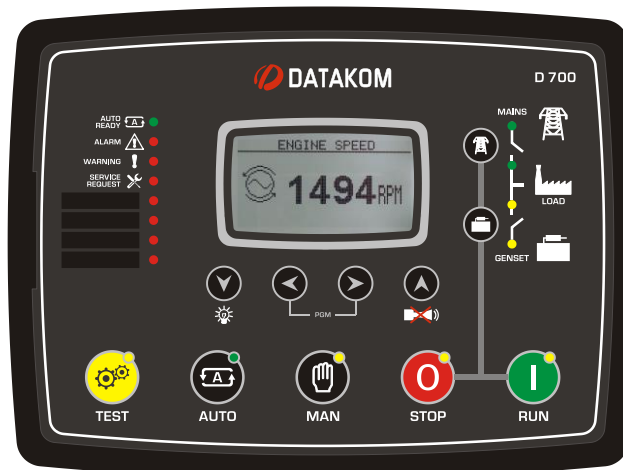




MODBUS APPLICATION MANUAL

D-300 / D-500 / D-700



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ABOUT THIS DOCUMENT

This document describes minimum required details for the successful 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 review 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).

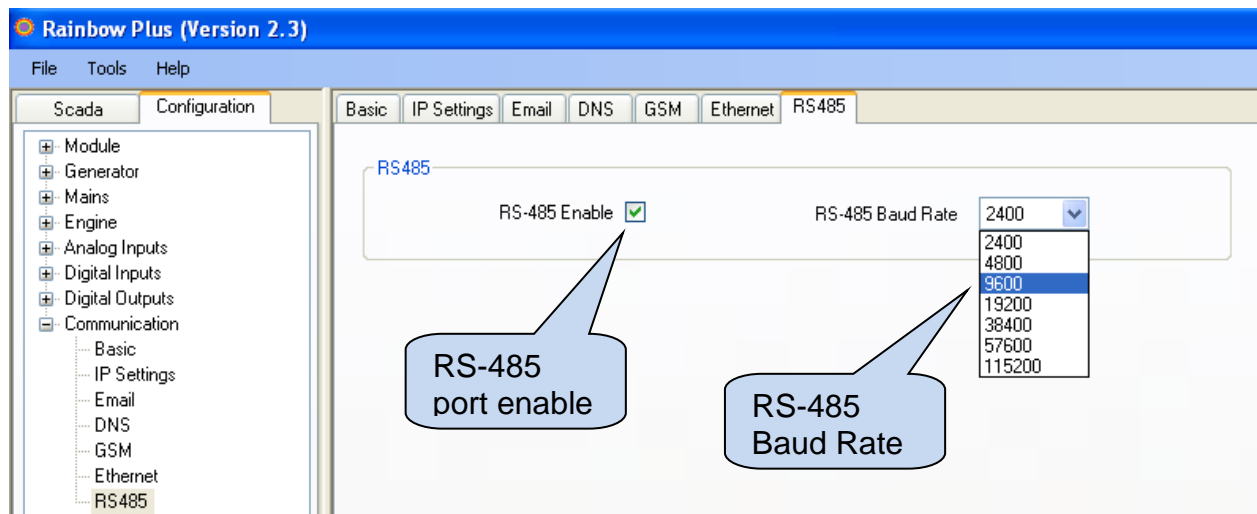
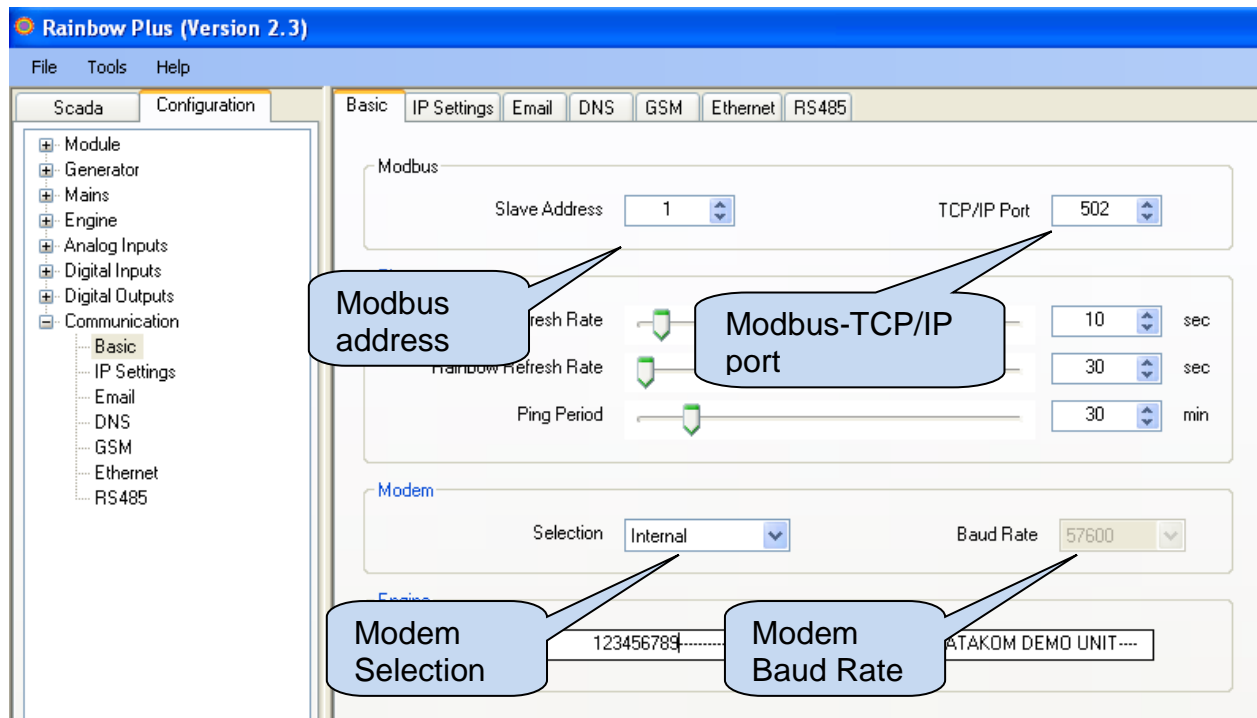
Modem Selection: Internal or external following your configuration.

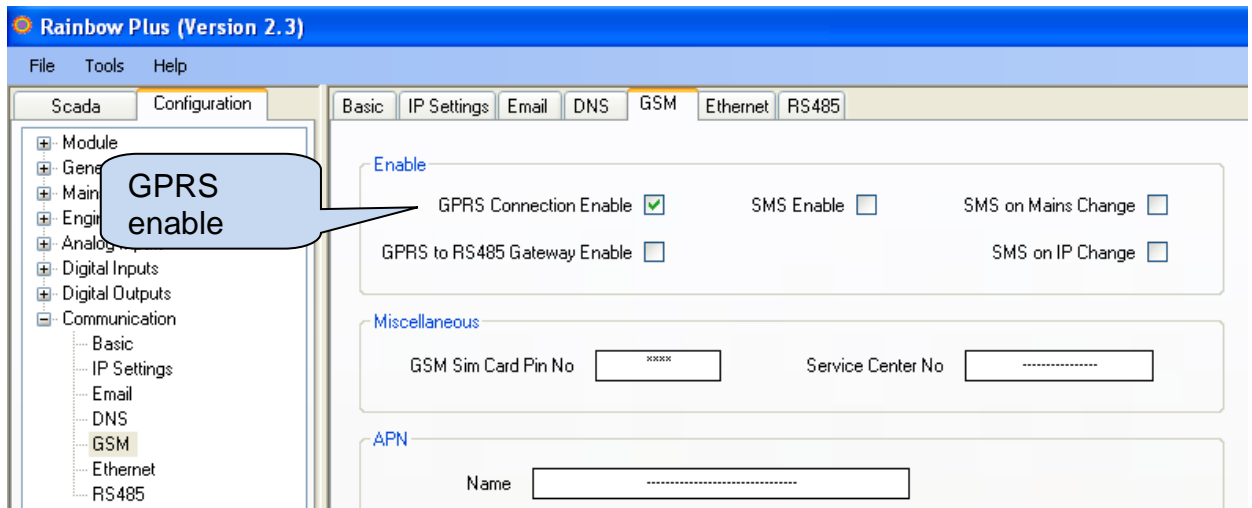
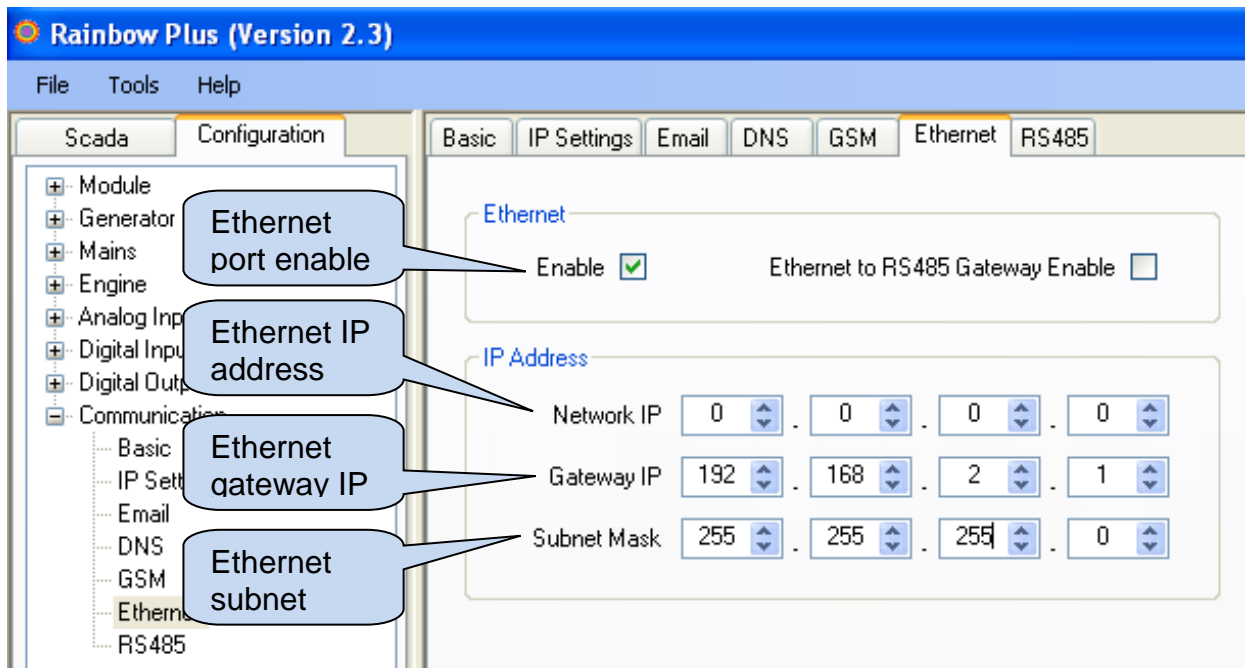
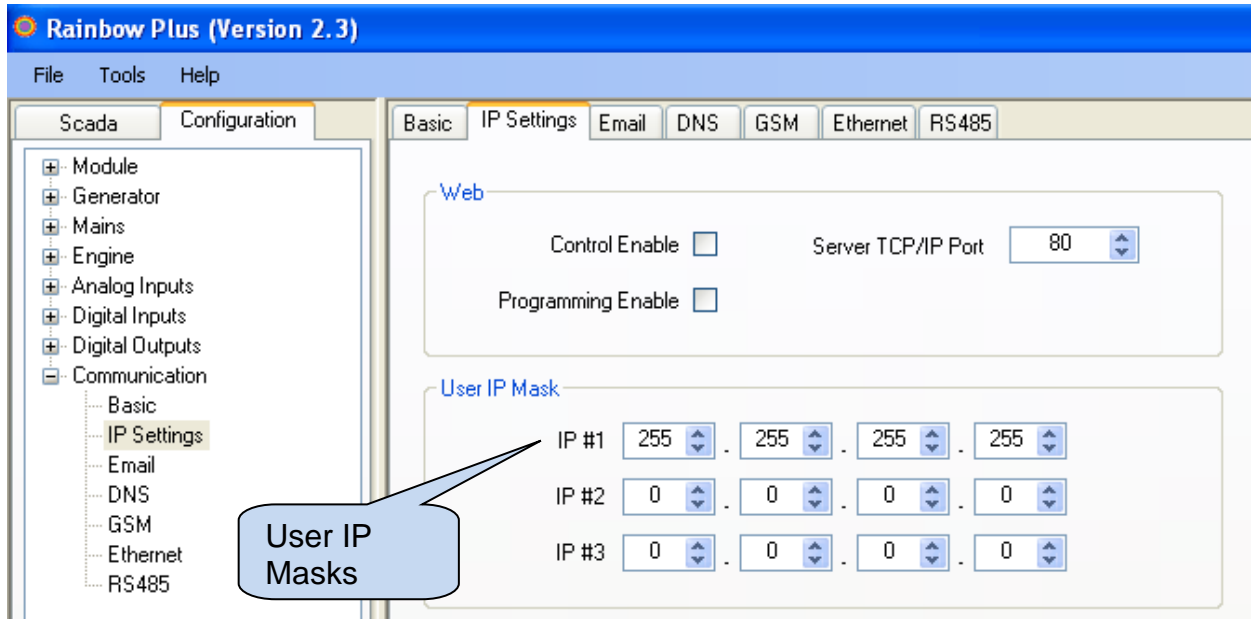
Modem Baud Rate: Selectable only for external modem. 115200 bauds advised. Selecting a lower baud rate will slow down communication between the controller and the modem.

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.





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 length 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	See below for the checksum calculation
5	Data low byte	
6	CRC low byte	
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	See below for the checksum calculation
5	Data low byte	
6	CRC low byte	
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 length 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 BIT 2.Simulate Auto button BIT 3.Simulate Test button BIT 4.Simulate Run button BIT 5.Simulate GCB 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 0= STOP mode 1= AUTO mode 2= MANUAL mode 3= 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. Including 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	094: Sender 7 Open Circ.
008....047: Extension input alarms	095: Sender 8 Open Circ.
048: Genset Low Frequency	096: Low Battery Voltage
049: Genset High Frequency	097: High Battery Voltage
050: Genset Low RPM	098: Fail To Start
051: Genset High RPM	099: Fail To Stop
052: Genset Low Voltage	100: Low Charge Volt
053: Genset High Voltage	101: J1939 ECU Error
054: Low Oil Pressure	102: High Air Inlet Temp
055: High Oil Pressure	103: Low Coolant Level
056: Low Engine Temp.	104: Voltage Unbalance
057: High Engine Temp.	105: Current Unbalance
058: Low Fuel Level	106: Over Current
059: High Fuel Level	107: Over Load
060: Low Oil Temp	108: Reverse Power
061: High Oil Temp	109: Gen Phase Order Fail
062: Low Canopy Temp	110: Mains Phase Order Fail
063: High Canopy Temp	111: Gen CB Fail To Close
064: Low Ambient Temp	112: Gen CB Fail To Open
065: High Ambient Temp	113: Mains CB Fail ToClose
066: Sender 1 Low Level	114: Mains CB Fail To Open
067: Sender 2 Low Level	115: Device Address Fail
068: Sender 3 Low Level	116: Comm. Bus Error
069: Sender 4 Low Level	117: Excitation Lost
070: Sender 5 Low Level	118: Service 1 Request
071: Sender 6 Low Level	119: Service 2 Request
072: Sender 7 Low Level	120: Service 3 Request
073: Sender 8 Low Level	121: G59: No Mains Freq.
074: Sender 1 High Level	122: G59: Mains Freq Fail
075: Sender 2 High Level	123: G59: Mains ReversePow
076: Sender 3 High Level	124: G59: R.o.c.o.f. df/dt
077: Sender 4 High Level	125: G59: Vector Shift
078: Sender 5 High Level	126: NVM Function Failure
079: Sender 6 High Level	127: Communication Lost
080: Sender 7 High Level	128: Synchronization Fail
081: Sender 8 High Level	129: Loss Of Pick-Up Sign
082: Oil Pressure Snd Open	130: Unit Not Tested!
083: Engine Temp. Snd Open	131: Wrong Expansion Order
084: Fuel Level Snd Open	132: Busbar Voltage Fail
085: Oil Temp Snd Open	133: Busbar Freq. Fail
086: Canopy Temp Snd Open	134: Min Genset NotReached
087: Ambient Temp Snd Open	135: DeadBus Volt Exceeded
088: Sender 1 Open Circ.	136: Insuff. StartUp Power
089: Sender 2 Open Circ.	137: Fuel Pump Failure
090: Sender 3 Open Circ.	138: Unit Locked!
091: Sender 4 Open Circ.	139: EEprom Write Fault
092: Sender 5 Open Circ.	140: Low Battery-2 Voltage
093: Sender 6 Open Circ.	141: High Battery-2 Volt.
	142....255: Reserved Alarms

LIST OF FUNCTION FLAGS

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