HDMS
Modbus and PC Software

Rev 1.0

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Chapter 1 Introduction

1.1 Foreword

HDMS is a dynamic motor starter for single phase scroll compressors and submersible pumps.

The purpose of this document is to outline information on the:

- functionalities that are provided by Modbus;
- Carlo Gavazzi Soft Starter Studio (CGS^3) PC software which can be used to initialise, control and monitor HDMS motor starters.

Should there be any problems that cannot be solved with the information provided in this guide, contact our technical representative who will be willing to help you.

1.2 Product inspection

Please check the following when receiving and unpacking HDMS units:

- The product is the one specified in your purchase order
- Check if there are any damages caused by transportation. In case of any problem, do not install the product and contact Carlo Gavazzi sales representative.

We suggest keeping the original packing in case it is necessary to return the instrument to our After Sales Department. In order to achieve the best results with your product, we recommend reading the instruction manual carefully. If the product is used in a way not specified by the producer, the protection provided by the product may be impaired.

1.3 Precautions

For your safety, the following symbol is to remind you to pay attention to safety instructions on configuring and installing HDMS. Be sure to follow the instructions for higher safety.


This symbol indicates a particularly important subject or information.

Please read this manual thoroughly before using the device. Should there be any problem using the product which cannot be solved with the information provided in the manual, contact your nearest Carlo Gavazzi distributor or our sales representatives to help you. Check that the device is installed in accordance with the procedures as described in this manual.

The manufacturer accepts no liability for any consequence resulting from inappropriate, negligent or incorrect installation or adjustment of the optional parameters of the equipment. The contents of this guide are believed to be correct at the time of printing. In the interests of commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the content of the guide without notice.

Chapter 2 Software Installation

2.1 System requirements

The monitoring software is designed to run on:

- Windows 8/8.1
- Windows 10

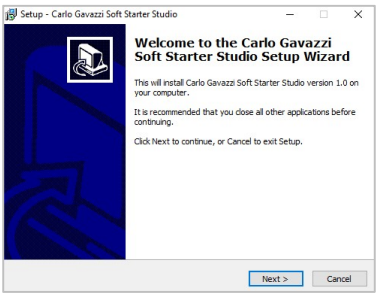
2.2 Software setup file

You can download the latest version of the software from our website: http://gavazziautomation.com/nsc/HQ/EN/soft_starters.

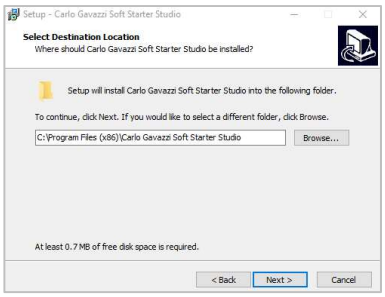
2.2 Installing the software

If the setup file is downloaded successfully, you can start installing the software by unzipping the file and then run the setup.exe file. The first step is to select one of the languages that is supported by the software:

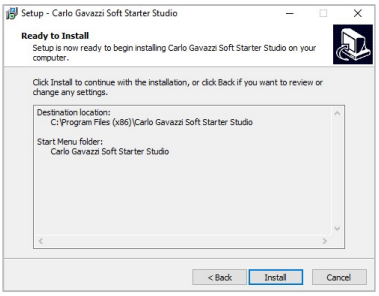
After the selection of the language, the following window will appear:



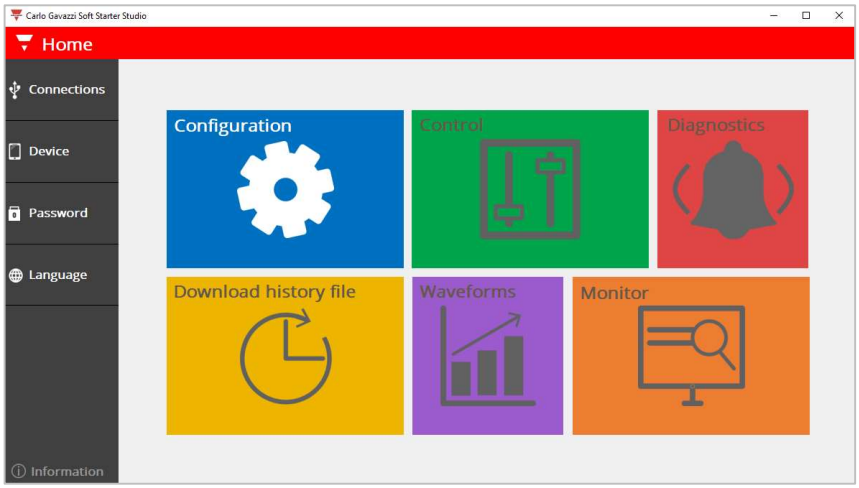
Click next to progress through the Install Wizard and install the software. Choose a location to install the software or click next to continue with the default location.



Click next to start the installation.



Once the installation is complete, you should see the Carlo Gavazzi logo on your desktop. Double click to open the software. The following screen will appear:



2.3 Uninstalling the software

When you uninstall the software, the installed files will be removed from your PC.

The following steps instruct you to uninstall the software from your PC.

- Open the Control Panel in Windows and under Programs, click on Uninstall a program
- Select the software and click on Uninstall

Chapter 3 Establishing Communication

3.1 Introduction

The HDMS can be interfaced either to a PC or to a controller using Modbus RTU protocol with **one-to-one communication**. The Modbus link between the master and slaves can be established on a 3-wire RS485 communication port.

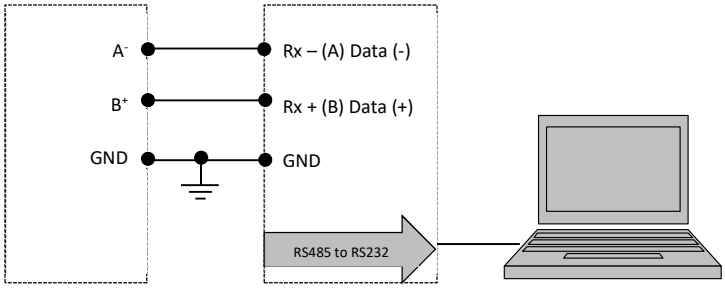
The HDMS starters leave the factory with default communication parameters as listed below:

Default communication parameters	
Parameter	**Default Value**
Device address	1
Baud rate	9600
Parity	No parity
Stop Bit	2

The factory default communication parameters can be modified.

3.2 Installation

In order to establish communication between a PC (or a controller) and the HDMS, you will need to connect a cable between the communicating device and the A^-, B^+, GND terminals available on the HDMS unit as shown below.

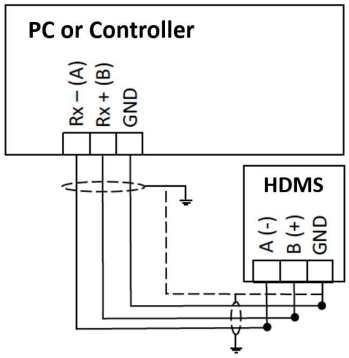


The A^- and the B^+ connections from the HDMS must be connected to the Rx- (A) and Rx+ (B) line of the communicating device respectively. If this connection is not followed, communication will not be established.

To reduce noise on the RS485 communication cable, use a twisted pair and shielded cable. In addition, connect the shield to the GND terminal to further minimize the noise on the RS-485 cable.

3.3 Establishing communication

If the supply LED (PWR) is green fixed on the HDMS, you can establish one-to-one communication between a PC (or a controller) and one HDMS.

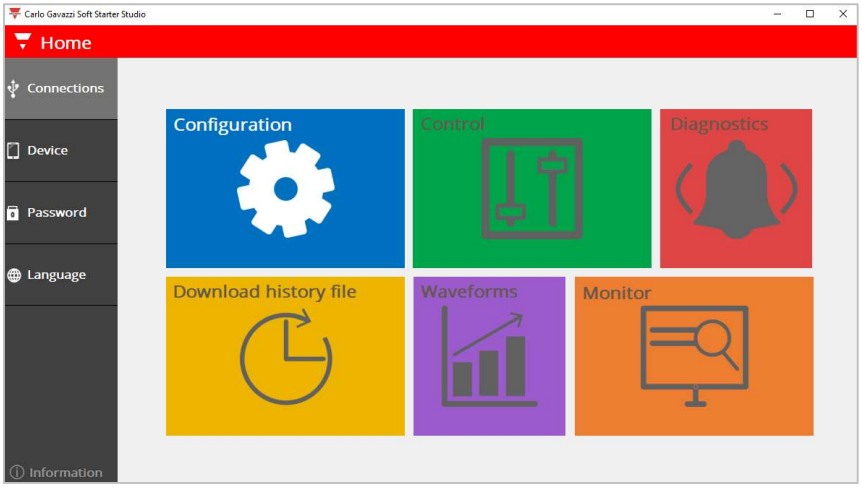


In order to establish one-to-one communication, the HDMS unit must first be powered-up with the specified supply voltage (110 / 230 VAC).

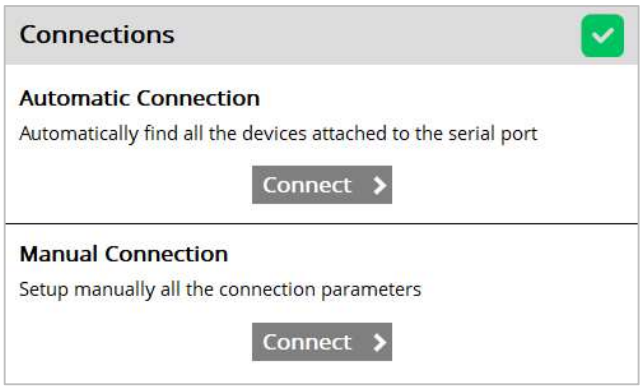
3.4 Carlo Gavazzi Soft Starter Studio (CGS³)

In the following section we will explain the steps you need to follow to *establish communication* with the HDMS when using the Carlo Gavazzi Soft Starter Studio (CGS³) PC software.

Communication via software can be established by clicking on the *Connections* menu.



The software provides two methods to establish one-to-one communication:
a. Automatic connection *(more details in section 3.4)*
b. Manual connection *(more details in section 3.5)*



3.5 Automatic connection

The automatic connection is useful when the communication parameters mentioned in Section 3.1 are unknown.

Follow this procedure to establish automatic connection:

1. Select the serial port that you will be using on the PC.

2. Click on the Connect icon and the software starts to find the device attached to the serial port.

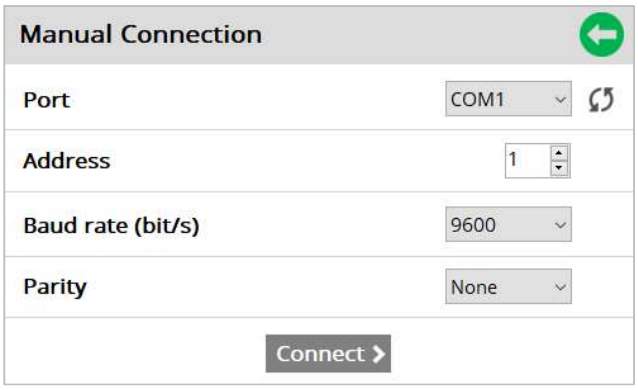
The software takes approximately five seconds to check every address.

3.6 Manual connection

The manual connection is useful when the communication parameters mentioned in Section 3.1 are known.

Follow this procedure to establish manual connection:

1. Select the serial *port* that you will be using on the PC and enter the relevant communication parameters.



2. Click on the *Connect* icon and the software tries to establish communication with the selected communication parameters.

3.7 Connection messages

In automatic or manual connection, if connection is:

a. SUCCESSFUL, the following message will appear:

Communication is established!

b. NOT SUCCESSFUL, one of the following messages will be displayed:

Comport is already open! Please choose another comport.

Cause: The selected comport is probably being used by another software.

Corrective action: Close any software that may be using the selected comport.

Communication was not established!
Check comport, communication parameters or supply.

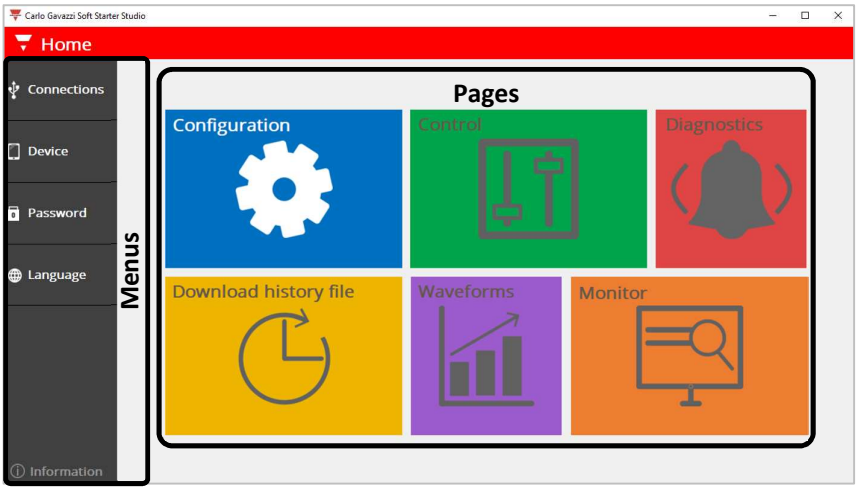
Cause: a) Comport is not properly connected
b) Communication parameters are not correctly selected (applies only for Manual connection)
c) The HDMS starter is switched off

Corrective actions: a) Open the Device Manager in Windows and check the comport that is being used by the PC.
b) Make sure that you have selected the correct communication parameters.
c) Apply power to the HDMS (green LED must be fully on).

Chapter 4 Software User Interface

4.1 Dashboard

The *Dashboard* serves as the starting point of the software where you can communicate, configure, control, monitor and troubleshoot the HDMS motor starter.

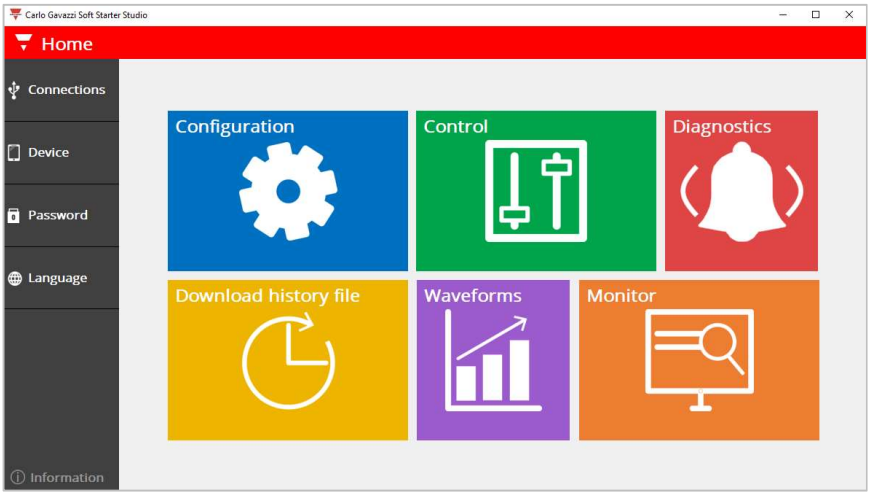


The *Dahsboard* contains 6 pages:

Section	Page	Description
4.2	*Configuration*	It contains a list of programmable groups. An offline configuration can be created since this page can also be accessible when communication is not established.
4.3	*Control*	Start/stop motor, reset alarms and monitor the device status.
4.4	*Diagnostics*	Overview of alarms and faults.
4.5	*Download history file*	Download a history file from device.
4.6	*Waveforms*	Graphical interface of logged data.
4.7	*Monitor*	Lists the instantaneous variables and counters in real-time.

All of the aforementioned pages are only accessible when the PC establishes communication with the device except the *Configuration* page. In fact, you can create a configuration for the motor starter without having the physical device at your disposal.

When you establish communication with the HDMS, the background colour of the icons on the *Dashboard* will turn from grey into white as shown in the figure below.



The *Dashboard* also contains 5 menus:

Section	Menu	Description
3.3	*Connections*	To establish communication with device: ❖ Automatic Connection ❖ Manual Connection
4.8	*Device*	Information on the device that is communicating with the software.
4.9	*Password*	Password to unlock protected settings and variables for current device.
4.10	*Language*	List of the available languages.
4.11	*Information*	Information on the software version and release date.

***Dashboard* navigation:**

- Click on one of the coloured icons to select a page. To return to the dashboard, click on the Home icon which is available on every page at the upper left corner.
- Click on one of the icons available in the left pane to select a menu. To return to the dashboard, click on the OK icon which is available on every menu at the upper left corner.

Icon	Definition	Description
	Home	Return to the home page from a particular page
	OK	Return to the home page from a particular menu

4.2 Configuration

To customise the HDMS for your application, please select the *Configuration* page.

An offline configuration can be created without having the physical device at your disposal.

If communication is established, make sure that the unit is in idle state when modifying parameters.

This page lists all programmable parameters available for the device divided into five groups:

a. *Communication*
b. *Control*
c. *Delays*
d. *Protection*
e. *ID codes*

Toolbar:

The *Configuration* page has different icons in the toolbar. Note that a textbox displaying the description of the icon is displayed when the you hover on one of the icons available in the toolbar.

Configuration toolbar if communication is not established:

Configuration toolbar if communication is established:

Icon	Definition	Description
	New	Creates a new configuration.
	Open	Loads a configuration file (in Soft Starter (.softstarter) format) that is already saved on the PC.
	Save	Saves a configuration file (in Soft Starter (.softstarter) format) at any desirable location on your PC.
	Preview	Generates a configuration file report (in Portable Document Format (.pdf)).
	Read	Reads the value of all programmable parameters. This icon is activated only if communication exists between the PC and the device.
	Write	Updates the value of all programmable parameters with respect to the user password protection level. This icon is activated only if communication exists between the PC and the device.

Programmable parameters:

A. Communication

In this group, you can visualise and modify the communication parameters.

Parameter	Default value	Range	Function	
			Read	Write
Address	1	1 … 247	✓	✓
Baud rate	9600	9600 … 57600	✓	✓
Parity	None	None … Even	✓	✓

The communication parameters become effective only when the power is cycled OFF/ON.

B. Control

In this group, you can select the *Control Mode* (Modbus or A1-A2 mode) and you can also enable/disable the *refresh command* (a.k.a. heartbeat signal).

Parameter	Default value	Range	Function	
			Read	Write
Control mode	A1-A2	A1-A2 / Modbus	✓	✓
Refresh command	Disable	Disable / Enable	✓	✓
Refresh interval	10 s	1 … 600 s	✓	✓

The factory default *Control Mode* is set to A1-A2 mode.

If the *Refresh Command* is disabled, the output of the HDMS will remain in the same state in case communication is lost.

C. Delays

This group contains the delays related to stop-to-start and start-to-start intervals.

Parameter	Default value	Range	Function	
			Read	Write
Minimum stop to start	0 s	0 … 65535 s	✓	✓
Minimum start to start	0 s	0 … 65535 s	✓	✓

Make sure that the maximum starts/hr that the HDMS can handle is not exceeded.

D. Protection

In this group, you can visualise and modify a set of alarm limits.

Parameter	Default value	Range	Function	
			Read	Write
Over supply voltage limit	20.0 %	1.0 … 150.0 %	✓	X
Under supply voltage limit	20.0 %	1.0 … 61.7 %	✓	X
Maximum bypass current limit	Device dependent	12.6 … 38.9 A	✓	X
Motor overload protection	Enable	Disable / Enable	✓	✓
Alarm relay logic	Normally Closed	NC / NO	✓	✓
Bypass relay logic	Normally Open	NC / NO	✓	✓
Auto adapt	Enable	Disable / Enable	✓	✓

E. ID codes

In this group, you can visualise the *ID codes* of the device.

Parameter	Default value	Range	Function	
			Read	Write
Device	Device dependent	0 … 65535	✓	X
Firmware			✓	X
Revision			✓	X

Messages:

The following messages can be triggered when:

A. Trying to modify a password protected parameter.

Parameter is password protected!

B. Clicking on the read icon.

Reading data from device…

C. Software successfully read the value of all parameters from the device.

Data successfully read!

D. Clicking on the write icon.

Writing data from device…

E. Software successfully writes the values of every parameter into the device.

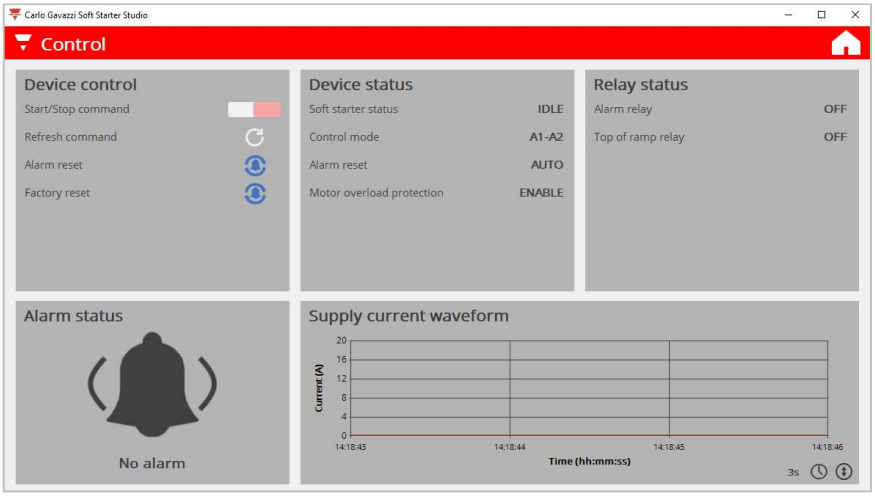
Data successfully written!

4.3 Control

This page is designed specifically to start/stop motor, reset alarms and monitor the device status.

It contains 5 blocks:

a. Device control
b. Device status
c. Relay status
d. Alarm status
e. Supply current waveform



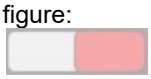
A. Device control

➢ Start/Stop command

This command can be used to switch ON/OFF the control signal; if the control mode is set to Modbus control.

The control mode parameter can be modified through the software from the *Configuration* page under the *Control* section.

If the *control mode* is set to A1-A2, the slider switch looks similar to the following figure:



If the *control mode* is set to Modbus, the slider switch looks similar to the following figure:

If this command is ON, as soon as the motor starter resets from an alarm, the load will switch ON.

➢ Refresh command

When *refresh command* is enabled, the HDMS expects a refresh command to be sent within the refresh interval. If this command is not sent during the refresh interval, then the HDMS assumes that communication has been lost and will switch OFF its output.

The refresh command and refresh interval parameters can be modified through the software from the *Configuration* page under the *Control* section.

- Alarm reset

  If an alarm is triggered, the alarm reset can be used to reset the alarm manually.

- Factory reset

  When factory reset is selected, the value of each programmable parameter of the motor starter is restored to its default values

B. Device status

- Soft starter status
- Control mode
- Alarm reset
- Motor overload alarm

C. Relay status

- Alarm relay
- Top of ramp relay

D. Alarm status

If an alarm is triggered, the alarm status block will look as the following figure:

E. Supply current waveform

This block is similar to an oscilloscope and it can monitor the supply current.

Icon	Definition	Description
	Time base	4x time bases: 3s, 5s, 10s, 20s
	Current range	4x current ranges: 0~20A, 0~30A, 0~40A, 0~60A.

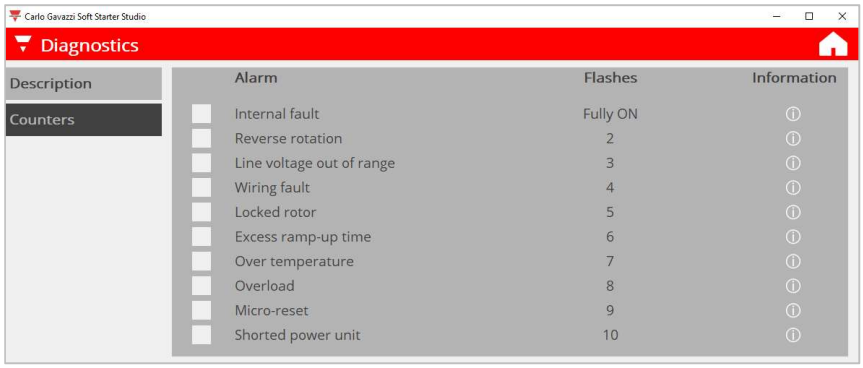
4.4 Diagnostics

The *Diagnostics* page gives an overview of alarms and faults that can be triggered by the HDMS. Furthermore, the HDMS memorises the triggered alarms, stores them in dedicated counters and the software displays the values of these counters.

This page is divided into 2 sections:

a. Alarm description
b. Alarm counters

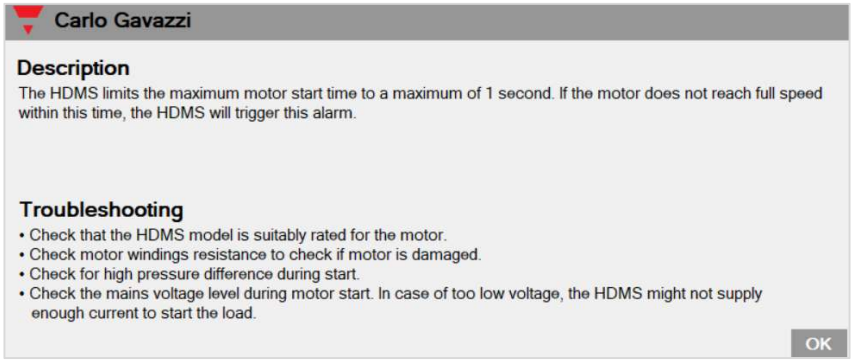
A. Alarm description



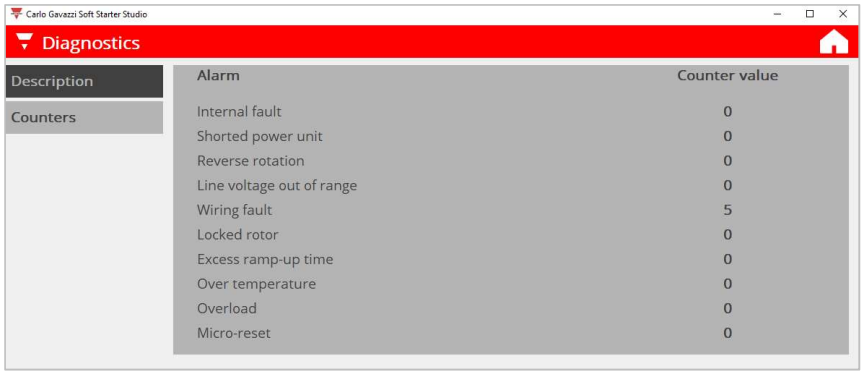
If an alarm is triggered the indication block next to the triggered alarm will convert from white to red.

An alarm information icon is also available for each alarm where it shows:

a. description on the alarm and;
b. solution to reset the alarm.



B. Alarm counters



4.5 Download history file

You can download the data stored in the HDMS memory by clicking on the *Download history file* icon. The history file (CSV (.csv) format) is divided into 4 sections:

a. Serial code
b. Information about the starts performed by the device
   i. First 8 starts
   ii. Last 24 starts in a FIFO (first-in, first-out) type queue
c. Information about the alarm events (maximum 143 events)
d. Counters related to alarms and other variables

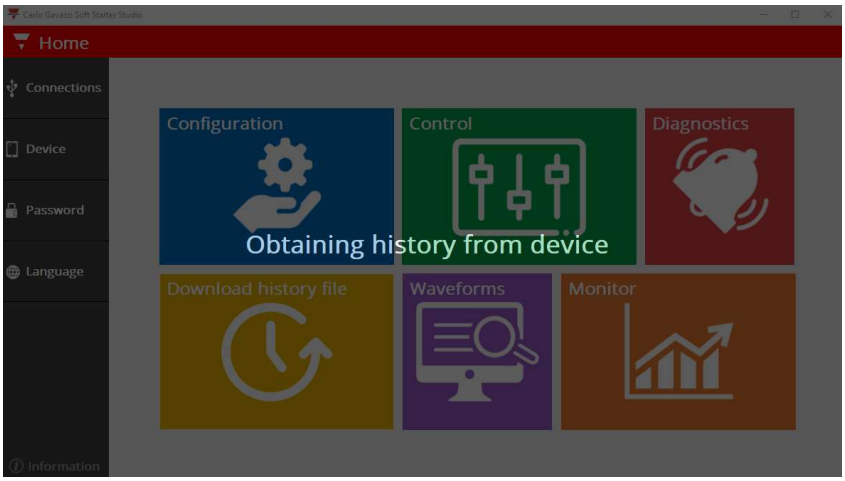
For further information on the content of the history file we advise you to contact Carlo Gavazzi sales support.

Procedure to download the history file:

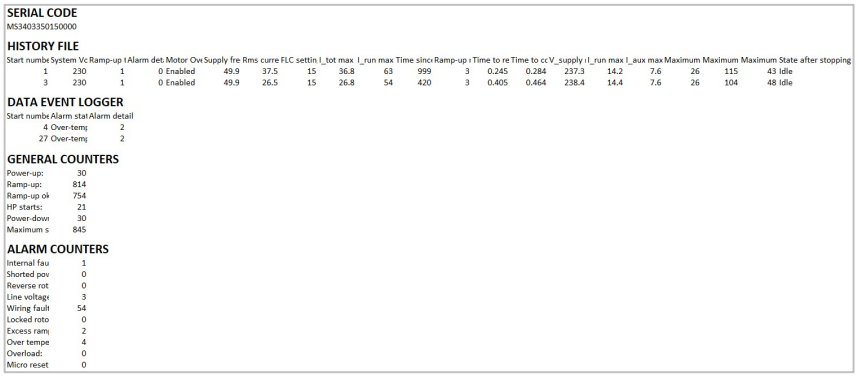
1. Click on the Download history block

Make sure that motor is not running (i.e. motor starter is not in ramp/bypass state).

2. The software starts to extract history data from devicve. This process should take approximately 5 seconds.



3. Save the history file at any desirable location on the PC.


SERIAL CODE
MS3403350150000

HISTORY FILE

Start numbe	System Vc	Ramp-up t	Alarm det	Motor Ov	Supply fre	Rms curre	FLC settin	I_tot max	I_run max	Time sinc	Ramp-up t	Time to re	Time to cc	V_supply r	I_run max	I_aux max	Maximum	Maximum	Maximum	State after stopping
1	230	1	0	Enabled	49.9	37.5	15	36.8	63	999	3	0.245	0.284	237.3	14.2	7.6	26	115	43	Idle
3	230	1	0	Enabled	49.9	26.5	15	26.8	54	420	3	0.405	0.464	238.4	14.4	7.6	26	104	48	Idle

DATA EVENT LOGGER

Start numbe	Alarm stat	Alarm detail
4	Over-tem	2
27	Over-tem	2

GENERAL COUNTERS

Power-up:	30
Ramp-up:	814
Ramp-up ok	754
HP starts:	21
Power-down	30
Maximum s	845

ALARM COUNTERS

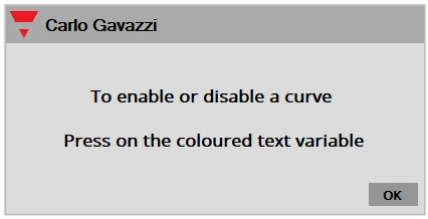
Internal fau	1
Shorted pov	0
Reverse rot	0
Line voltage	3
Wiring fault	54
Locked roto	0
Excess ram	2
Over tempe	4
Overload:	0
Micro reset	0

4.6 Waveforms

This page is similar to an oscilloscope where you can monitor the following variables:

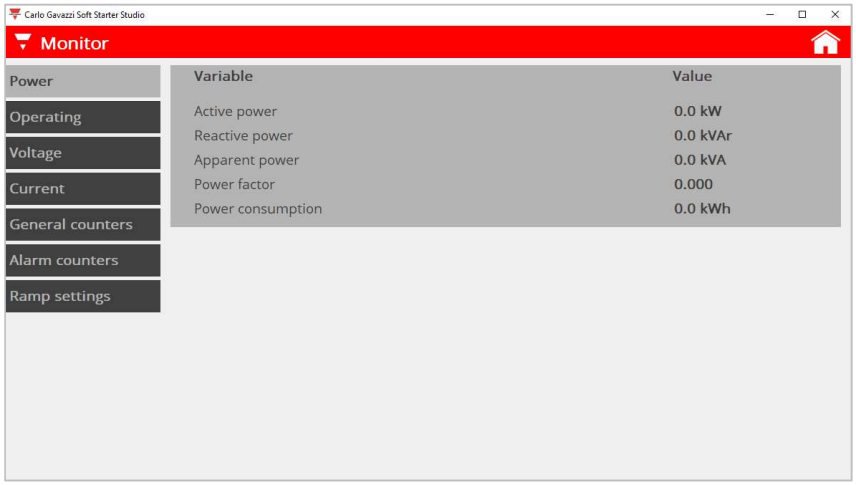
a. Voltage in each phase (V L-N, V M-N, V A-N)
b. Current in each phase (I TOT, I MAIN, I AUX)
c. Power (Active, Reactive, Apparent, Power factor)
d. Temperature (TCU, NTC, Junction, Virtual motor)

The junction and virtual motor temperatures are password protected variables.

Icon	Definition	Description
	Enable preview	Unfreeze the screen
	Disable preview	Screen freeze to capture a screenshot
	Time base	4x time bases: 10s, 20s, 30s, 40s
	Information	To enable or disable a curve, press the coloured text variable 

4.7 Monitor

The *Monitor* page lists the instantaneous variables and the counters available in the HDMS motor starter units.



This page lists all variables available for the device divided into 7 groups:

a. Power

Variable	Value
Active power	0.0 kW
Reactive power	0.0 kVAr
Apparent power	0.0 kVA
Power factor	0.000
Power consumption	0.0 kWh

b. Operating

Variable	Value
Frequency	49.97 Hz
Thermal capacity used	0.0 %
NTC temperature	37.21 °C
Junction temperature	Password protected
Virtual motor temperature	Password protected

The junction and virtual motor temperatures are password protected variables.

c. Voltage

Variable	Value
V L-N	232.6 Vrms
V M-N	2.2 Vrms
V A-N	2.4 Vrms

d. Current

Variable	Value
I TOT	0.0 Arms
I MAIN	0.0 Arms
I AUX	0.0 Arms
Maximum I TOT at ramp-up	0.3 Arms
Maximum I MAIN at ramp-up	0.0 Arms
Maximum I AUX at ramp-up	0.5 Arms
Maximum I TOT at bypass	0.0 Arms
Maximum I MAIN at bypass	0.0 Arms
Maximum I AUX at bypass	0.0 Arms
Maximum I TOT at ramp-down	0.3 Arms
Maximum I MAIN at ramp-down	0.1 Arms
Maximum I AUX at ramp-down	0.3 Arms

e. General counters

Variable	Value
Number of ramp-up	5
Running hours	0 hr
Running seconds	0 s
Maximum start time	0 ms
Number of HP starts	0
Number of power-up	12
Number of power-down	11
Time from last stop	65535 s
Time from last start	65535 s

f. Alarm counters

Variable	Value
Internal fault	0
Shorted power unit	0
Reverse rotation	0
Line voltage out of range	0
Wiring fault	5
Locked rotor	0
Excess ramp-up time	0
Over temperature	0
Overload	0
Micro-reset	0

g. Ramp settings

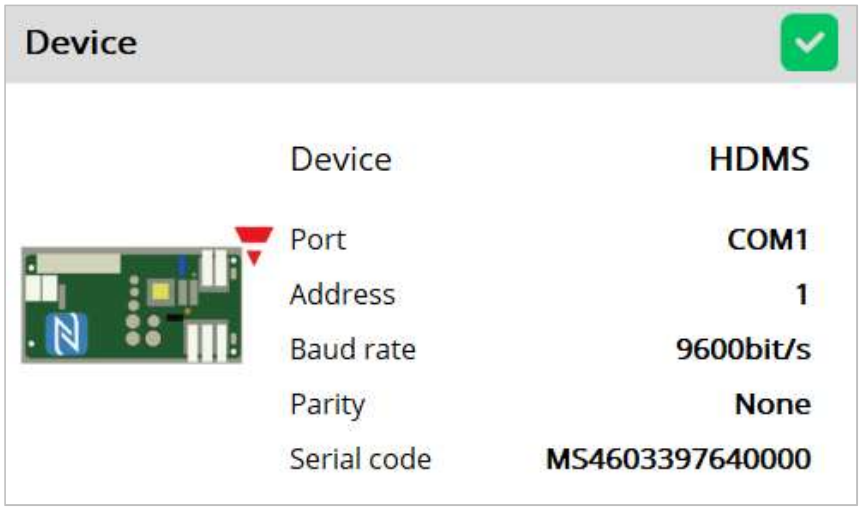
Variable	Value
Ramp-up	1 s
Ramp-down	0 s
Full load current	37 A
Current limit ratio	1.3
System voltage	230.0 V

4.8 Device

The *Device* menu displays information on the device that it is communicating with the software.

Device menu if communication is not established:

Device menu if communication is established:



It provides information about the device, comport, address, baud rate, parity and serial code.

4.9 Password

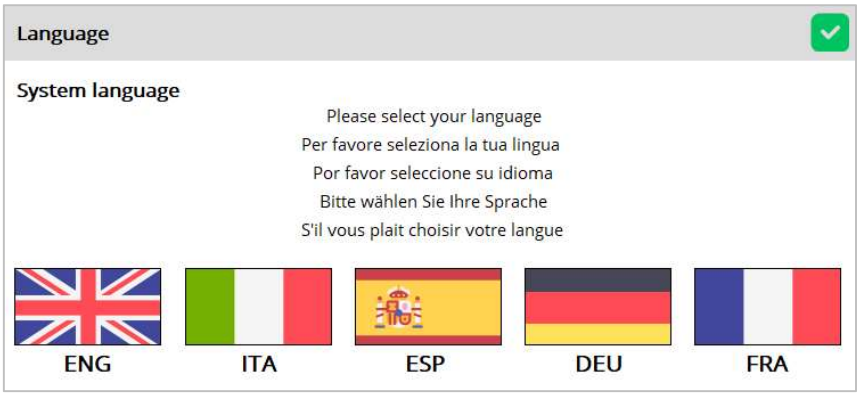
When you select the *Password* menu, the following window appears:

To unlock protected settings and variables, please enter the correct access code. The access code can be obtained from Carlo Gavazzi sales support.

4.10 Language

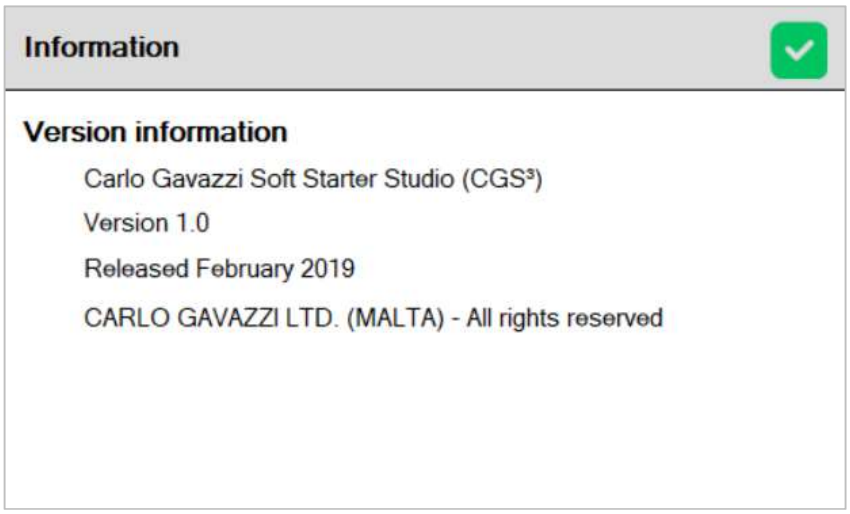
The following languages for the CGS[3] are available:

a. English (ENG)
b. Italian (ITA)
c. Spanish (ESP)
d. German (DEU)
e. French (FRA)



4.11 Information

The *Information* menu displays information on the software version and release date.



Chapter 5 Modbus RTU Protocol

5.1 Introduction

Modbus RTU protocol is a messaging structure used to establish master-slave communication between devices in which only one device (called master) can initiate transactions (called queries); the other devices (called slaves) respond with the requested data to the master.

5.2 Modbus RTU functions

The following Modbus functions are available on the HDMS motor starters:

- Reading of n “Input register” (code 04h)
- Writing of one “holding register” (code 06h)
- Broadcast mode (code 00h)

In this document, the Modbus address field is indicated in two modes:

- *Modicon address*: it is the 6-digit Modicon representation with Modbus function code 04h (Read input registers).
- *Physical address*: it is the word address value included in the communication frame.

Read Input Registers (04h):

This function code is used to read the contents of 1 input register (word). The request frame specifies the starting register address and the number of registers to be read.

The register data in the response message is packed as two bytes per register (word), with the binary contents right justified within each byte. For each register, the first byte contains the high order bits (MSB) and the second contains the low order bits (LSB).

The only exceptions are:

- History file readout

Request Frame:

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	04h	-
Starting Address	2 bytes	000Bh to 00E8h	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	1h to 78h (1 to 120)	Byte order: MSB, LSB – As stated above no contiguous registers can be read. The values 1 to 78h are the minimum and maximum numbers respectively that are accepted. Each read function should be separately called using the number stated in the field named ‘Length (words)’.
CRC	2 bytes	-	-

Response Frame (correct action):

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	04h	-
Byte Count	1 byte	N word * 2	-
Register Value	N* 2 bytes	-	Byte order: MSB, LSB
CRC	2 bytes	-	-

Response Frame (incorrect action):

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	84h	-
Exception Code	1 byte	01h, 02h, 03h, 06h	Possible exception: 01h: illegal function 02h: illegal data address 03h: illegal data value 06h: slave device busy
CRC	2 bytes	-	-

Write Single Holding Register (06h):

This function code is used to write a single holding register. The Request frame specifies the address of the register (word) to be written and its contents.

The correct response is an echo of the request, returned after the register contents have been written.

Request Frame:

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	06h	-
Starting Address	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
Quantity of Registers (N word)	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes	-	-

Response Frame (correct action):

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	06h	-
Starting Address	2 bytes	0000h to 00E3h	Byte order: MSB, LSB
Register Value	2 bytes	0000h to FFFFh	Byte order: MSB, LSB
CRC	2 bytes	-	-

Response Frame (incorrect action):

Description	Length	Value	Note
Physical Address	1 byte	1h to F7h (1 to 247)	-
Function Code	1 byte	86h	-
Exception Code	2 bytes	01h, 02h, 03h, 06h	Possible exception: 01h: illegal function 02h: illegal data address 03h: illegal data value 06h: slave device busy
CRC	2 bytes	-	-

Broadcast Mode (00h)

In broadcast mode the master can send a request (command) to all the slaves. No response is returned to broadcast requests sent by the master. It is possible to send the broadcast message only with function code 06h and using address 00h.

5.3 Register Map

Data Format Representation

Format	IEC data type	Description	Bits	Range
UINT16	UINT	Unsigned integer	16	0…65535

Group Description

Group	Description
Communication Parameters	Includes the communication parameters of the device
Device Settings	Indicates the settings of the device
Device Status	Describes the status of the device and other parameters of the device
Control	Includes several functions to control the device
Delays	Includes the delays related to stop-to-start and start-to-start intervals
Protection Settings	Includes information on alarm limits
History File	Contains information about the last starts storef in the memory of the device. For further information on the history file refer to Appendix
Alarm Counters	Lists the number of times a particular alarm has occurred
General Counters	Includes counters related to operational use
Instantaneous Voltage and Current	Lists the instantaneous electrical variables (voltage and current)
Maximum Current Variables	Lists the maximum current measured on each phase during ramp-up, bypass and ramp-down
Instantaneous Power Variables	Lists all information related to power
Serial code	Contains information on the serial number of the device

Communication Parameters

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Device Address	✓	✓	2000h	1	UINT16	1	Device Address [x1] 1: Device Address 1 2: Device Address 2 . . . 247: Device Address 247
Baud Rate	✓	✓	2001h	1	UINT16	0	Baud Rate [x1] 0: 9600bps 1: 19200bps 2: 38400bps 3: 57600bps
Parity	✓	✓	2002h	1	UINT16	0	Parity [x1] 0: No Parity, 2 stop bits 1: Odd Parity, 1 stop bit 2: Even Parity, 1 stop bit

Device Settings

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Ramp-up (s)	✓	X	8000h	1	UINT16	1	N/A [x1000]
Ramp-down (s)	✓	X	8001h	1	UINT16	0	N/A [x1000]
Full load current (A_{RMS})	✓	✓	8002h	1	UINT16	Device rated current	2.0 … Device rated current [x10]
Current Limit Ratio	✓	X	8003h	1	UINT16	Device dependent	N/A [x10]
System Voltage	✓	X	8007h	1	UINT16	Device dependent	110 / 230 VAC [x10]

Device Status

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Soft Starter Status	✓	X	5000h	1	UINT16	-	0: Idle 1: Ramp-up 2: Bypass 3: Ramp-down 4: Alarm 5: Alarm Recovery
Top of ramp (TOR) relay status	✓	X	5001h	1	UINT16	-	0: TOR relay is OFF 1: TOR relay is ON
Alarm relay status	✓	X	5002h	1	UINT16	-	0: Alarm relay is OFF 1: Alarm relay is ON
Control Input – Status A1-	✓	X	5006h	1	UINT16	-	0: Switch OFF 1: Switch ON
Alarm status	✓	X	5007h	1	UINT16	-	Outputs a number equal to number of flashes of alarm issued.

No of Flashes	*Alarm Status*
0	No alarm
1	Internal fault
2	Reverse rotation
3	Line voltage out of range
4	Wiring fault
5	Locked rotor
6	Excess ramp-up time
7	Over temperature
8	Overload
9	Micro-reset
10	Short-circuit

Soft Alarm Reset	X	✓	5009h	1	UINT16	-	0: No action 1: Reset alarm

Control

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Control Mode	✓	✓	7000h	1	UINT16	0	0: A1, A2 control mode 1: Modbus control mode
Control Input Status - Modbus	✓	✓	7001h	1	UINT16	-	0: Switch OFF 1: Switch ON
Force Refresh Signal	✓	✓	7002h	1	UINT16	0	0: Disable 1: Enable
Refresh Interval (s)	✓	✓	7003h	1	UINT16	10	1 … 600 [x1]
Force Refresh Signal (Heartbeat Signal)	✓	✓	7004h	1	UINT16	-	1: To send force refresh signal. If force refresh signal mode is enabled, this register has to be set to 1 within every refresh interval otherwise the HDMS unit will switch OFF the output.

Delays

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Minimum Stop to Start Delay (s)	✓	✓	9000h	1	UINT16	0	0 … 65535 [x1]
Minimum Start to Start Delay (s)	✓	✓	9001h	1	UINT16	0	0 … 65535 [x1]
Time from Last Stop (s)	✓	X	9002h	1	UINT16	-	0 … 65535 [x1]
Time from Last Start (s)	✓	X	9003h	1	UINT16	-	0 … 65535 [x1]

Protection Settings

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Auto adapt	✓	✓	A000h	1	UINT16	Enable	0: Disable 1: Enable
Over Voltage Supply Limit (%)	✓	X	A001h	1	UINT16	20.0	1.0 … 150.0 [x10]
Under Voltage Supply Limit (%)	✓	X	A002h	1	UINT16	20.0	1.0 … 61.7 [x10]
I_{MAX} Bypass (A_{rms})	✓	X	A004h	1	UINT16	Device dependent	12.6 … 38.9 [x10]
Motor Overload alarm mode	✓	✓	A006h	1	UINT16	0001h	0: Enable 1: Disable
Alarm relay mode	✓	✓	A007h	1	UINT16	0000h	0: Normally closed 1: Normally open
Bypass relay mode	✓	✓	A008h	1	UINT16	0001h	0: Normally closed 1: Normally open 2: Booster kit (Normally closed)

History File

The history file allows you to download a series of data related to the last 32 starts done by the device.

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Start 1 to Start 4	✓	X	C000h	64	UINT16	-	N/A [x1]
Start 5 to Start 8	✓	X	C001h	64	UINT16	-	N/A [x1]
Start 9 to Start 12	✓	X	C002h	64	UINT16	-	N/A [x1]
Start 13 to Start 16	✓	X	C003h	64	UINT16	-	N/A [x1]
Start 17 to Start 20	✓	X	C004h	64	UINT16	-	N/A [x1]
Start 21 to Start 24	✓	X	C005h	64	UINT16	-	N/A [x1]
Start 25 to Start 28	✓	X	C006h	64	UINT16	-	N/A [x1]
Starts 29 to Start 32	✓	X	C007h	64	UINT16	-	N/A [x1]

Alarm Counters

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Internal fault	✓	X	6000h	1	UINT16	-	0 … 65535 [x1]
Short-circuit	✓	X	6001h	1	UINT16	-	0 … 65535 [x1]
Reverse rotation	✓	X	6002h	1	UINT16	-	0 … 65535 [x1]
Line voltage out of range	✓	X	6003h	1	UINT16	-	0 … 65535 [x1]
Wiring fault	✓	X	6004h	1	UINT16	-	0 … 65535 [x1]
Locked Rotor	✓	X	6005h	1	UINT16	-	0 … 65535 [x1]
Excess ramp-up time	✓	X	6006h	1	UINT16	-	0 … 65535 [x1]
Over temperature	✓	X	6007h	1	UINT16	-	0 … 65535 [x1]
Overload	✓	X	6008h	1	UINT16	-	0 … 65535 [x1]
Micro-reset	✓	X	6009h	1	UINT16	-	0 … 65535 [x1]

General Counters

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
kWh	✓	X	4000h	1	UINT16	-	0 … 65535 [x1]
Overflow of kWh counter	✓	X	4001h	1	UINT16	-	0 … 65535 [x1]
Number of starts	✓	X	4002h	1	UINT16	-	0 … 65535 [x1]
Overflow of number of starts	✓	X	4003h	1	UINT16	-	0 … 65535 [x1]
Running hours (hr)	✓	X	4004h	1	UINT16	-	0 … 65535 [x1]
Running seconds (s)	✓	X	4005h	1	UINT16	-	0 … 65535 [x1]
Maximum start time (ms)	✓	X	4006h	1	UINT16	-	0 … 65535 [x1]
Number of HP starts	✓	X	4007h	1	UINT16	-	0 … 65535 [x1]
Number of power up	✓	X	4008h	1	UINT16	-	0 … 65535 [x1]
Number of power down	✓	X	4009h	1	UINT16	-	0 … 65535 [x1]

Instantaneous Voltage and Current

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
V L-N (V_{RMS})	✓	X	3000h	1	UINT16	-	N/A [x10]
V M-N (V_{RMS})	✓	X	3001h	1	UINT16	-	N/A [x10]
V A-N (V_{RMS})	✓	X	3002h	1	UINT16	-	N/A [x10]
I TOT (A_{RMS})	✓	X	3003h	1	UINT16	-	N/A [x10]
I MAIN (A_{RMS})	✓	X	3004h	1	UINT16	-	N/A [x10]
I AUX (A_{RMS})	✓	X	3005h	1	UINT16	-	N/A [x10]

Maximum Current Variables

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
I TOT Ramp-up (A_{RMS})	✓	X	4100h	1	UINT16	-	N/A [x10]
I MAIN Ramp-up (A_{RMS})	✓	X	4101h	1	UINT16	-	N/A [x10]

I AUX Ramp-up (A_{RMS})	✓	X	4102h	1	UINT16	-	N/A [x10]
I TOT Bypass (A_{RMS})	✓	X	4103h	1	UINT16	-	N/A [x10]
I MAIN Bypass (A_{RMS})	✓	X	4104h	1	UINT16	-	N/A [x10]
I AUX Bypass (A_{RMS})	✓	X	4105h	1	UINT16	-	N/A [x10]
I TOT Ramp-down (A_{RMS})	✓	X	4106h	1	UINT16	-	N/A [x10]
I MAIN Ramp-down (A_{RMS})	✓	X	4107h	1	UINT16	-	N/A [x10]
I AUX Ramp-down (A_{RMS})	✓	X	4108h	1	UINT16	-	N/A [x10]

Instantaneous Power Variables

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
P_{output} (kW)	✓	X	3100h	1	UINT16	-	N/A [x10]
Q_{output} (kVAr)	✓	X	3101h	1	UINT16	-	N/A [x10]
S_{output} (kVA)	✓	X	3102h	1	UINT16	-	N/A [x10]
PF Total Total	✓	X	3103h	1	UINT16	-	N/A [x1000]
Frequency (Hz)	✓	X	3104h	1	UINT16	-	N/A [x100]
TCU (%)	✓	X	3108h	1	UINT16	-	N/A [x10]
NTC Temperature	✓	X	3109h	1	UINT16	-	N/A [+27300 & x100]

Serial Code

Description	Function		Physical Address	Length (words)	Data Format	Default value	Range [Scaling Factor]
	R	W					
Order number	✓	X	8F00h	1	UINT16	-	Manufacturing plant [x1] (Change to ASCII)
	✓	X	8F01h	1	UINT16	-	Year of manufacture [x1] (Change to ASCII)
	✓	X	8F02h	1	UINT16	-	Week of manufacture [x1]
	✓	X	8F03h	1	UINT16	-	Order number (LSW) [x1]
	✓	X	8F04h	1	UINT16	-	Order number (MSW) [x1]
Serialisation	✓	X	8F05h	1	UINT16	-	Device number within particular order [x1]

The complete device serial number is made up of the combination of the *Order Number* and *Serialisation*.