD300, 0xD500, 0xD700....)	
10610	R	16bit	-	Device hardware version information	
10611	R	16bit	-	Device software version information	
10616	R	32bit	x1	Counter: number of genset runs	
10618	R	32bit	x1	Counter: number of genset cranks	
10620	R	32bit	x1	Counter: number of genset on load	
10622	R	32bit	x100	Counter: engine hours run	
10624	R	32bit	x100	Counter: engine hours since last service	
10626	R	32bit	x100	Counter: engine days since last service	
10628	R	32bit	x10	Counter: genset total active energy (kWh)	
10630	R	32bit	x10	Counter: genset total inductive reactive energy (kVArh-ind)	
10632	R	32bit	x10	Counter: genset total capacitive reactive energy (kVArh-cap)	
10634	R	32bit	x100	Counter: remaining engine hours to service-1	
10636	R	32bit	x100	Counter: remaining engine days to service-1	
10638	R	32bit	x100	Counter: remaining engine hours to service-2	
10640	R	32bit	x100	Counter: remaining engine days to service-2	
10642	R	32bit	x100	Counter: remaining engine hours to service-3	
10644	R	32bit	x100	Counter: remaining engine days to service-3	
10646	R	32bit	-	GPRS IP as 4 bytes	
10648-11159	R	8192 bit	-	Graphic LCD display buffer	

ADDRESS (decimal)	R / W	DATA SIZE	COEFF.	DESCRIPTION
11160-11163	R	64bit	-	Led status bits. Each led is defined by 2 bits. 00: led off 01: led on 10: quick falsh 11: slow flash
11164-11166	R	48bit	-	Digital output status bits. Inluding 32 extension outputs.
11167-11168	R	32bit	-	Extension digital input status bits.
11172	R	16bit	x100	Minimum battery_2 voltage, measured during cranking.
11173	R	16bit	x10	Battery Charge Current
11174	R	16bit	x10	Battery Charge Current of battery 2
11555	R	224 bit	-	These array of flags indicate activity status of various functions within the controller. The list of function flags is given at the end of this document.
11569	R	32bit	x10	Counter: mains total active energy (kWh)
11571	R	32bit	x10	Counter: mains total inductive reactive energy (kVArh-ind)
11573	R	32bit	x10	Counter: mains total capacitive reactive energy (kVArh-cap)
11575	R	32bit	x10	Counter: total export active energy (kWh)
11577	R	32bit	x10	Counter: fuel counter
11680	R	32bit	x10	Flowmeter
11682	R	16bit	x1	Ethernet reset counter
11683	R	16bit	x1	Ethernet TCP/IP packet counter
11684-11686	R	48bit	-	Ethernet MAC address
11687-11692	R	96bit	-	Controller Unique ID
11693-11700	R	128bit	-	Modem IMEI number
11555	R	32bit	x10	Counter: mains total active energy (kWh)
11557	R	32bit	x10	Counter: mains total inductive reactive energy (kVArh-ind)
11559	R	32bit	x10	Counter: mains total capacitive reactive energy (kVArh-cap)
11561	R	32bit	x10	Counter: total export active energy (kWh)
11555	R	32bit	x10	Counter: fuel counter
11680	R	32bit	x10	Flowmeter
11682	R	16bit	x1	Ethernet reset counter
11683	R	16bit	x1	Ethernet TCP/IP packet counter
11684-11686	R	48bit	-	Ethernet MAC address
11687-11692	R	96bit	-	Controller Unique ID
11693-11700	R	128bit	-	Modem IMEI number

MULTI-GENSET LOAD SHARE PARAMETERS

ADDRESS (decimal)	R / W	DATA SIZE	COEFF.	DESCRIPTION
11175	R	32bit	x10	Multi genset total active power
11177	R	32bit	x10	Multi genset total reactive power
11374	R	16bit	x10	Multi genset average active power load %
11375	R	16bit	x10	Multi genset average reactive power load %
11376	R	16bit	x10	Multi genset average power factor
11377	R	16bit	x10	Multi genset speed correction %
11378	R	16bit	x10	Multi genset voltage correction %

LIST OF ALARM BITS

000....007: On-board digital input alarms
008....047: Extension input alarms
048: Genset Low Frequency
049:Genset High Frequency
050: Genset Low RPM
051: Genset High RPM
052: Genset Low Voltage
053: Genset High Voltage
054: Low Oil Pressure
055: High Oil Pressure
056: Low Engine Temp.
057: High Engine Temp.
058: Low Fuel Level
059: High Fuel Level
060: Low Oil Temp
061: High Oil Temp
062: Low Canopy Temp
063: High Canopy Temp
064: Low Ambient Temp
065: High Ambient Temp
066: Sender 1 Low Level
067: Sender 2 Low Level
068: Sender 3 Low Level
069: Sender 4 Low Level
070: Sender 5 Low Level
071: Sender 6 Low Level
072: Sender 7 Low Level
073: Sender 8 Low Level
074: Sender 1 High Level
075: Sender 2 High Level
076: Sender 3 High Level
077: Sender 4 High Level
078: Sender 5 High Level
079: Sender 6 High Level
080: Sender 7 High Level
081: Sender 8 High Level
082: Oil Pressure Snd Open
083: Engine Temp. Snd Open
084: Fuel Level Snd Open
085: Oil Temp Snd Open
086: Canopy Temp Snd Open
087: Ambient Temp Snd Open
088: Sender 1 Open Circ.
089: Sender 2 Open Circ.
090: Sender 3 Open Circ.
091: Sender 4 Open Circ.
092: Sender 5 Open Circ.
093: Sender 6 Open Circ.
094: Sender 7 Open Circ.
095: Sender 8 Open Circ.
096: Low Battery Voltage
097: High Battery Voltage
098: Fail To Start
099: Fail To Stop
100: Low Charge Volt
101: J1939 ECU Error
102: High Air Inlet Temp
103: Low Coolant Level
104: Voltage Unbalance
105: Current Unbalance
106: Over Current
107: Over Load
108: Reverse Power
109: Gen Phase Order Fail
110: Mains Phase Order Fail
111: Gen CB Fail To Close
112: Gen CB Fail To Open
113: Mains CB Fail ToClose
114: Mains CB Fail To Open
115: Device Address Fail
116: Comm. Bus Error
117: Excitation Lost
118: Service 1 Request
119: Service 2 Request
120: Service 3 Request
121: G59: No Mains Freq.
122: G59: Mains Freq Fail
123: G59: Mains ReversePow
124: G59: R.o.c.o.f. df/dt
125: G59: Vector Shift
126: NVM Function Failure
127: Communication Lost
128: Synchronization Fail
129: Loss Of Pick-Up Sign
130: Unit Not Tested!
131: Wrong Expansion Order
132: Busbar Voltage Fail
133: Busbar Freq. Fail
134: Min Genset NotReached
135: DeadBus Volt Exceeded
136: Insuff. StartUp Power
137: Fuel Pump Failure
138: Unit Locked!
139: EEprom Write Fault
140: Low Battery-2 Voltage
141: High Battery-2 Volt.
142....255: Reserved Alarms

LIST OF FUNCTION FLAGS

000: Fuel
001: Horn
002: Crank
003: Stop Solenoid
004: Genset Contactor
005: Mains Contactor
006: Idle Speed
007: Preheat
008: Alternate Crank
009: Fuel Main Winding
010: Genset Close Pulse
011: Genset Open Pulse
012: Genset UV Coil
013: Mains Close Pulse
014: Mains Open Pulse
015: Mains UV Coil
016: Flashing Relay
017: Gas Solenoid
018: Fuel Pump Control
019: Choke
020: Block Heater
021: Coolant Cooler
022: Coolant Heater
023: Fan Control
024: Air Flap Control
025: Canopy Fan Control
026: Ambient Fan Control
027: Remote Start Output
028: Genset Ready
029: Bus Bar Contactor
030: Bus Bar Close Pulse
031: Bus Bar Open Pulse
032: Bus Bar UV Coil
033: Load Shedding
034: Load Add
035: Load Substract
036: Service 1 Request
037: Service 2 Request
038: Service 3 Request
039: Mains Ph.Order Fail
040: Genset Ph.Order Fail
041: Auto Ready
042: Weekly Schedule On
043: Exerciser On
044: Mains Fail
045: Pgm Mode Active
046: Engine Running
047: Genset Voltage Ok!
048: Alarm Check Enable
049: Oil Pressure Ok!
050: Shutdown Alarm
051: Loaddump Alarm
052: Warning Alarm
053: Shutdown or Loaddump
054: Shutdown or Loaddump or Warning
055: Test Mode
056: Auto Mode
057: Manual Mode
058: Off Mode
059: Not In Auto
060: Genset At Rest
061: Waiting Before Fuel
062: Preheating
063: Waiting Oil Flash Off
064: Engine Heating
065: Synchronizing
066: Cooling Down
067: Stopping
068: Protections Disabled
069: Remote Start Input
070: Disable Auto Start
071: Force to Start
072: AutoRestoreInhibited
073: Gen.LoadingInhibited
074: Inp.Expansion1Mounted
075: Inp.Expansion2Mounted
076: Out.Expansion1Mounted
077: Out.Expansion2Mounted
078: Master Unit
079: Multi Gen. Remote Start
080: Remote Control Out 1
081: Remote Control Out 2
082: Remote Control Out 3
083: Remote Control Out 4
084: Remote Control Out 5
085: Remote Control Out 6
086: Remote Control Out 7
087: Remote Control Out 8
088: Remote Control Out 9
089: Remote Control Out 10
090: Remote Control Out 11
091: Remote Control Out 12
092: Remote Control Out 13
093: Remote Control Out 14
094: Remote Control Out 15
095: Remote Control Out 16
096: Multi Load Add Out 1
097: Multi Load Subst. Out 1
098: Multi Load Add Out 2
099: Multi Load Subst. Out 2
100: Multi Load Add Out 3
101:Multi Load Subst. Out 3
102:Multi Load Add Out 4
103:Multi Load Subst. Out 4
104:Multi Load Add Out 5
105:Multi Load Subst. Out 5
106:Heavy Duty Active
107:ECU Power On
108:Battery Charge Run
109:Fire Circuit PS Active
110:Pre-transfer Delay
111: Secondary Volt Freq.
112...223: Unused flag