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HUMAN-MACHINE INTERFACE M822E ON CHLORIDE® SYSTEMS

Features and capabilities of the M822E touchscreen offered on Chloride® Uninterruptible Power Supply Systems

Foreword

The technical specification for an industrial UPS system generally defines the recommended technology, the features, configurations, the required operation modes, etc.

Then comes the communication part, and particularly the Human-Machine Interface (HMI). The UPS interface often comes second as it is mainly used to locally check the operating state of the UPS and to visualize some electrical measurements. In addition, a UPS is generally remotely monitored from a control room by mean of a communication protocol. Consequently, one may usually find typical sentences inside the UPS technical specification so that the system shall include a local human-machine interface to monitor and control the UPS and to allow for the visualization of the status, alarms and measurements of the system. However, a Human-Machine Interface can bring real benefits if it is used judiciously.

The purpose of this document is to describe all the functionalities provided by the M822E Human Machine Interface which is integrated into Chloride® industrial Uninterruptible Power Supply (UPS) systems, as well as the benefits that this interface provides.

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Summary

Introduction

Technology has a huge impact on our daily life, especially the touchscreen technology. Thanks to the availability of "multitouch" devices, such as smartphones or touchscreen tablets, we have now access to information in the fastest and most convenient way.

In such a context, the constant evolution of technology pushes the manufacturers to equip their industrial machines with touchscreens to satisfy their customers, by offering the easy-to-use touch technology on specific industrial systems.

However, industrial reality forces their technological choices: First, the low production volumes of specific machines is a selection mean for manufacturers to leave aside the technology used on smartphones, because these are produced on a large scale and therefore benefit from a reduced production cost. Then, the operation conditions and the industrial environments help doing the choice of the most robust technologies.

These are the main reasons why industrial Uninterruptible Power Supply systems are usually provided with basic Human-Machine Interfaces: one or more lines of characters allow to check the status and alarms of the system and, a simplified single-line diagram with integrated LEDs gives a simplified view of the system.

The M822E Human-Machine Interface provided with Chloride® industrial Uninterruptible Power Supply systems takes you further by providing you with a unique experience.

1 Presentation of the M822E HMI (Human-Machine Interface)

The M822E Human-Machine Interface is a color touchscreen that is convenient, easy to use, intuitive and multilingual. It facilitates the interaction of the operator with the UPS through its enhanced capabilities to diagnose, measure, record and analyze.

The M822E screen is made of the following elements:

- 3 light emitting diodes (LED) visually inform the user of the UPS status. These LEDs are positioned above the screen.
- A 7'' LCD (Liquid Crystal Display) touchscreen is able to detect the location of a touch on the displaying area. Dimensions of the screen are approximately 16cm x 9cm.
- An audible warning device is used to inform the operators about UPS faults. This function is integrated to the touchscreen casing.
- An external USB connector is dedicated to some specific operations on the UPS system. This connector is protected by a cap.

Figure 1 : Overview of the Chloride® M822E HMI

The M822E displaying unit is connected to the UPS electronic system via the internal CAN bus (Controller Area Network), originated from the car manufacturing industry. Thanks to the CAN bus, the M822E can receive information and messages from all components that are connected to this field bus.

Should the HMI fail, or should the CAN bus be inadvertently disconnected, the UPS would remain operational. Indeed, the HMI is only a monitoring device that collects the information on the CAN bus, but the control of the UPS remains performed by the system internal electronic pcb's (printed circuit boards).

1.1 The light emitting diodes (LEDs)

The M822E display incorporates 3 light-emitting diodes (LEDs) indicating the overall operating status of the system (charger, inverter, or UPS) as well as its subassemblies.

Even if these LEDs operate in conjunction with the active mimic shown on the LCD display, they work independently from the screen, i.e., the touchscreen does not need to be active for the LEDs to be lighted (the screen can be in sleep mode).

In addition, the LEDs operate independently one from another: they can light up simultaneously according to the situation.

A detailed description of the diodes is given in the table below.

LED	LED color and behavior	Description		Comments
		On AC system	On DC system	
	Steady green	• Normal operation • Load supplied by the inverter • Battery is kept charged • Charger is running	• Normal operation • Load supplied by the rectifier-charger • Battery is kept charged • Charger is running	/
	Flashing green	• Load on inverter (running on battery) • Charger is off	• Load on battery • Charger is off	/
		• Load on inverter (battery is disconnected) • Charger is running	• Load on rectifier-charger (battery is disconnected) • Charger is running	• Output protection is closed • Battery protection is open
		• Load on reserve line	/	• Output protection is closed • Reserve line is OK
		• Load on reserve line and maintenance bypass switch in maintenance position	/	• Output protection is closed • The maintenance switch is closed • The display will automatically switch off
	Steady yellow	• UPS warning	• DC system warning	• One (or more) warning message is active
	Flashing yellow	• UPS information	• DC system information	• One (or more) information message is active
	Steady red	• UPS blocking fault	• DC system blocking fault	• One (or more) system block is faulty and stopped • One (or more) fault message is active (acknowledgement is needed)
	Flashing red	• UPS non-blocking fault	• DC system non-blocking fault	• One (or more) system block is faulty, but not stopped • One (or more) fault message is active (acknowledgement is needed)
		• CAN communication fault	• CAN communication fault	• The system internal communication CAN bus is not correctly plugged-in or is in failure

Figure 2 : Operation description table of the LEDs of the M822E HMI.

1.2 The LCD touchpad

The M822E display is a microprocessor-based touchscreen, with built-in RAM and ROM. It is perfectly adapted for use in industrial environments thanks to several major features:

M822E display benefits from the "resistive touch" technology: it is widely used in the fields of automation, medical and industry as it is perfectly adapted for these conditions of use; Indeed, the resistive touchscreen can identify the touch of a gloved finger, a fingernail or any object capable of creating sufficient pressure. Thus, this technology ensures the safety of the user since the latter can keep his PPE (personal protective equipment).

Figure 3 : M822E HMI is compatible with PPE

- M822E display uses the « single touch » technology: The touch controller detects single touch gestures done with a finger or a stylus. The « single touch » technology was chosen to limit the sensitivity to one touch at a time (as opposed to « multi-touch » technology) to avoid operators mistakes.
- M822E display successfully passed several harsh environment tests: It was tested at 95°C and was submitted to the damp heat cyclic test, dry heat test, earthquake resistance test, IP (Ingress Protection) test.

1.3 The buzzer

M822E display is provided with a built-in buzzer to signal anomalies of the system. In standard configuration, the buzzer is activated and operates as follow:

- As soon as a fault, alarm or information message appears, an intermittent audible alarm sound. The sound can be stopped by pressing the Stop buzzer button (see paragraph on function buttons)
- When the system has been running on battery and when the battery is close of its end of autonomy, the "Imminent battery shutdown" alarm appears, which triggers the permanent audible alarm. Again, the sound can be stopped by pressing the Stop buzzer button (see paragraph on the function buttons).

The buzzer automatically stops when no more fault, alarm or information message is active.

It is possible to configure the buzzer via the display configuration page, so that the buzzer can be permanently set to active mode or inactive mode.

1.4 The USB port

The M822E display is equipped with an external USB port which, for safety reasons, can only perform some functions:

- Flashing the M822E displaying unit, i.e., installing or updating the version of software used by the display
- Configuring the M822E displaying unit, i.e., defining what needs to be shown on the screen
- Exporting some information about the Chloride system.

SUMMARY

- The HMI display of Chloride® systems employs resistive, one-touch technology, known for its reliability and robustness in harsh conditions, such as those of industrial sites.
- It features 3 LEDs and a buzzer, to signal the system status, as well as a USB port to allow some dedicated operations.

2 Navigation in the M822E HMIThe M822E display offers an intuitive touchscreen navigation.

The touch area is divided into 3 zones:

- The top banner includes general UPS control functions as well as some important functions.
- The central part of the screen is the area where information, messages, measurements, single-line diagram are displayed. It also includes some specific action buttons.
- The bottom banner includes the navigation buttons to switch from one page to another.

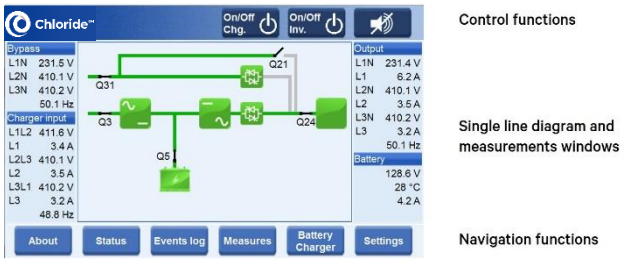


Figure 4 : The 3 areas of the touchscreen

2.1 The home page

By default, the home page of the M822E displays the active mimic diagram of the system.

The displayed mimic varies according to the type of system, as shown on the 3 figures hereafter.

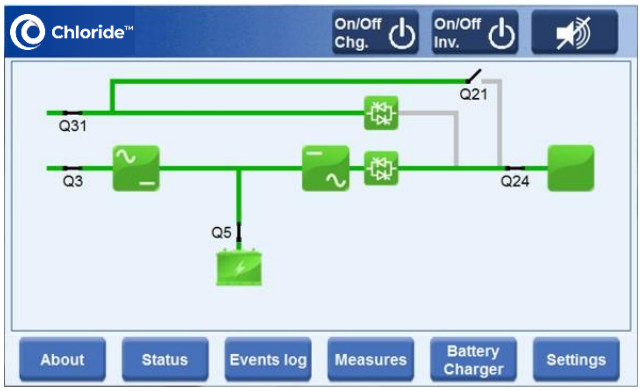


Figure 5 : Home page of an AC UPS

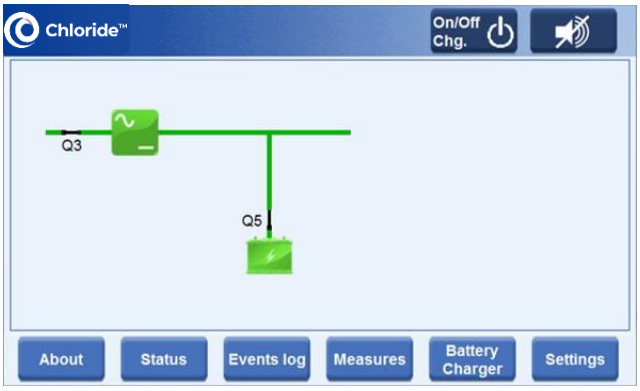


Figure 6 : Home page of a DC UPS

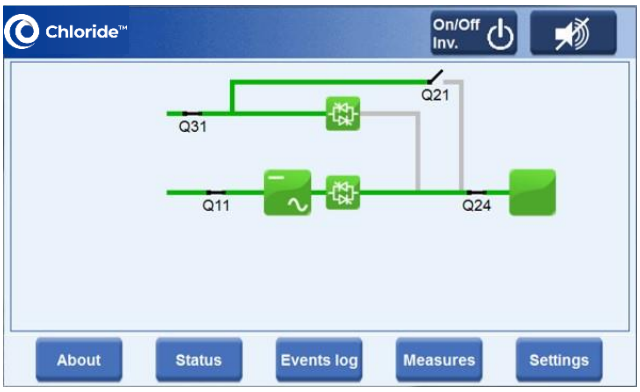


Figure 7 : Home page of an inverter

By using the Settings page, it is possible to configure the home page so that the input and / or the output values of the system can be displayed.

Here is an example of the home page of an AC UPS with all the measurements values being displayed.

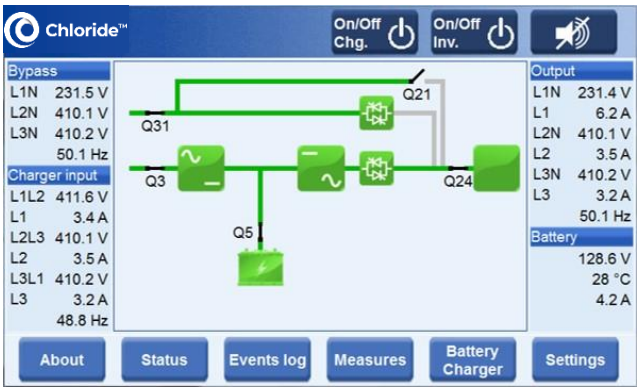


Figure 8 : Home page set with all measurements

2.2 The function buttons

The function buttons are available on the home page, on the top banner of the screen.

For example, in the case of an AC UPS, the top banner displays the following buttons:

On/Off charger. According to the current state of the rectifier/charger and after confirmation of the request, this button sends a start or stop command to the rectifier/charger module.

On/Off inverter. According to the current state of the inverter and after confirmation of the request, this button sends a start or stop command to the inverter module.

Mute buzzer. This button mutes the sound of the buzzer that was previously activated due to the appearance of an information, alarm or fault message.

2.3 The navigation buttons

The navigation buttons are available on the bottom banner of all pages of the screen.

Figure 9 : Navigation buttons

The navigation buttons give access to the following pages:

1. The « About » page displays various information such as the serial number, the software versions, the IP address, etc. This button is only accessible from the home page.

2. The « Status » page displays the current state of the system. The blocks dynamically change color with the incident level.

3. The « Events log » page displays the history of the recorded events with date, time and description of the event.

4. The “Measurements” page displays the main measurements for each block according to the type of system (Rectifier, Battery, Inverter, Bypass line, and Load).

5. The "Battery charger" page allows the operator to modify the current battery charging mode or to initiate a battery test.

6. The "Settings" page allows the operator to modify the display settings such as language, brightness, measurements, etc.

2.4 Access to the block's information

From the home page, it is possible to directly access the status of a sub-assembly by simply clicking on it.

As shown on the example below, the click on the bypass static switch triggers the display of the corresponding page.

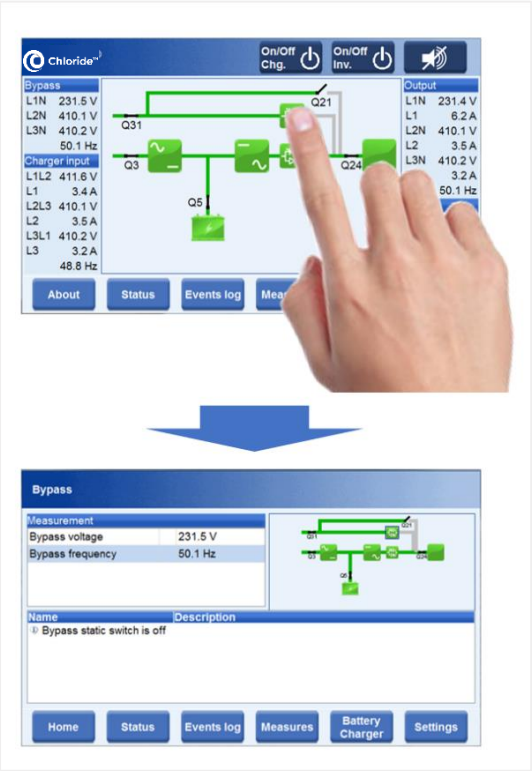


Figure 10 : Direct navigation on the single-line diagram

Every bloc page is divided into 3 parts:

- At the top right is the synoptic of the system that highlights the block concerned by the page being viewed
- At the top left are shown the measurements that are related to the visualized block
- The bottom part displays the current state of the concerned block.

SUMMARY

- The simple touch navigation of the M822E display on Chloride® systems is very intuitive. The HMI screen includes action buttons to start and stop the system, navigation buttons to easily find the information needed. The main view can be configured so that the user can show or hide essential systems measurements. The single-line diagram is also interactive so that the information to a functional block is easily accessed via a simple touch.

3 Information in the M822E HMI

The information available in the Chloride® M822E HMI is categorized by type and can be identified by criticality level and by color code.

3.1 Message categories

The M822E display of Chloride® systems includes 4 categories of messages. These categories correspond to different degrees of importance of the message. They are represented by 4 symbols being used on several screens, and particularly on the block's pages, on the "Status" page, as well as on the "Events log" page. These symbols, their corresponding category and their impact on the system operation are described in the table below.

3.2 Sub-assembly color coding

The sub-assemblies (blocks) represented on the active mimic diagram of the home page dynamically change color according to their status, i.e., according to the category of the active message on each block.

The block systematically takes the color that represents the most important message category.

Block color	Description
	No information, no warning, no fault. The block is in perfect operation condition.
	At least one information or one warning message is active on the block. No fault is present on the block.
	One or more fault message is active on the block. The block may also have information or warning messages that are active.
	Communication was lost.

Figure 11 : Description table of the block color coding

Symbol	Category	Description
	Status	A message displayed with this symbol shows the current status of a block. Each block can take several statuses.
	Information	A message displayed with this symbol indicates that an event due to external conditions (or due to the operator) has occurred. This event does not stop the associated block and the event is not memorized, which means that it will self-disappear without the need for intervention.
	Warning	A message displayed with this symbol indicates that an event due external conditions (or due to the operator) has occurred and that this event stops the associated block. This event is not memorized, which means that it will self-disappear without the need for intervention.
	Fault	A message displayed with this symbol highlights the occurrence of a blocking fault, meaning a failure of the system resulting in the shutdown of the associated functional block. A maintenance operation must be performed to solve the issue. This event is memorized and must therefore be acknowledged.

Figure 12 : Description table of symbols and of categories of messages in the Chloride® M822E HMI

3.3 Color-coding of the Status button

In the same way as the blocks from the active mimic, the « Status » button from the home page also dynamically changes its color and its text according to the state of the sub-assemblies of the system.

This button always takes the most important state: for example, if 2 alarm messages and 1 fault message are active, priority will be given to the fault message. Thus, the button will turn red with the text "Fault".

Thus, the « Status » button can take one of the following 4 states:

Button color	Description
Status	The system is in normal operation status.
Info	As an information message is triggered, the button turns yellow and displays the text “Info”. This means that at least one information message is active and that no alarm or fault message is present.
Warning	As a warning message is triggered, the button turns yellow and displays the text “Warning”. This means that at least one warning message is active and that no fault message is present.
Fault	As a fault message is triggered, the button turns red and displays the text “Fault”. This means that at least one fault message is present.

Figure 13 ; Description table of the Status button

Here is an example of active mimic situation and how to understand it:

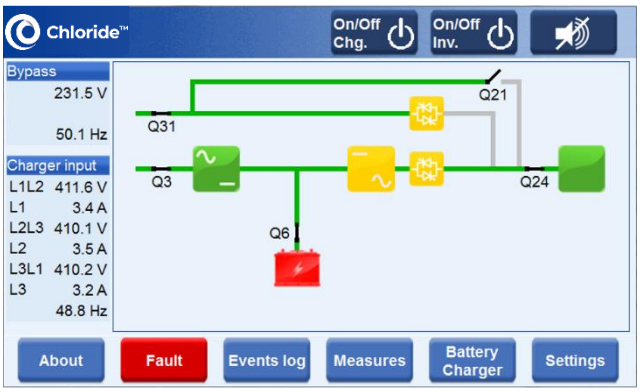


Figure 14 : Example of synoptic situation

On this active mimic view, we can see that:

- The load is supplied by the inverter, which itself is supplied by the rectifier/charger, the latter being supplied by the mains power supply network. This is represented on the active mimic by the green power line.
- The rectifier/charger block is green, which means it is in perfect operation conditions.
- The inverter and static-switch blocks are yellow, which means that information or warning messages are triggered on these blocks.
- The battery block is red, indicating the presence of a fault message on the battery.
- The “Status“button turned red with “Fault“ text which means that a fault is present on the system.

3.4 The system status page

From the home page, it is possible to directly access the detailed status of the complete system.

By clicking the “Status” button (or “Info”, “Warning” or ”Fault” according to the button state), the operator accesses to the system status page. This page is split in categories that correspond to the sub-assemblies of the system.

Figure 15 : Navigation to the System Status page

In the example of an AC UPS given above, touching the “Fault” button allows to display the System status page, on which we can see that:

- The system performed a battery test, and it was unsuccessful. This indicates that a battery check should be done. This triggered a fault message in the system.
- The inverter is in current limitation operation mode, which may mean an overload. This triggered an information message in the system.
- The bypass line static switch detected that the frequency of reserve line is out of tolerances. This triggered a warning message in the system.
- The battery is charging, the bypass line static switch is off, the inverter is on. This is displayed as 3 statuses in the system.

3.5 List of messages per block

The list of available measurements, information, warning and fault messages per block is given in Appendix, according to the type of system. This information may vary depending on the type of system, the configuration and the options provided.

3.6 The measurements page

From the home page, it is possible to directly access the measurements of the system.

By clicking the “Measures” button, the operator accesses to the measurements page. This page is split in several tabs that correspond to the sub-assemblies of the system.

In the example of an AC UPS given below, touching the “Measures” button allows to display the Measures page with all its tabs.

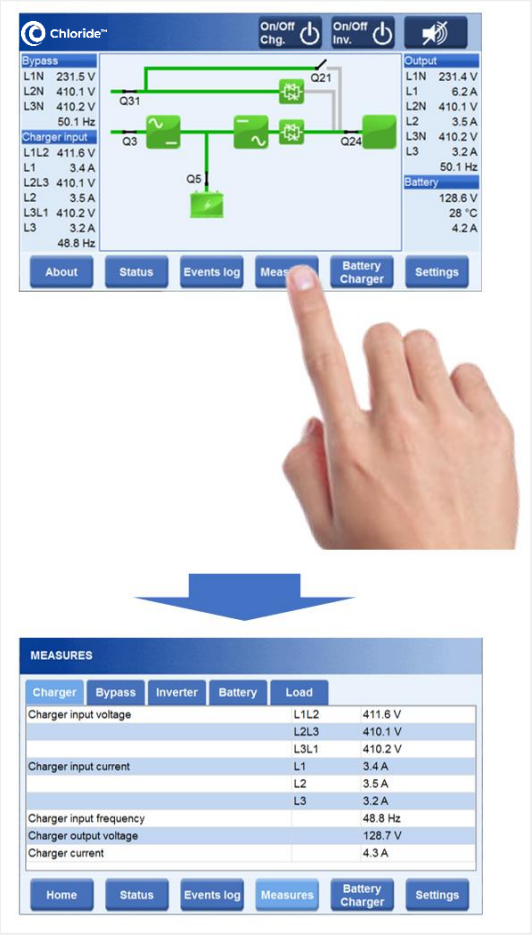


Figure 16 : Navigation to the Measures page

Each type of Chloride® system equipped with the M822E HMI offers a number of measurement tabs corresponding to the subassemblies of the system. The availability of the measurement tabs is given in the table below.

Measurement tab	CP70Z AC UPS	CP70R charger DC UPS	CP70i inverter DC/AC
Charger	✓	✓	-
Battery	✓	✓	-
Inverter	✓	-	✓
Bypass	✓	-	✓
Load (AC)	✓	-	✓

Figure 17 : Table of “Measurement” tabs available per type of system

3.7 The battery charger page

From the home page, it is possible to directly access the operation mode of the battery charger, for AC UPS systems and for DC UPS systems.

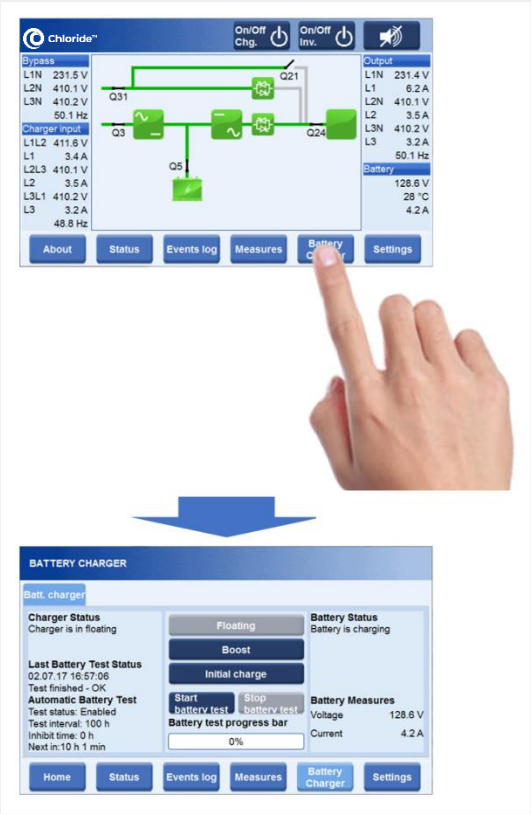


Figure 18 : Navigation to the Battery Charger page

The battery charging mode can be changed from this page. A maximum of 3 charging modes are possible:

- Floating mode,
- Boost mode (or fast charge),
- Initial charge mode (or commissioning charge)

NOTE:

- According to the type of battery connected to the system, some charging mode buttons might be disabled.

Furthermore, the battery charger page also allows to initiate and interrupt a battery test:

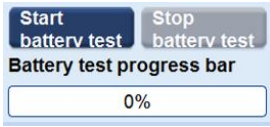


Figure 19 : Battery test buttons

3.8 The SMC Battery page

NOTE:

- The functionality described hereafter is only available with batteries of the type SMC.

According to the system's configuration, the M822E HMI includes a "SMC Battery" button in the bottom banner of the screen.

This specific button gives access to a dedicated page to supervise the SMC batteries (Sodium Metal Chloride).

Figure 20 : Example of SMC battery page

Chloride® systems operating with SMC battery are configured for an expected number of battery modules (solid color icon), and possibly with an expected number of backup battery modules for the redundancy (checkered icon).

An SMC battery module includes an internal contactor that is managed by its own integrated battery monitoring system (BMS). The status of this contactor is displayed at the top left of each battery icon. This contactor is used to disconnect the battery module from the DC bus when necessary (heating phase, redundant backup module, etc.)

Each SMC battery icon operates the same way as the blocks of the system, meaning that an SMC battery icon can turn green, grey, yellow or red depending on its status (see paragraph 3.2 for the color codes of the sub-assemblies).

4 Support tools

4.1 Event Logger

The M822E HMI of Chloride® systems includes an event logger. It is accessible from the home page via the “Events Log” button.

Figure 21 : Navigation to the Events Log page

The event log (or event register) can record up to 2000 events with time stamp, category of the event and description. Above 2000 recorded events, the event log operates in FIFO mode, meaning that the first recorded event disappears so that the last event can be recorded.

The event log page also allows to trace the sequence of events thanks to the recording and visualization of the appearance and disappearance of the event. Indeed, the appearance of an event is displayed on the screen with black characters while the disappearance of an event is shown with grey crossed out characters.

As the user accesses to the Events Log page, 2 new buttons appear in the action button panel on the top banner of the screen:

The "Export" button allows you to generate and export the system's event report. This function is described in paragraph 4.24.2.

The “Erase Events” button allows you to delete all the recorded and listed events. Note that pressing this button adds the event “Event log erased” to the log.

4.2 The Export Events function

The “Export” button is a tool to generate a complete report about the system, at the moment the data exportation is performed. Therefore, this report includes the event log but also the detailed system status at the time of the export, i.e., the active information, warning and fault messages, as well as the measurements. Finally, the report includes the software version and the system configuration.

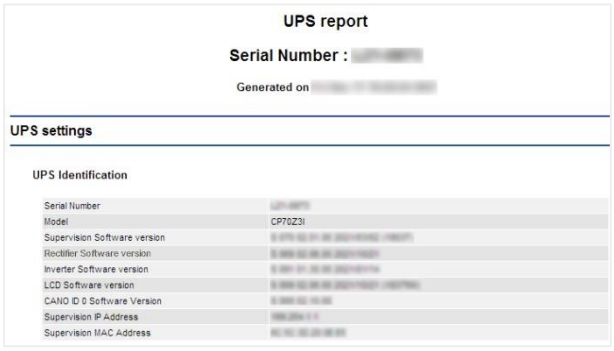
The report is automatically produced as an html file and is exported to the root directory of the USB stick that is connected to the USB port available on the front panel of the HMI.

In order to ease interaction and discussions, this report is systematically produced in 2 languages: in the language that was set by the user and in English.

4.3 The events report

An example of the report produced by the Export function (see paragraph 4.2) is given below.

- The Identification part includes the identity of the machine and its versioning:


UPS report

Serial Number :

Generated on

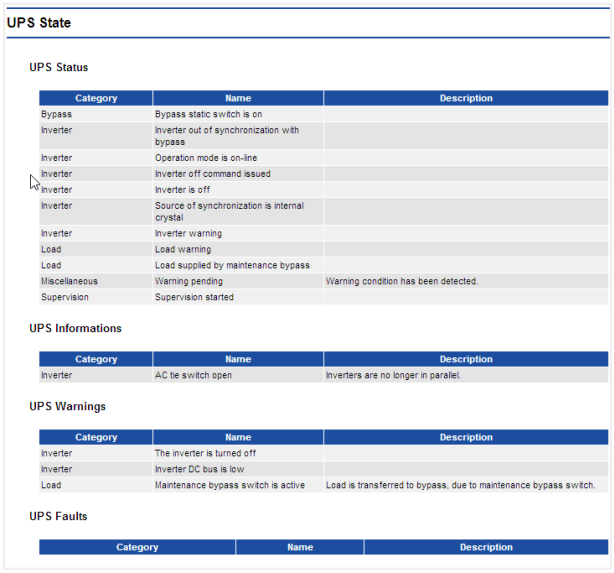
UPS settings

UPS Identification

Serial Number	
Model	CP70Z3I
Supervision Software version	
Rectifier Software version	
Inverter Software version	
LCD Software version	
CANO ID 0 Software Version	
Supervision IP Address	
Supervision MAC Address	

Figure 22 : "UPS Identification" part of the report

- The Status part gives all the active messages at the moment the report document was generated and exported:


UPS State

UPS Status

Category	Name	Description
Bypass	Bypass static switch is on	
Inverter	Inverter out of synchronization with bypass	
Inverter	Operation mode is on-line	
Inverter	Inverter off command issued	
Inverter	Inverter is off	
Inverter	Source of synchronization is internal crystal	
Inverter	Inverter warning	
Load	Load warning	
Load	Load supplied by maintenance bypass	
Miscellaneous	Warning pending	Warning condition has been detected.
Supervision	Supervision started	

UPS Informations

Category	Name	Description
Inverter	AC tie switch open	Inverters are no longer in parallel.

UPS Warnings

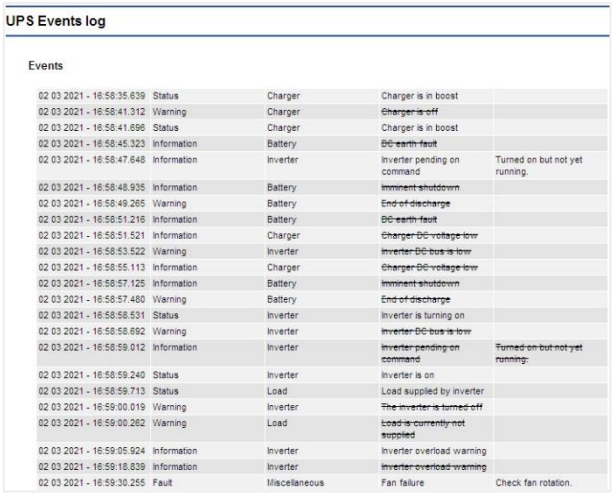
Category	Name	Description
Inverter	The inverter is turned off	
Inverter	Inverter DC bus is low	
Load	Maintenance bypass switch is active	Load is transferred to bypass, due to maintenance bypass switch.

UPS Faults

Category	Name	Description

Figure 23 : "UPS State" part of the report

- The Events part lists all the recorded events, with a maximum of 2000 entries, since the last reset of the event register: The sequence of events can be tracked thanks to the visualization of the appearance (normal text) and of the disappearance of the event (crossed out text).

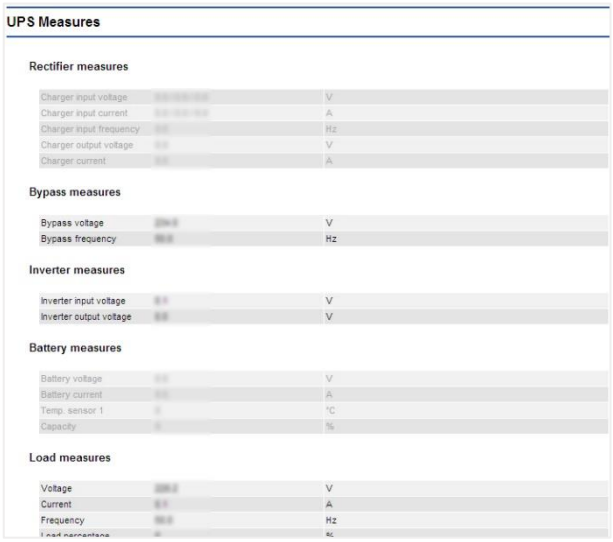

UPS Events log

Events

02 03 2021 - 16:58:35.639	Status	Charger	Charger is in boost	
02 03 2021 - 16:58:41.312	Warning	Charger	~~Charger is off~~	
02 03 2021 - 16:58:41.696	Status	Charger	Charger is in boost	
02 03 2021 - 16:58:45.323	Information	Battery	~~DC earth fault~~	
02 03 2021 - 16:58:47.648	Information	Inverter	Inverter pending on command	Turned on but not yet running.
02 03 2021 - 16:58:48.935	Information	Battery	~~Imminent shutdown~~	
02 03 2021 - 16:58:49.265	Warning	Battery	~~End of discharge~~	
02 03 2021 - 16:58:51.216	Information	Battery	~~DC earth fault~~	
02 03 2021 - 16:58:51.521	Information	Charger	~~Charger DC voltage low~~	
02 03 2021 - 16:58:53.522	Warning	Inverter	~~Inverter DC bus is low~~	
02 03 2021 - 16:58:55.113	Information	Charger	~~Charger DC voltage low~~	
02 03 2021 - 16:58:57.125	Information	Battery	~~Imminent shutdown~~	
02 03 2021 - 16:58:57.480	Warning	Battery	~~End of discharge~~	
02 03 2021 - 16:58:58.531	Status	Inverter	Inverter is turning on	
02 03 2021 - 16:58:58.692	Warning	Inverter	~~Inverter DC bus is low~~	
02 03 2021 - 16:58:59.012	Information	Inverter	~~Inverter pending on command~~	~~Turned on but not yet running.~~
02 03 2021 - 16:58:59.240	Status	Inverter	Inverter is on	
02 03 2021 - 16:58:59.713	Status	Load	Load supplied by inverter	
02 03 2021 - 16:59:00.019	Warning	Inverter	~~The inverter is turned off~~	
02 03 2021 - 16:59:00.262	Warning	Load	~~Load is currently not supplied~~	
02 03 2021 - 16:59:05.924	Information	Inverter	Inverter overload warning	
02 03 2021 - 16:59:18.839	Information	Inverter	~~Inverter overload warning~~	
02 03 2021 - 16:59:30.255	Fault	Miscellaneous	Fan failure	Check fan rotation.

Figure 24 : "Events log" part of the report

- The Measures part gives all the measurements that were recorded at the moment the report document was generated and exported:


UPS Measures

Rectifier measures

Charger input voltage		V
Charger input current		A
Charger input frequency		Hz
Charger output voltage		V
Charger current		A

Bypass measures

Bypass voltage		V
Bypass frequency		Hz

Inverter measures

Inverter input voltage		V
Inverter output voltage		V

Battery measures

Battery voltage		V
Battery current		A
Temp. sensor 1		°C
Capacity		%

Load measures

Voltage		V
Current		A
Frequency		Hz
Load percentage		%

Figure 25 : "UPS Measures" part of the report

SUMMARY

- The Export function allows the generation of a complete system report at a specific time. The operator on site can then easily request assistance from Chloride® technical support. Indeed, the generated file can be easily shared by email thanks to its small size. Thus, it is possible to obtain the support of a team of experts to better understand the sequence of events and thus implement corrective actions.

4.4 Update of system settings

The Chloride® systems are factory-set so that they are configured to be dedicated for their defined application. Nevertheless, it is sometimes necessary to locally proceed to settings adjustments, once the system has been installed on site.

4.4.1 Update by Chloride, remotely, without physical connection

The M822E display allows local adjustments of settings, without the need of having a Chloride® service engineer on site, and without the need of using the Chloride® settings software.

In order to proceed to the adjustments, simply contact the Chloride Service Support team and detail the settings to be modified.

For example, one may want to change the number of battery cells and adjust the settings accordingly.

In order to meet this requirement, Chloride's service team first checks the feasibility of the adjustments and then prepares a settings file.

This file is sent by email with detailed instructions for use.

Once the settings file has been received on site, the operation consists in loading this file onto a USB stick and take it to the Chloride® system.

The next step is to access the "Config" tab of the "Settings" page, as shown below:

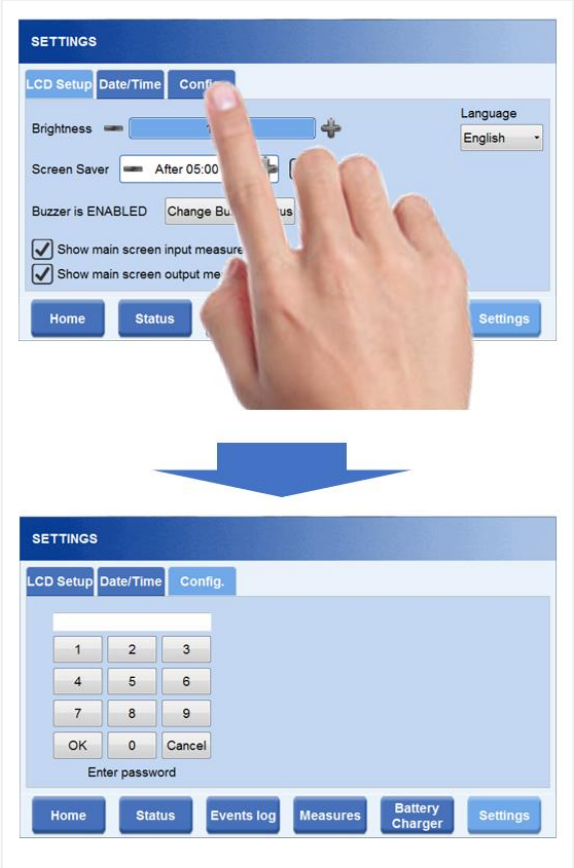


Figure 26 : Navigation to the "Config." tab

After entering the password, simply follow the technical instructions (sent with the configuration file) to proceed to the settings adjustments of the charger, the inverter or of the AC UPS, remotely, in an autonomous way.

SUMMARY

- Once on site, if the system requires some parameter adjustments, it is now possible to remotely update some settings, without a physical internal connection, thanks to the USB port. This is achieved with the remote support of the Chloride® service team.

4.4.2 Update by a local maintenance team (Chloride or Client)

NOTE:

- The functionality described in this paragraph is only available on DC systems.

It is possible to locally proceed to settings adjustments on Chloride® DC systems equipped with the M822E HMI.

For this, the operator needs to be granted the access to a specific parameters page.

NOTES:

- Access to this specific settings page is subject to prior request. For security reasons and even if its access is password protected, the possibility of access to this page is not systematic.
- Again, for safety reasons, access to this page and consequently access to the adjustment of some parameters is only possible on DC systems as these do not require specific inverter settings.
- We would like to draw your attention to the fact that the self-adjustment of some settings on a DC system should only be carried out by **competent persons who have been trained to perform the adjustment of the system.**

To be able to locally set some parameters of a DC UPS system, the engineer, who has been trained beforehand, needs to access the “Settings” tab of the “Settings page”, as shown on the figure hereafter:

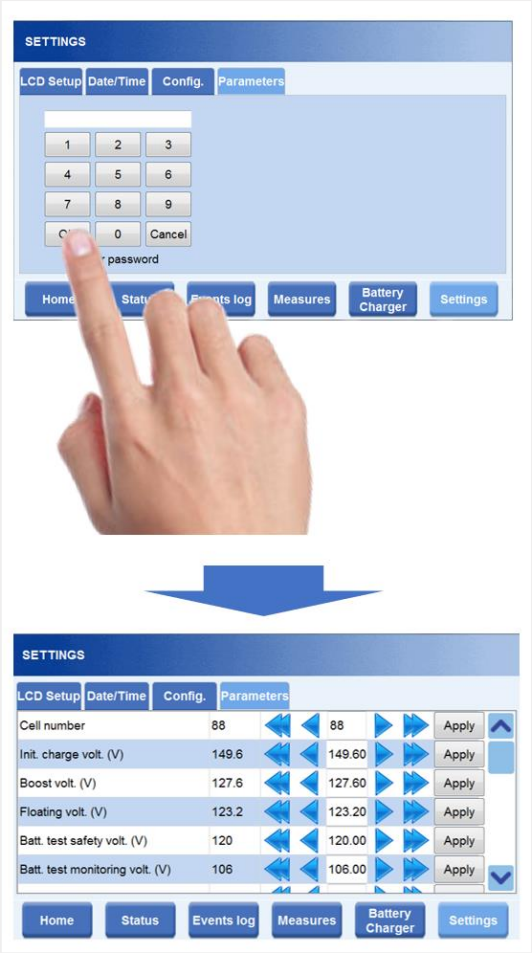


Figure 27 : Navigation to the Settings page for a DC system

Once entering the password, the engineer can proceed to the **manual adjustment of the charger settings**.

The parameters available for manual setting are:

- Number of battery cells
- Floating setting (voltage)
- Boost settings (voltage, duration)
- Initial charge settings (voltage, duration)
- Settings of the battery test threshold
- Battery imminent shutdown voltage threshold
- Battery current limitation

SUMMARY

- Some settings of a Chloride® DC system can be modified locally via the M822E HMI without the need of a specific software. For safety reasons, this is only possible on DC systems and requires a training beforehand.

4.5 Backup and restoration of all, or part, of the system settings

Thanks to the M822E display, all the settings of a Chloride® system can be saved.

By saving and storing the settings files in a secure location, it becomes possible to replace a failed electronic board more quickly. Indeed, after proceeding to the maintenance operations and replacement of the pcb, the engineer can download the settings previously saved in the new electronic board so that it is immediately operational.

NOTES:

- Accessing this specific page is only granted to **competent persons who have been trained to perform these operations.**
- Access to this specific settings page is subject to prior request. For security reasons and even if it is password protected, the possibility of access to this page is not systematic.
- In order to be able to perform the replacement and the settings of the pcb as described above, the versions of pcb's must be compatible with each other, in both hardware and software.

In order to be able to save and restore the system settings, the engineer needs to access to the "Save/Restore" tab of the "Settings" page, as shown hereafter:

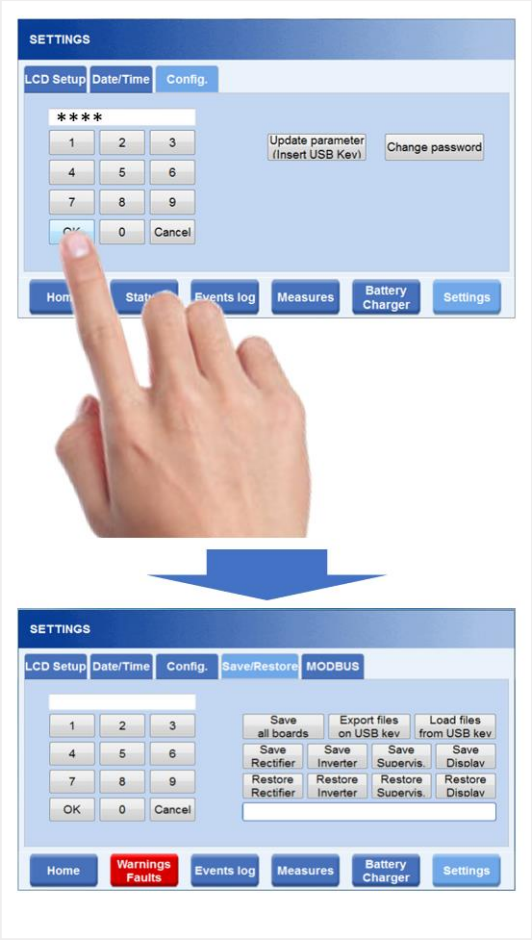


Figure 28 : Navigation to the Save/restore tab

After accessing this specific page, the engineer can:

- Save / restore all the settings of the system
- Save / restore the settings of the rectifier/charger
- Save / restore the settings of the inverter
- Save / restore the settings of the supervision internal board
- Save / restore the settings of the display

SUMMARY

- The M822E HMI eases the replacement of electronic boards with its unique feature to save and restore all or part of the system settings. Thanks to it, the maintenance operations get more efficient and spare parts can be interchanged between systems of the same generation with the same hardware and software versions.

4.6 Specific messages and monitoring the status of external equipment

NOTE:

- The functionality described in this paragraph is only available as an option and upon request.

In some cases, the M822E HMI of Chloride® systems can collect status and alarm information from electrical devices that are external to the Chloride system itself. For example, some information (e.g., failure of the ventilation system of the battery room) can be connected back to the Chloride® system so that the HMI M822E can display this information and potentially report it in the communication protocol. Such an information may also be used to change the system operation mode, for example in the above-mentioned situation, by forcing and keeping the system in floating mode, following the battery room ventilation fault information.

On the other hand, it is also possible to set some specific messages, internal to the machine, depending on the need.

When specific external or internal information is collected by the Chloride® system, it is integrated into the event log and can also be integrated in the external communication protocol.

NOTES:

- Integration of specific internal or external messages is subject to a **preliminary study**.
- Information that can be integrated are of the digital (binary) type and their quantity is limited. Please consult us so that our teams can check the feasibility on your project.

4.7 Perturbograph

NOTES:

- The functionality described in this paragraph is only accessible and available to Chloride® technical and service teams (for software reasons).
- This feature is only available on AC systems.

The M822E display of Chloride® systems includes a unique and outstanding function called Perturbograph (or disturbance recorder): It consists in an integrated system that records important measurements during an incident in order to be able to carry out an analysis afterwards.

When some predefined and identified events occur, the perturbograph starts and records some measurements of the Chloride® system. It memorizes important measurements points, every 1 ms, 40 ms before the event and 20 ms after the event.

These recordings are stored in the M822E display and are made available to the Chloride engineer via the USB port.

This gives the Chloride engineer the possibility to further analyze the sequence of events and determine the root causes.

Example:

You will find hereafter an example of some measurements recorded by the perturbograph: the inverter has detected an overload that is high enough so that it triggered the inverter internal safety timer before it stopped the inverter. At the end of the countdown (and after several intermediate steps of inverter overload information messages), the perturbograph started and recorded the measurements 40ms before the fault and 20ms after the fault.

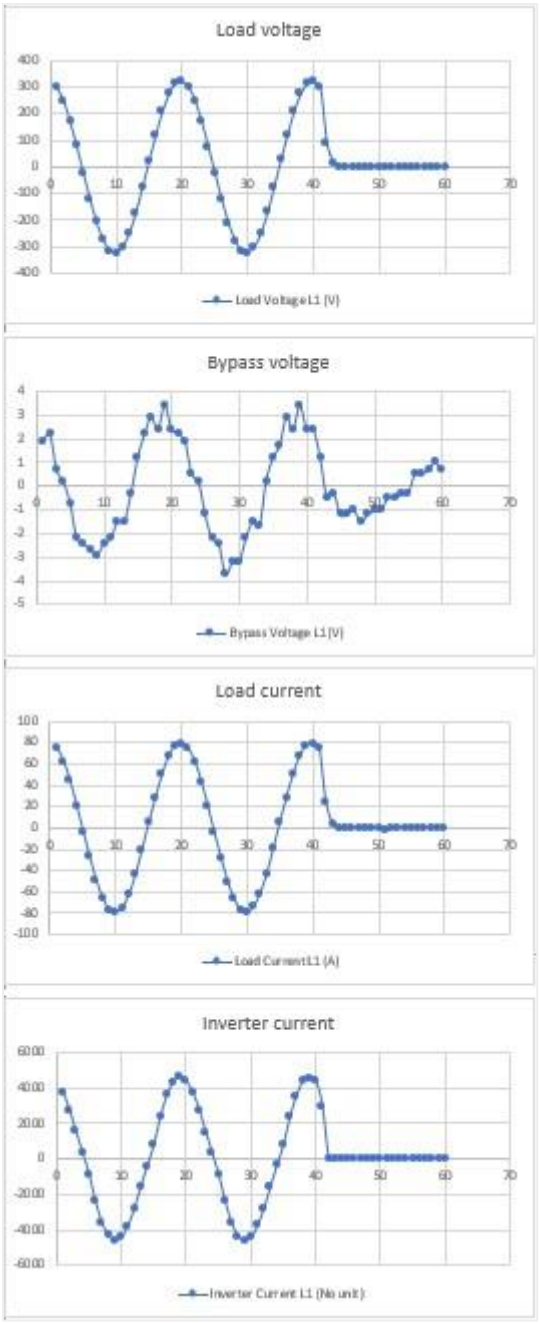


Figure 29 : Example of some of the recordings done by the perturbograph

SUMMARY

- The perturbograph integrated to Chloride® AC systems is a advanced investigation tool: the device records electrical measurements 40ms before and 20ms after a critical fault
- The perturbograph is and can only be operated by Chloride engineers. (for software reasons)

Conclusion

Nowadays, we can no longer do without Human-Machine Interfaces (HMI). The increasing complexity of machines and processes forces manufacturers to develop interfaces to operate the machines in the best possible way. However, on UPS systems, it is often only required to have an interface to visualize the status and alarms of the machine, but an elaborate HMI can offer more possibilities and allow for a smarter operation of the machine.

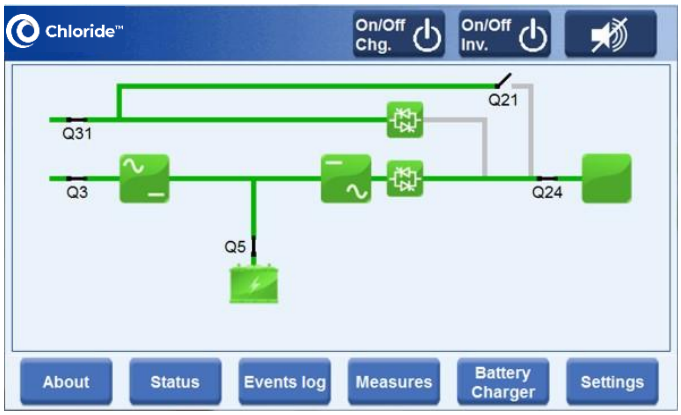
The HMI that is integrated in Chloride® UPS systems offers much more than just a visualization of the UPS status and alarms. Indeed, it allows the operator to interactively view the system's one-line diagram, collect important information, record crucial data and actively participate in troubleshooting by providing innovative tools.

The technology embedded in the Chloride® HMI brings the remote Chloride engineer closer to the on-site operator: communication and exchanges of information are facilitated, investigations can go deeper, and remedy solutions can be found in a more efficient way.


Chloride™
Power to Protect

5 Appendix 1: List of information on Chloride CP70Z AC UPS

Chloride® CP70Z AC UPS: List of information available per sub-assembly



NOTE:

- Information given hereafter and marked with * depend on the system configuration and of options.

Rectifier-Charger

Status:

Charger is in floating
Charger is in boost*
Charger is in auto battery test*
Charger is in manual battery test*
Charger is in initial charge*
Charger is in imposed floating*
Charger is in imposed boost*
Charger is in imposed battery test*
Charger is in imposed initial charge*
DC bus tie switch open*
No voltage on DC bus tie*

Measurements:

Charger input voltage
Charger input current
Charger input frequency
Charger output voltage
Charger current

Information:

Charger overload
Charger DC voltage low
Charger over temperature*
Charger in current limitation
Charger output switch open*
DC load switch open*
Charger/Battery isolator switch open*
Charger transformer over temperature warning*

Warnings:

Charger input switch open
Charger mains failure
Wrong phase rotation
Charger is off
Charger is off (remote)*
Test mode

Faults:

Charger temperature fault*
Charger transformer over temperature fault
Charger DC over voltage
Charger fuse blown
Excessive battery current
Charger high DC voltage
Charger high DC voltage (memorized)*
Charger high DC voltage redundant
Charger input protection trip*
Charger output protection trip*
DC load protection trip*
Charger/Battery isolator protection trip*
DC bus tie protection trip*

Battery

Status:

Battery current normal
Battery is charging

Measurements:

Battery voltage
Battery current*
Battery temperature*
Capacity*

Information:

DC earth fault*

Warnings:

Battery switch open
BMS warning*
Battery discharging
Imminent shutdown
End of discharge

Faults:

Battery overvoltage

Battery test failure*
Battery protection tripped*
Battery temperature sensor failure*

Inverter

Status:

Inverter is off
Inverter is turning on
Inverter is on
Inverter out of synchronization with bypass*
Inverter out of synchronization with external source*
No voltage on AC bus tie*

Measurements:

Inverter input voltage
Inverter output voltage
Inverter input current*

Information:

Inverter overload warning
Inverter pending off command
Inverter pending on command
AC tie switch open*
Inverter not synchronized*
Inverter is in current limitation
Inverter overload timeout warning

Warnings:

Inverter DC bus is low
The inverter is turned off
Test mode
Hardware Init mode
DC input switch open*

Faults:

Emergency power off*
Inverter bridge over temperature
Multiple inverter overload cut off
Current limitation timeout fault
Inverter overload timeout fault
Undelayed inverter DC bus overvoltage
Delayed inverter DC bus overvoltage
Inverter output overvoltage
Inverter output under voltage
Inverter output frequency out of limits
Inverter output short circuit
Inverter output has DC component (ph1)
Inverter output has DC component (ph2)
Inverter output has DC component (ph3)
Inverter output has DC component
Inverter IGBT desaturation (ph1)
Inverter IGBT desaturation (ph2)
Inverter IGBT desaturation (ph3)
Multiple low DC failure
Load breaker tripped*
Power supply failure
DC input switch tripped*
AC tie switch tripped*

Bypass

Status:

Bypass parallel communication is not yet established*
Bypass static switch is on
Bypass static switch is off
Bypass static switch is waiting for parallel*

Measurements:

Bypass input voltage
Bypass input frequency

Information:

Genset operation*

Warnings:

Bypass input switch is open
Bypass is in overload condition
Wrong phase rotation on bypass*
Parallel bypass failure*
Bypass voltage is out of tolerance
Bypass frequency is out of tolerance

Faults:

Emergency power off*
Bypass static switch command failure
Bypass static switch power supply failure
Backfeed protection active
Overload time-out
Bypass breaker tripped*
Load breaker tripped*

Load (AC output)

Status:

Load supplied by inverter
Load supplied by bypass*
Load supplied by maintenance bypass*
Load is currently not supplied

Measurements:

Load percentage per phase
Voltage
Current
Real power*
Apparent power*
Power factor*
Frequency
Overload time remaining
Load percentage
Total load real power
Total load apparent power
Average power factor

Information:

AC earth fault*

Warnings:

Output switch is open*

Load is currently not supplied
Retransfer is inhibited due to overload*
Load is supplied by the bypass*
Maintenance bypass switch is active*
Retransfer is inhibited due to Bypass not ok*

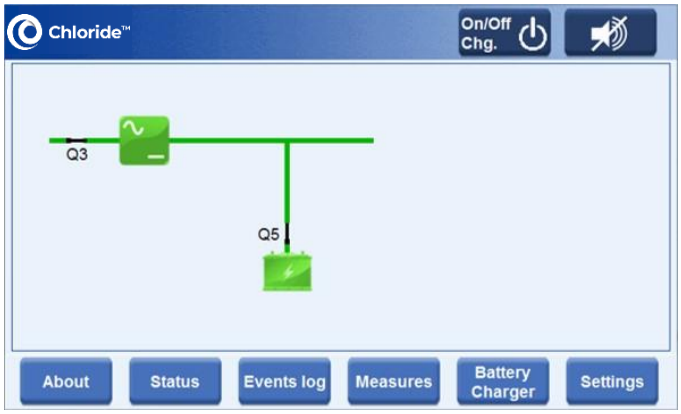
Ambient temperature sensor*
Fan failure*

Miscellaneous

Information:
Input air high temperature*
Input air temperature out of range*
Faults:
Parallel cable fitted signal is missing*

6 Appendix 2: List of information on Chloride CP70R DC UPS

Chloride® CP70R DC UPS: List of information available per sub-assembly



NOTE:

- Information given hereafter and marked with * depend on the system configuration and of options.

Rectifier-Charger

Status:

- Charger is in floating
- Charger is in boost*
- Charger is in auto battery test*
- Charger is in manual battery test*
- Charger is in initial charge*
- Charger is in imposed floating*
- Charger is in imposed boost*
- Charger is in imposed battery test*
- Charger is in imposed initial charge*
- DC bus tie switch open*
- No voltage on DC bus tie*

Measurements:

- Charger input voltage
- Charger input current
- Charger input frequency
- Charger output voltage
- Charger current

Information:

- Charger overload
- Charger DC voltage low
- Charger over temperature*
- Charger in current limitation
- Charger output switch open*
- DC load switch open*
- Charger/Battery isolator switch open*
- Charger transformer over temperature warning*

Warnings:

- Charger input switch open
- Charger mains failure
- Wrong phase rotation
- Charger is off
- Charger is off (remote)*
- Test mode

Faults:

- Charger temperature fault*
- Charger transformer over temperature fault
- Charger DC over voltage
- Charger fuse blown
- Excessive battery current
- Charger high DC voltage
- Charger high DC voltage (memorized)*
- Charger high DC voltage redundant
- Charger input protection trip*
- Charger output protection trip*
- DC load protection trip*
- Charger/Battery isolator protection trip*
- DC bus tie protection trip*

Battery

Status:

- Battery current normal
- Battery is charging

Measurements:

- Battery voltage
- Battery current*
- Battery temperature*
- Capacity*

Information:

- DC earth fault *

Warnings:

- Battery switch open
- BMS warning*
- Battery discharging
- Imminent shutdown
- End of discharge

Faults:

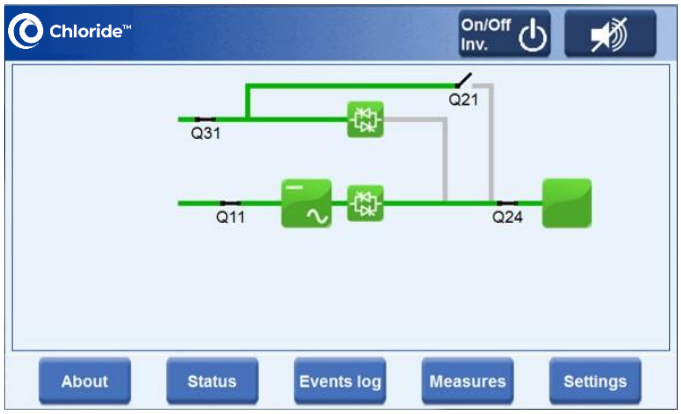
Battery overvoltage
Battery test failure*
Battery protection tripped*
Battery temperature sensor failure*

Miscellaneous

Faults:
Fan failure*

7 Appendix 3: List of information on Chloride CP70i DC/AC inverter

Chloride® CP70i DC/AC INVERTER: List of information available per sub-assembly



NOTE:

- Information given hereafter and marked with * depend on the system configuration and of options.

Inverter

Status:

- Inverter is off
- Inverter is turning on
- Inverter is on
- Inverter out of synchronization with bypass*
- Inverter out of synchronization with external source*
- No voltage on AC bus tie*

Measurements:

- Inverter input voltage
- Inverter output voltage
- Inverter input current*

Information:

- Inverter overload
- Inverter pending off command
- Inverter pending on command
- AC tie switch open*
- Inverter not synchronized*
- Inverter is in current limitation
- Inverter overload timeout warning

Warnings:

- Inverter DC bus is low
- The inverter is turned off
- Test mode
- Hardware init mode
- DC input switch open*

Faults:

- Emergency power off*
- Inverter bridge over temperature
- Multiple inverter overload cut off
- Current limitation timeout fault
- Inverter overload timeout fault
- Undelayed inverter DC bus overvoltage
- Delayed inverter DC bus overvoltage
- Inverter output overvoltage
- Inverter output under voltage
- Inverter output frequency out of limits
- Inverter output short circuit
- Inverter output has DC component (ph1)
- Inverter output has DC component (ph2)
- Inverter output has DC component (ph3)
- Inverter output has DC component
- Inverter IGBT desaturation (ph1)
- Inverter IGBT desaturation (ph2)
- Inverter IGBT desaturation (ph3)
- Multiple low DC failure
- Load breaker tripped*
- Power supply failure
- DC input switch tripped*
- AC tie switch tripped*

Bypass

Status:

- Bypass parallel communication is not yet established*
- Bypass static switch is on
- Bypass static switch is off
- Bypass static switch is waiting for parallel*

Measurements:

- Bypass input voltage
- Bypass input frequency

Information:

- Genset operation*

Warnings:

Bypass input switch is open
Bypass is in overload condition
Wrong phase rotation on bypass*
Parallel bypass failure*
Bypass voltage is out of tolerance
Bypass frequency is out of tolerance
Faults:
Emergency power off*
Bypass static switch command failure
Bypass static switch power supply failure
Backfeed protection active
Overload time-out
Bypass breaker tripped*
Load breaker tripped*

Load (AC output)

Status:
Load supplied by inverter
Load supplied by bypass*
Load supplied by maintenance bypass*
Load is currently not supplied
Measurements:
Load percentage per phase
Voltage
Current
Real power*
Apparent power*
Power factor*
Frequency
Overload time remaining
Load percentage
Total load real power
Total load apparent power
Average power factor
Information:
AC earth fault*
Warnings:
Output switch is open*
Load is currently not supplied
Retransfer is inhibited due to overload*
Load is supplied by the bypass*
Maintenance bypass switch is active*
Retransfer is inhibited due to Bypass not ok*

Miscellaneous

Information:
Input air high temperature*
Input air temperature out of range*
Faults:
Parallel cable fitted signal is missing*
Ambient temperature sensor*
Fan failure*

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