

# Chloride Apodys rectifier-charger 1Ph

*Product catalogue – 2 Pulses*



**CHLORIDE**

  
**EMERSON**  
Network Power





# Chloride Apodys rectifier-charger

*Rectifier – Battery charger*

*1-phase input – 2 Pulses - DC output*

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## 1 Scope

This document describes a continuous duty single phase input, stand-alone, Direct Current (DC) output Uninterruptible Power System (UPS).

The Apodys charger range meets customers' technical specifications for industrial applications such as: Power generation, Power Transmission and distribution, Oil and gas offshore developments (platforms, FPSO, etc...), Oil and gas transportation (pipelines...), Oil and Gas treatment plants (refineries, petrochemical units...), Railways and undergrounds control and signalling systems, etc...

The Apodys range is part of Chloride's know-how and long-time relationship with industrial businesses.

Chloride Industrial Systems services include:

- Consultancy services
- Pre-engineering design and support
- Project Management (contract management, detailed engineering, documents for approval, manufacturing, product testing, witness-testing if requested, shipment, tailored user manual)
- Services (recommended commissioning spare parts, commissioning services, product lifetime spare parts, hotline, trainings, maintenance contracts, etc...)

## 2 General requirements

### 2.1. ISO certification

Chloride France S.A. is certified by the British Standard Institution (BSI), as a company with a total quality and environmental control system in accordance with the ISO 9001 and ISO 14001.

### 2.2. Applied standards

The Apodys range of battery chargers shall have the CE mark in accordance with the Safety and EMC Directives 2006/95/EC and 2004/108/EC.

The Apodys charger range is designed and manufactured in accordance with the following international standards:

- IEC60146 Semi conductor converters:
  - IEC60146-1-1 specifications of basic requirements
  - IEC60146-1-3 transformers and reactors
  - IEC60146-2 self-commutated semiconductor converters including direct dc converters.
- IEC60950 Safety of information technology equipment including electrical business equipment
- IEC60439 Low voltage switchgear and control gear assemblies
  - IEC60439-1 Type-tested and partially type-tested assemblies
  - IEC60439-2 Particular requirements for busbar trunking systems (busways)
  - IEC 60439-3 Particular requirements for LV switchgear and control gear assemblies intended to be installed in places where unskilled persons have access

for their use – distribution boards

- IEC60529 Degrees of protection provided by enclosures (IP Code)
- IEC60726 Dry-type power transformers
- EN61000-6-2 Electromagnetic compatibility (EMC) Generic standards – Immunity for industrial environments
- IEC61000-6-4 Electromagnetic compatibility (EMC) Generic standards – Emission standard for industrial environments.

## 3 Range overview

The system described is a static direct current uninterruptible power supply system (DC UPS) as shown in Figure 1. The system operates on a microprocessor-based thyristors charger. By means of digital control technology the performance of the rectifier / charger are enhanced. By adding system components, such as paralleling diodes, safety and disconnecting devices, distribution cubicles, isolated or non-isolated DC/DC converters, as well as software and communications solutions, it is possible to set up elaborated systems ensuring complete DC load protection.

### 3.1. The system

The DC UPS provides high quality DC power for electronic equipment loads. It offers the following features:

- Increased DC power quality
- Compatibility with all types of loads
- Power blackout protection (for systems associated with battery)
- Full battery care
- Lifetime of, at least, 20 years, combined with an appropriate preventive maintenance
- Operation temperature of 0 to 40°C permanent.

The DC UPS automatically provides continuous electrical power, within the defined limits and without interruption, upon failure or degradation of the network supply AC source. The length of the back-up time, i.e. autonomy time in the event of power network failure, is determined by the battery capacity.

### 3.2. Models available

The Apodys charger range includes several DC voltage output models as specified in paragraph 9. It is of the single-phase input type.

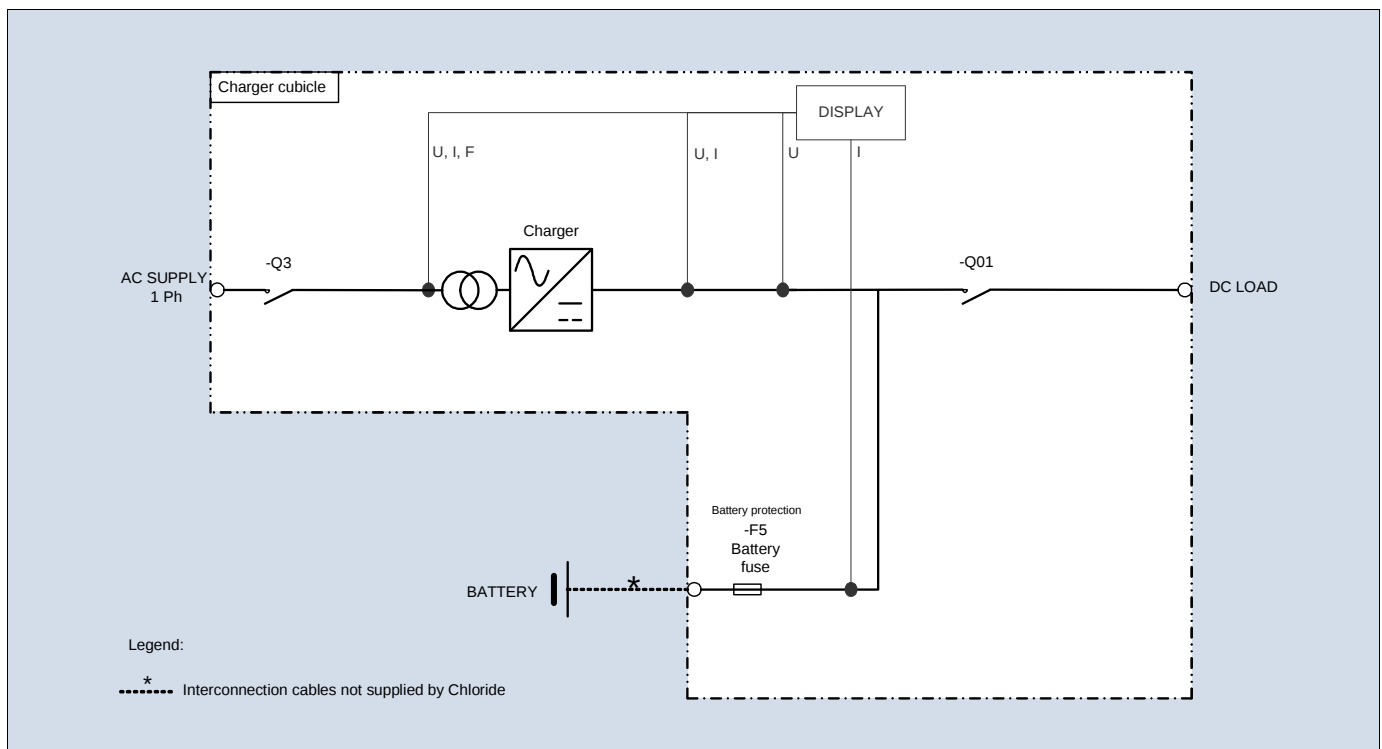


Figure 1: APODYS rectifier-charger single line diagram

## 4 System description

In this section, the main power electronic features and the operating modes of the Apodys rectifier-charger range are described.

### 4.1. General description

The single-phase current taken from the AC source is converted to a regulated DC voltage by a 2-pulse rectifier.

In order to protect the power components within the system, the rectifier bridge is fused with a fast acting fuse. A transformer is provided at the input of the rectifying bridge.

The rectifier/charger is able to operate with the following types of battery:

- Valve regulated Lead Acid
- Vented Lead Acid
- Recombination Nickel Cadmium
- Vented Nickel Cadmium

The selection of the optimum charging method is completely managed by the microprocessor.

### 4.2. Components

The DC UPS shall consist of the following major components:

- One input isolator
- One main transformer
- Thyristors bridge Rectifier / battery charger
- One LC smoothing circuit
- One Control unit, based on one microprocessor and one Digital Signal Processor-DSP
- One control and visualisation unit
- Battery stand or matching battery cubicles if requested

### 4.3. Operating modes

The Apodys rectifier-charger is regulated with constant voltage and current limiting, respecting an UI characteristic. The DC UPS will operate as follows:

#### 4.3.1. Normal operation

The critical DC load is continuously supplied by the rectifier. The rectifier/ charger derives power from the AC source and converts it into DC power for the critical load whilst simultaneously maintaining the battery in a fully charged and optimum operational condition. The rectifier-charger operates in floating mode, floating voltage being determined by the battery type and data.

#### 4.3.2. AC supply failure

Upon fault of the AC source, the critical load is still supplied by the battery. The critical DC load draws its power from the associated battery without switching. During failure, reduction or restoration of the AC source, there is no interruption to the critical load. While the critical load is powered by the batteries, indication is provided of the battery discharging status.

#### 4.3.3. Recharge operation

Upon restoration of the AC source, the rectifier-charger automatically restarts and gradually takes over both the DC load and the battery recharge, even if the batteries are fully discharged.

This operational mode is a fully automatic function and does not cause any interruption to the critical load. It operates as follow:

- For a power failure below 5 minutes, the rectifier-charger automatically remains in floating mode upon restoration of the AC source.
- For a power failure beyond 5 minutes and upon restoration of the AC source, the rectifier-charger automatically switches to the equalizing charge mode for 15 hours and then switches back to the floating mode.

#### 4.3.4. Boost mode

This operating mode is a specific mode dedicated to vented type batteries. It is used when boost charge or commissioning charge is requested. Before launching this operating mode, the operator shall check that all DC loads are disconnected from the DC UPS output.

During boost mode, the voltage limitation is increased (up to 2.65V per cell for a Lead Acid battery and up to 1.7V per cell for a Nickel Cadmium battery). Restoration of the floating mode is automatic after a preset typical time of 5 hours, unless the floating mode is manually initiated by the operator through the control unit.

### 4.4. Electrical features

#### 4.4.1. Total harmonic distortion of input voltage

The maximum voltage THD allowed on the rectifier input is 8% to guarantee the correct operation of the system (either from utility or from generator).

#### 4.4.2. Rectifier current limitation

The rectifier-charger current is limited to the nominal value either in floating, charge and boost mode.

#### 4.4.3. Battery current limitation

The battery current is limited to 0,1C (Pb) or 0,2C (NiCd) of the associated battery, in floating or charge modes. In equalization mode, the battery current is limited to 0,05C (Pb) or 0,1C (NiCd).

#### 4.4.4. Over voltage protection

The rectifier-charger is automatically turned off if the DC voltage exceeds the maximum value associated to their operational status.

## 5 Advanced Battery Care

The Apodys range increases battery life by using several battery care features, as described hereafter.

### 5.1. Operating parameters

Unless specified in the customer's technical specification, the battery parameters are determined by Chloride Industrial Systems in full respect with the customer's application and the choice of battery type.

The battery parameters to be determined and set up in the DC UPS are:

- High voltage alarm (V)
- Float voltage (V)
- Charge voltage (V)
- Boost voltage (V)\*
- End of discharge voltage (V)
- Battery discharging alarm (V)
- Minimum battery test voltage (V)\*\*
- Imminent shutdown alarm (V)

\* according to battery type

\*\* optional

### 5.2. Automatic battery test

The operating conditions of the batteries are automatically tested

by the control unit at selectable intervals, e.g. weekly, fortnightly or monthly. A short-time discharge of the battery is made to confirm that all the battery blocks and connecting elements are in good working order. In order to avoid a faulty diagnosis, the test is launched 15 hours after the last battery discharge at the earliest. The battery test is performed without any risk to the user, even if the battery is wholly defective. A detected battery fault is alarmed to the user. The battery test does not cause any degradation in terms of expected life of the battery.

### 5.3. Ambient temperature compensated battery charger

The rectifier-charger output voltage operates within narrow limits according to the battery manufacturer's technical data. In order to ensure an optimum battery charging, regulation is automatically adjusted to the ambient temperature.

The float voltage and the discharge voltage of the battery are

automatically adjusted as a function of the temperature in the battery compartment in order to maximise battery operating life.

The temperature adjustments are:

- -3 mV/°C/cell for Lead Acid battery
- -2 mV/°C/cell for Nickel Cadmium battery
- 

### 5.4. Battery Monitoring System (optional)

The Apodys range can be connected to our Battery Monitoring System, upon request (contact us for more details).

The use of the Battery Monitoring System significantly increases the reliability and safety of batteries, and thus the reliability of the entire DC UPS unit.

The features of the Battery Monitoring System option are:

- It monitors each individual battery block (of 6V or 12 V) or cell (2V or 1.2V) throughout all phases of DC UPS operation.
- It diagnoses changes and faults in the battery system
- It warns the user early enough before the breakdown of the whole DC UPS.
- It helps localise errors by measuring the voltages of each battery block or cell.
- It helps to drastically reduce ongoing maintenance costs.

## 6 Monitoring and Control Interfaces

The rectifier-charger incorporates the necessary controls, instruments and indicators to allow the operator to monitor the system status and performance and take any appropriate action. Furthermore, interfaces are available upon request, which allow extended monitoring and control, as well as service functions.

### 6.1. Light emitting diodes (LEDs)

The rectifier-charger includes 3 external Light Emitting Diodes (LEDs) to indicate the overall system operation status as well as the condition of the functional blocks. LEDs operation is described in Figure2.

These LEDs shall interact with the active mimic diagram displayed on the graphical display.

### 6.2. Start and Stop push buttons

The Start and Stop push buttons are integrated into the mimic panel board, and operate as described on Figure3.

The control incorporates a safety feature to prevent inadvertent operation yet still allow rapid shutdown in the event of an emergency. This is achieved by pressing the “STOP” button for 2 seconds before the charger stops. « Charger OFF » is displayed on the LCD.

### 6.3. Display

A graphical (64 x 128 pixels) illuminated Liquid Crystal Display (LCD) is provided to enable the operating parameters, all the measurements and the active mimic diagram of the rectifier or DC UPS to be monitored. The LCD messages are accessed by navigation buttons (see Figure3). The text is available in English, unless otherwise mentioned.

By using the appropriate push-buttons it is possible to display the information described hereafter.

| Symbol                                                                              | LED colour     | Description                          | Comments                                               |
|-------------------------------------------------------------------------------------|----------------|--------------------------------------|--------------------------------------------------------|
|  | Green          | DC UPS or rectifier normal operation | /                                                      |
|  | Green flashing | load on battery                      | Loads powered by battery                               |
|  | Orange         | DC UPS or rectifier warning          | One or more subassembly are affected but not stopped   |
|  | Red            | DC UPS or rectifier fault            | Subassembly are faulty and stopped or manually stopped |

Figure 2: Apodys rectifier-charger – Light Emitting Diodes (LED) operation description

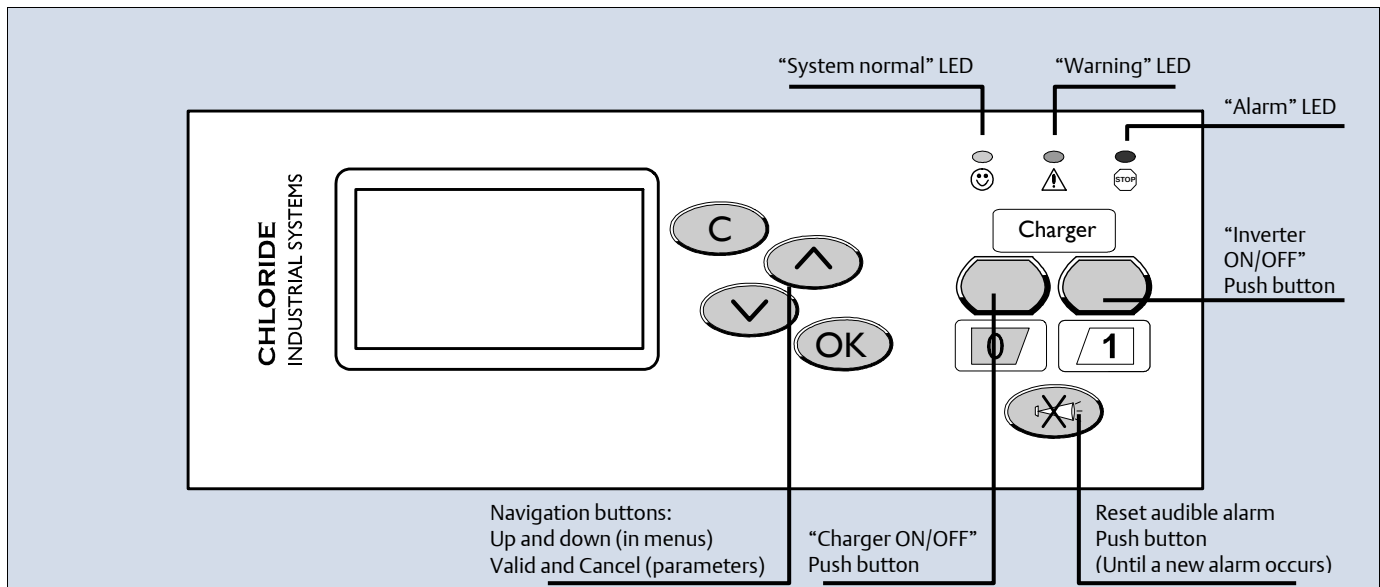


Figure 3: Apodys rectifier-charger – Local human-machine interface.

## 6.3.1. Default page

The default page displays the active mimic diagram of the rectifier or DC UPS system (see Figure 4).

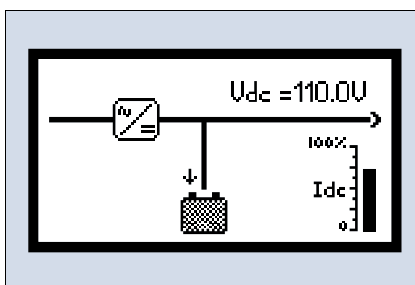


Figure 4: mimic default page.

By pressing the “OK”, “UP”, or “DOWN” buttons, the user enters the general menu. If the user is navigating in the menus, he may return to the active mimic diagram by pressing the “C” button. If the user does not request any action (such as pressing a button) for 5 minutes while displaying the menus, the system will automatically return to the display

of the default page active mimic diagram.

## 6.3.2. Active mimic diagram

The active mimic diagram displays the following information:

- View of the connected load
- View of the power flow
- View of the status of each functional block

The Figure 5 provides an example of an active mimic situation:

- Mains input failure
- Charger stopped
- DC load still supplied by battery discharge

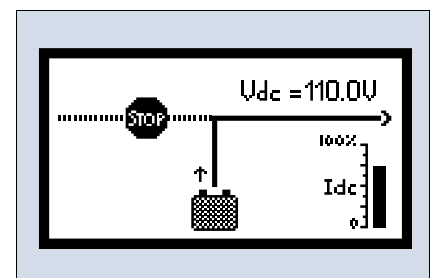


Figure 5: Example of Mimic situation

## 6.3.3. General menu

Pressing any key from the default page (active mimic diagram) allows the user to access to the following general menu:

- Rectifier-charger
- Battery
- Reset
- Event log
- Display setting
- Date/Time
- Contact
- About
- Adjust param

## 6.3.4. Menus of functional blocks

Each functional block (charger block, battery block) includes its own menu to provide the user with detailed information, such as:

- Block status
- Block measures
- Block faults
- Block warnings

By using these menus, the user can access to detailed information about each following component:

- Rectifier-Charger
- Battery
- Load

## 6.3.5. Rectifier-charger information

Status indications:

|                       |
|-----------------------|
| Charger off           |
| Initialisation        |
| Charger stop          |
| Equalisation mode*    |
| Equalisation imposed* |
| Floating mode         |
| Battery test mode*    |
| Battery test imposed* |
| Boost mode*           |

Measures indications:

|                                |
|--------------------------------|
| UDC (charger output voltage)   |
| IDC (charger output current)   |
| U12 (Input voltage ph 1 and 2) |
| U23 (Input voltage ph 2 and 3) |
| U31 (Input voltage ph 3 and 1) |
| I1 (input line current)        |
| I2 (input line current)        |
| I3 (input line current)        |
| Freq (input frequency)         |
| Number of mains failures       |

Warning indications:

|                  |
|------------------|
| Test mode        |
| Fan failure*     |
| DC voltage low   |
| Overload inhibit |

|                          |
|--------------------------|
| Charger in current limit |
| Customised message 1 *   |
| Customised message 2 *   |
| Customised message 3 *   |

Fault indications:

|                              |
|------------------------------|
| No fault                     |
| High DC voltage              |
| High DC voltage memorised    |
| Too high I battery memorised |
| Charger fuse blown           |
| Input protection opened      |
| Charger off                  |
| Remote switch off*           |
| AC supply fault              |
| Customised message 1 *       |
| Customised message 2 *       |
| Customised message 3 *       |

\* Optional messages (according to specification and system configuration)

## 6.3.6. Battery information

Status indications:

|                  |
|------------------|
| Normal           |
| Discharging      |
| Charging         |
| Fault or warning |

Measures indications:

|                      |
|----------------------|
| Battery voltage      |
| Battery current      |
| Battery temperature  |
| Battery autonomy (%) |

Warnings indications:

|                              |
|------------------------------|
| DC earth fault*              |
| Battery begin discharge      |
| Imminent shutdown            |
| Temp sensor fault memorised* |
| Warning BMS*                 |
| Customised message 1 *       |
| Customised message 2 *       |
| Customised message 3 *       |

Faults indications:

|                              |
|------------------------------|
| Battery test fault memorised |
| End of discharge             |
| Battery protection opened*   |

|                        |
|------------------------|
| Customised message 1 * |
| Customised message 2 * |
| Customised message 3 * |

\* Optional messages (according to specification and system configuration)

## 6.3.7. Event log

The Event Log function is available through the display and allows memorising each event into the historical record, in a chronological way.

The Event Log function can operate in 2 different ways:

- Saturable mode: It records a maximum of 100 events after the first event appearance.
- FIFO mode: After recording 100 events, the 101<sup>st</sup> event deletes the 1<sup>st</sup> one and so on.

## 6.3.8. Commissioning adjustments

By using the menu “Adjust param”, it becomes possible to the user to define its own settings for the charger commissioning. Up to 27 parameters can be user-defined such as:

- Boost voltage adjustment
- Equalization voltage adjustment
- Battery current limitation setting
- Imminent shutdown threshold

## 6.4. Remote signalling and control signal

### 6.4.1. Logic outputs for remote indications

The Apodys rectifier-charger is able to deliver several output information. Upon request, these output information can be made available on double-pole change-over (dpco) contacts (8A/250V AC1; 8A/30V DC1; 1A/60V DC1).

The following information can be made available on voltage-free contacts:

|                     |
|---------------------|
| Charger OK          |
| High DC voltage     |
| Low DC voltage      |
| Mains OK            |
| Floating Mode       |
| Equalization Mode   |
| Initial charge mode |
| Battery test mode   |

When information is requested on voltage-free contact, connection of the customer cables is achieved on the labelled, screw-clamp terminal blocks of each relay-holder.

## 6.4.2. Logic inputs

The Apodys range allows the signalisation of specific alarms from the customer's environment and eventually takes the appropriate action on the DC UPS thanks to dedicated logic inputs available.

Upon request, the following logic inputs can be wired:

|                           |
|---------------------------|
| Remote control on/off     |
| Battery protection status |
| DC earth fault            |
| Input protection status   |
| Boost /commissioning mode |

## 6.5. Communication interfaces (options)

### 6.5.1. Isolated RS 232 link

Upon request, Apodys can be equipped with one sub-D 9 points connector for direct (1 master, 1 slave, max 15 meters) serial RS232 communication.

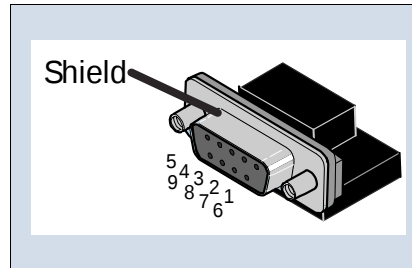


Figure 6: RS 232 SubD 9 points connector

Pin assignment is described in the Table 1 hereafter.

| Pin | Signal    | Explanation         |
|-----|-----------|---------------------|
| 1   | Not used  |                     |
| 2   | Tx        | Transmission RS232  |
| 3   | Rx        | Reception RS232     |
| 4   | Not used  |                     |
| 5   | RS232 GND | Signal ground       |
| 6   | Not used  |                     |
| 7   | RTS       | Clear to send RS232 |
| 8   | Not used  |                     |
| 9   | Not used  |                     |

Table 1: RS232 pin assignment

### NOTE:

**If simultaneous use of RS232 port and RS 485 is necessary, this will require 2 separate PCB, one for RS232 and the other for RS485.**

### 6.5.2. Isolated RS 485 link

Upon request, Apodys can be equipped with 6 points socket for multipoint (1 master, up to 31 slaves, max 1300 meters) serial RS485 communication.

Customer connection is easily achieved thanks to the screw-clamp connector provided (see figure below). Earth connection is achieved on the PCB through a 6.35 Faston lug.

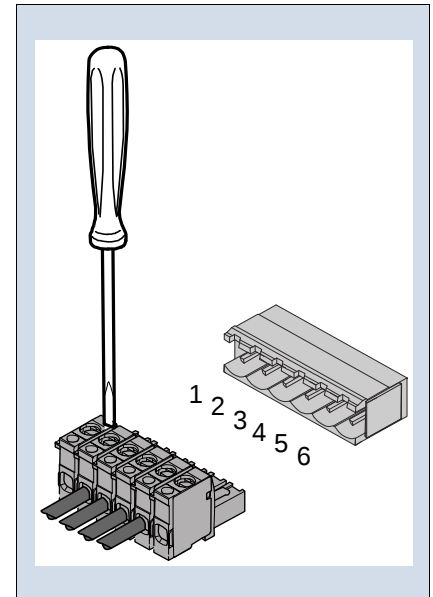


Figure 7: RS 485 6 points connector

The RS485 communication path may be used either in 4 wires mode or in 2 wires mode, as described in the Table 2 hereafter.

| Pin | Signal | 4-wires mode             | 2-wires mode    |
|-----|--------|--------------------------|-----------------|
| 1   | GND    | Not used                 | Not used        |
| 2   | Tx-    | Transmission RS485/ neg. | Negative signal |
| 3   | Tx+    | Transmission RS485/ pos. | Positive signal |
| 4   | Rx-    | Reception RS485/ neg.    | Not used        |
| 5   | Rx+    | Reception RS485/ pos.    | Not used        |
| 6   | +5V    | Not used                 | Not used        |

Table 2: RS 485 pin assignment

## 7 Mechanical data

### 7.1. Enclosure

The Apodys rectifier-charger is housed in a space-saving modular enclosure including front doors and removable panels (standard external protection IP 20). The enclosure is made of sheet steel. The doors can be locked. The enclosure is of the floor mounted type.

For harsh environmental conditions (dust, water), a higher degree of protection, of up to IP42 is available in option.

Specific system design can be achieved up to IP65. In such extreme cases, technical characteristics mentioned in this document are not maintained.

### 7.2. Ventilation

Natural air cooling is standard on most of Apodys rectifier-charger range. The cooling air entry is in the base and the air exit at the top of the device (some device also need side and/or rear clearance). It is recommended that the enclosure is installed with at least 400 mm of free space between device and ceiling at the top in order to allow an unhindered cooling air exit.

### 7.3. Cable entry

Cable entry is achieved via the bottom of the cabinet. Top cable entry is also available upon request.

### 7.4. Enclosure design

All the surfaces of the enclosure are finished with an electrostatically applied powder-epoxy-polyester coat, cured at high temperature. Colour of the enclosure is RAL 7032 (pebble grey) textured semi-gloss. For uniformity of the rectifier-charger with other equipments in electrical rooms, the surface finishing and the colour of the enclosure may be available according to the customer's specification and upon request.

### 7.5. Components identification

Main components are identified by self-adhesive vinyl labels. In option, the Apodys rectifier-charger offers the possibility to include specific component identification by engraved traffolyte labels.

### 7.6. Internal cables connection

Connection of cables is achieved by inserting cables directly in screw-clamps.

### 7.7. Access to integrated subassemblies

All internal subassemblies are accessible for typical and most frequent maintenance from the front of the unit. Top access is available for replacement of cooling fans, if any. Rear access is not required for installation or servicing. In any case and if side or rear access is required, the side and rear panels are removable.

### 7.8. Installation

The rectifier-charger is forkliftable from the front. Upon request, it can be equipped with lifting lugs to facilitate its installation on site.

## 8 Environmental conditions

The Apodys rectifier-charger is capable of withstanding any combination of the following environmental conditions. It operates without mechanical or electrical damage or degradation of operating characteristics.

### 8.1. Ambient temperature

The rectifier-charger is capable of operating permanently from 0° to 40°C.

### 8.2. Relative humidity

The rectifier-charger is capable of withstanding up to 90% humidity

level (non-condensing) for an ambient temperature of 20°C.

### 8.3. Altitude

The maximum altitude without derating is 1000 metres above sea level.

Please consult us for operating the system above 1000 metres.

## 9 Technical data

### Data common to the complete Apodys 1Ph-2P rectifier-charger range

#### Rectifier input

|                                                                                                      |      |                                      |
|------------------------------------------------------------------------------------------------------|------|--------------------------------------|
| Nominal input voltage                                                                                | (V)  | 230 [220 / 240] (other upon request) |
| Input phases                                                                                         |      | 1 ph                                 |
| Input voltage tolerance                                                                              | (%)  | +10 / -10                            |
| Nominal frequency                                                                                    | (Hz) | 50 / 60 (factory setting selectable) |
| Tolerance on frequency                                                                               | (%)  | +5 / -5                              |
| Rectifier type                                                                                       |      | 2-pulse (2 thyristors – 2 diodes)    |
| Isolation transformer                                                                                |      | Standard                             |
| soft start                                                                                           | (s)  | 5                                    |
| Maximum recommended voltage distortion (THD) from Mains (or generator) on the input of the rectifier | (%)  | 8                                    |

#### Rectifier output

|                                                                     |         |                                      |
|---------------------------------------------------------------------|---------|--------------------------------------|
| DC voltage stability                                                | (%)     | +/-1 (+/-1.5 for paralleled systems) |
| DC voltage ripple in float (with battery connected)                 | (% rms) | 1                                    |
| Rectifier-charger current limitation (in floating, charge or boost) |         | 1 nominal                            |

#### System data

|                            |         |                 |
|----------------------------|---------|-----------------|
| External protection degree |         | IP 20           |
| Internal protection degree |         | IP 20 open door |
| Cable entry                |         | Bottom          |
| Access                     |         | Front           |
| System design life         | (years) | 20 minimum      |

#### Environmental data

|                                            |      |                                  |
|--------------------------------------------|------|----------------------------------|
| Operating temperature                      | (°C) | 0 to 40 (permanent operation)    |
| Storage temperature                        | (°C) | 0 to +70                         |
| Maximum relative humidity (non condensing) | (%)  | <90                              |
| Operating altitude                         |      | 1000 m (without system derating) |

#### Battery

|                                                         |  |                                                                                                                       |
|---------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------|
| Battery types                                           |  | Lead Acid or Cadmium Nickel, vented or recombination types                                                            |
| Battery autonomy                                        |  | From 10 minutes to hours                                                                                              |
| Battery current limitation in floating and charge modes |  | According to customer's specification<br>Typical values:<br>0.1C (Lead Acid battery)<br>0.2C (Nickel Cadmium battery) |
| Battery current limitation in boost mode                |  | 0,05C (Lead acid battery)<br>0,1C (Nickel Cadmium battery)                                                            |

## Data for 24 VDC output systems

| Ratings                                | (A)               | 25    | 60   | 100  | 160  | 250  |
|----------------------------------------|-------------------|-------|------|------|------|------|
| <b>Rectifier input</b>                 |                   |       |      |      |      |      |
| Current consumption at full load       | (A)               | 5.9   | 13.2 | 21.7 | 52.8 | 13.2 |
| <b>Rectifier output</b>                |                   |       |      |      |      |      |
| Battery nominal voltage                | (V)               | 24    |      |      |      |      |
| Output voltage in floating             | (V)               | 27.24 |      |      |      |      |
| Max DC current                         | (A)               | 25    | 60   | 100  | 160  | 250  |
| <b>System data</b>                     |                   |       |      |      |      |      |
| Heat dissipation system(*)             |                   | N     | N    | N    | N    | N    |
| Dissipated power                       | (W)               | 264   | 488  | 768  | 1158 | 1702 |
| Efficiency(**)                         | (%)               | 72    | 77   | 78   | 79   | 80   |
| Noise                                  | (dBA)             | 60    | 60   | 60   | 60   | 60   |
| Height                                 | (mm)              | 1852  | 1852 | 1852 | 1852 | 1852 |
| Width                                  | (mm)              | 600   | 600  | 600  | 800  | 800  |
| Depth                                  | (mm)              | 608   | 608  | 608  | 808  | 808  |
| Footprint                              | (m <sup>2</sup> ) | 0.36  | 0.36 | 0.36 | 0.64 | 0.64 |
| Mass(**)                               | (kg)              | 90    | 114  | 144  | 227  | 285  |
| <b>Drawing code</b> (see paragraph 12) |                   |       |      |      |      |      |
| Code for general arrangement           |                   | A0    | A0   | A0   | B0   | B0   |

NOTA: These data are typical and are valid in the following conditions: Sealed lead acid battery (12 cells) operated at Ufloat=2,27V per cell and at 20°C, with a 1x230VAC Mains input at cos phi=0,7. The system can also be designed and pre-set for use with any other type of stationary battery.

-(\*) N: Natural cooling / F: Fan-assisted cooling

-(\*\*) For information only. Mass may vary according to configurations and options

-(\*\*\*) For tolerance, see IEC 60146-1-1

## Data for 48 VDC output systems

| Ratings                                | (A)               | 25    | 60   | 100  | 160  | 250  |
|----------------------------------------|-------------------|-------|------|------|------|------|
| <b>Rectifier input</b>                 |                   |       |      |      |      |      |
| Current consumption at full load       | (A)               | 10.6  | 24.7 | 40.2 | 63.7 | 98.3 |
| <b>Rectifier output</b>                |                   |       |      |      |      |      |
| Battery nominal voltage                | (V)               | 48    |      |      |      |      |
| Output voltage in floating             | (V)               | 54.48 |      |      |      |      |
| Max DC current                         | (A)               | 25    | 60   | 100  | 160  | 250  |
| <b>System data</b>                     |                   |       |      |      |      |      |
| Heat dissipation system(*)             |                   | N     | N    | N    | N    | N    |
| Dissipated power                       | (W)               | 340   | 717  | 1037 | 1538 | 2217 |
| Efficiency(**)                         | (%)               | 80    | 82   | 84   | 85   | 86   |
| Noise                                  | (dBA)             | 60    | 60   | 60   | 60   | 60   |
| Height                                 | (mm)              | 1852  | 1852 | 1852 | 1852 | 1852 |
| Width                                  | (mm)              | 600   | 600  | 600  | 800  | 800  |
| Depth                                  | (mm)              | 608   | 608  | 608  | 808  | 808  |
| Footprint                              | (m <sup>2</sup> ) | 0.36  | 0.36 | 0.36 | 0.64 | 0.64 |
| Mass(**)                               | (kg)              | 117   | 146  | 197  | 285  | 355  |
| <b>Drawing code</b> (see paragraph 12) |                   |       |      |      |      |      |
| Code for general arrangement           |                   | A0    | A0   | A0   | B0   | B0   |

NOTA: These data are typical and are valid in the following conditions: Sealed lead acid battery (24 cells) operated at Ufloat=2,27V per cell and at 20°C, with a 1x230VAC Mains input at cos phi=0,7. The system can also be designed and pre-set for use with any other type of stationary battery.

-(\*) N: Natural cooling / F: Fan-assisted cooling

-(\*\*) For information only. Mass may vary according to configurations and options

-(\*\*\*) For tolerance, see IEC 60146-1-1

# Chloride Apodys rectifier-charger 1Ph-2p

## Data for 110 VDC output systems

| Ratings                                | (A)               | 25     | 60   | 100  | 160   | 250   |
|----------------------------------------|-------------------|--------|------|------|-------|-------|
| <b>Rectifier input</b>                 |                   |        |      |      |       |       |
| Current consumption at full load       | (A)               | 22.1   | 51.7 | 84.3 | 133.3 | 205.9 |
| <b>Rectifier output</b>                |                   |        |      |      |       |       |
| Battery nominal voltage                | (V)               | 110    |      |      |       |       |
| Output voltage in floating             | (V)               | 118.04 |      |      |       |       |
| Max DC current                         | (A)               | 25     | 60   | 100  | 160   | 250   |
| <b>System data</b>                     |                   |        |      |      |       |       |
| Heat dissipation system(*)             |                   | N      | N    | N    | N     | N     |
| Dissipated power                       | (W)               | 604    | 1250 | 1764 | 2575  | 3647  |
| Efficiency(**)                         | (%)               | 83     | 85   | 87   | 88    | 89    |
| Noise                                  | (dBA)             | 60     | 60   | 60   | 60    | 60    |
| Height                                 | (mm)              | 1852   | 1852 | 1852 | 1852  | 1852  |
| Width                                  | (mm)              | 600    | 600  | 600  | 800   | 800   |
| Depth                                  | (mm)              | 608    | 608  | 608  | 808   | 808   |
| Footprint                              | (m <sup>2</sup> ) | 0.36   | 0.36 | 0.36 | 0.64  | 0.64  |
| Mass(**)                               | (kg)              | 129    | 217  | 305  | 459   | 605   |
| <b>Drawing code</b> (see paragraph 12) |                   |        |      |      |       |       |
| Code for general arrangement           |                   | A0     | A0   | A0   | B1    | B1    |

NOTA: These data are typical and are valid in the following conditions: Sealed lead acid battery (52 cells) operated at Ufloat=2,27V per cell and at 20°C, with a 1x230VAC Mains input at cos phi=0,7. The system can also be designed and pre-set for use with any other type of stationary battery.

-(\*) N: Natural cooling / F: Fan-assisted cooling

-(\*\*) For information only. Mass may vary according to configurations and options

-(\*\*\*) For tolerance, see IEC 60146-1-1

## 10 Parallel operation

The Apodys rectifier-charger systems have the capability to be connected in parallel for dual or trial configurations between units of the same rating. The parallel connection of Apodys rectifiers-chargers increases reliability for the DC load.

### 10.1. Operating principle

The paralleling principle is based on static regulation.

The characteristic  $U = f(I)$  is slightly changed to give it a small slope (of 0.5 to 1%) - (see Figure 8).

The internal voltage reference  $U_0$  is modified according to the current the charger must supply, so that the characteristic becomes:

$$U_s = U_0 - kI \quad \text{where:}$$

$U_s$  = output voltage

$U_0$  = reference voltage

$k$  = static regulation coefficient

$I$  = charger output current

Thus, when 2 chargers are connected in parallel, the characteristics are:

$$U_{s1} = U_{01} - k_1 I_1$$

$$U_{s2} = U_{02} - k_2 I_2$$

$$\text{And, } U_{s1} = U_{s2}$$

The  $U_0$ ,  $k$  and  $I$  parameters are set to the same values so that output currents are similar:  $I_1 = I_2$  (see Figure 9)

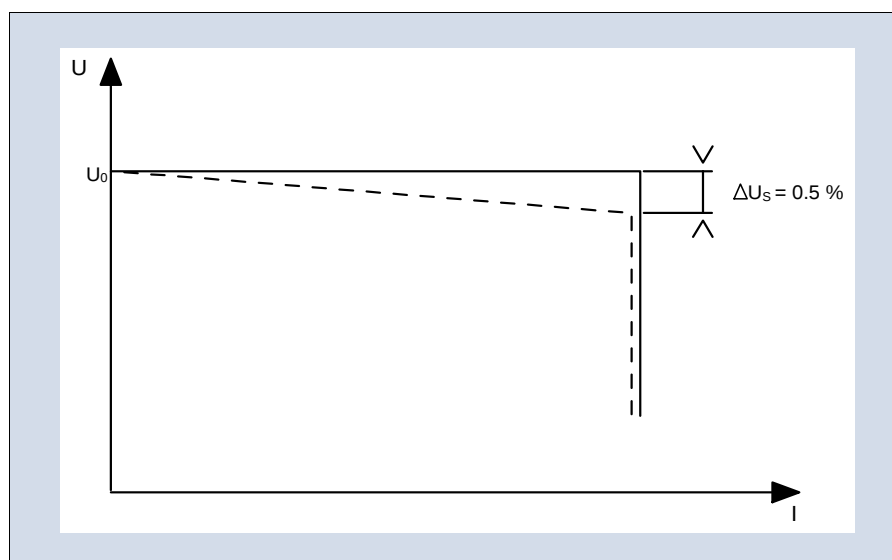


Figure 8: Slope description for static regulation of paralleled chargers

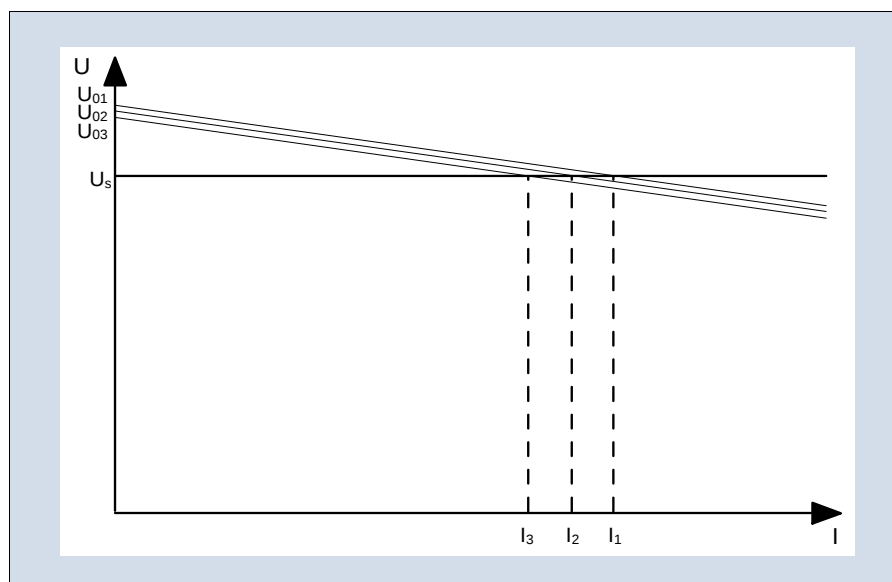


Figure 9: Curve principle of 3 chargers in parallel

## 10.2. Examples of configurations

The Apodys rectifier-charger range is capable of operating in parallel as shown on Figures 10, 11 and 12, among some other possibilities.

The blocking diodes ensure one major function: They allow the control of the recharge current of each battery.

On Figure 10, both Apodys rectifiers concur to charge the same battery. The DC load is equally shared between both rectifiers.

On Figure 11, both Apodys rectifiers concur to charge the same battery. Both DC loads 1 and 2 automatically take the power they need, they do not need to be equal.

On Figure 12, both DC UPS systems are in full-parallel redundant configuration. The DC bus tie allows to take a full system off while maintaining the 2 distribution systems.

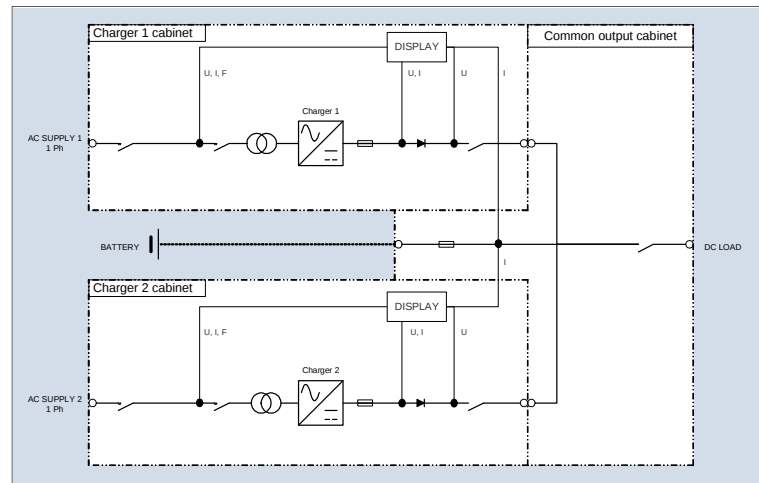


Figure 10: Parallel configuration example 1

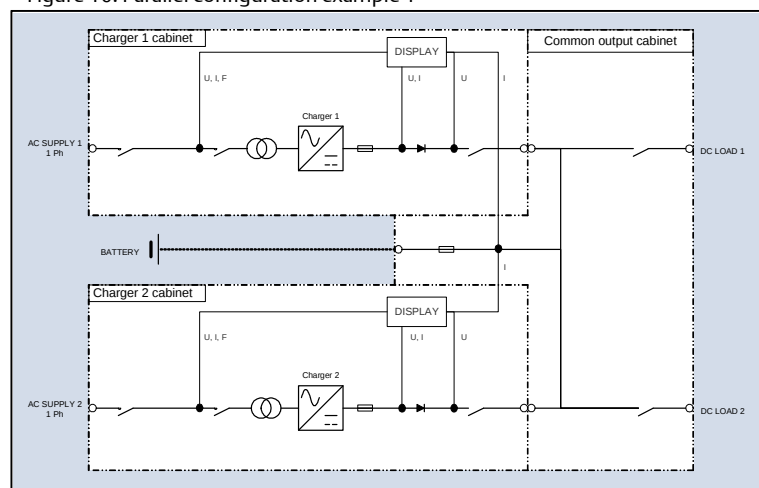


Figure 11: Parallel configuration example 2

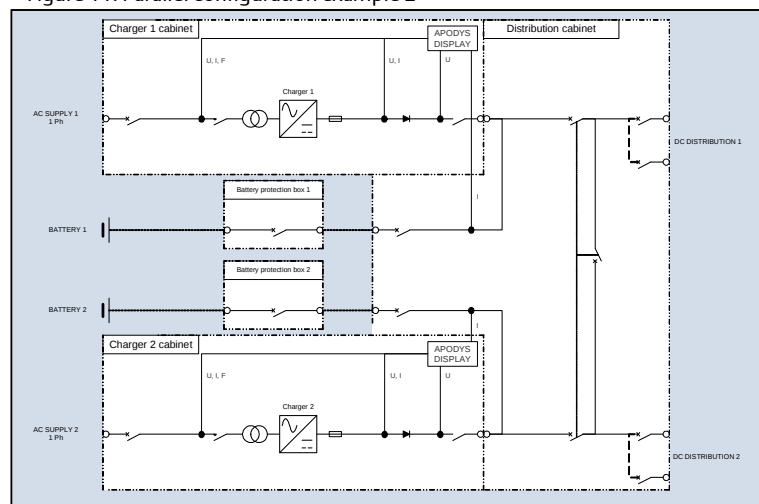


Figure 12: Parallel configuration example 3

## 11 Options

### 11.1. Main electrical options

The list of options described in this section is non-exhaustive. Please consult us for any other requirement.

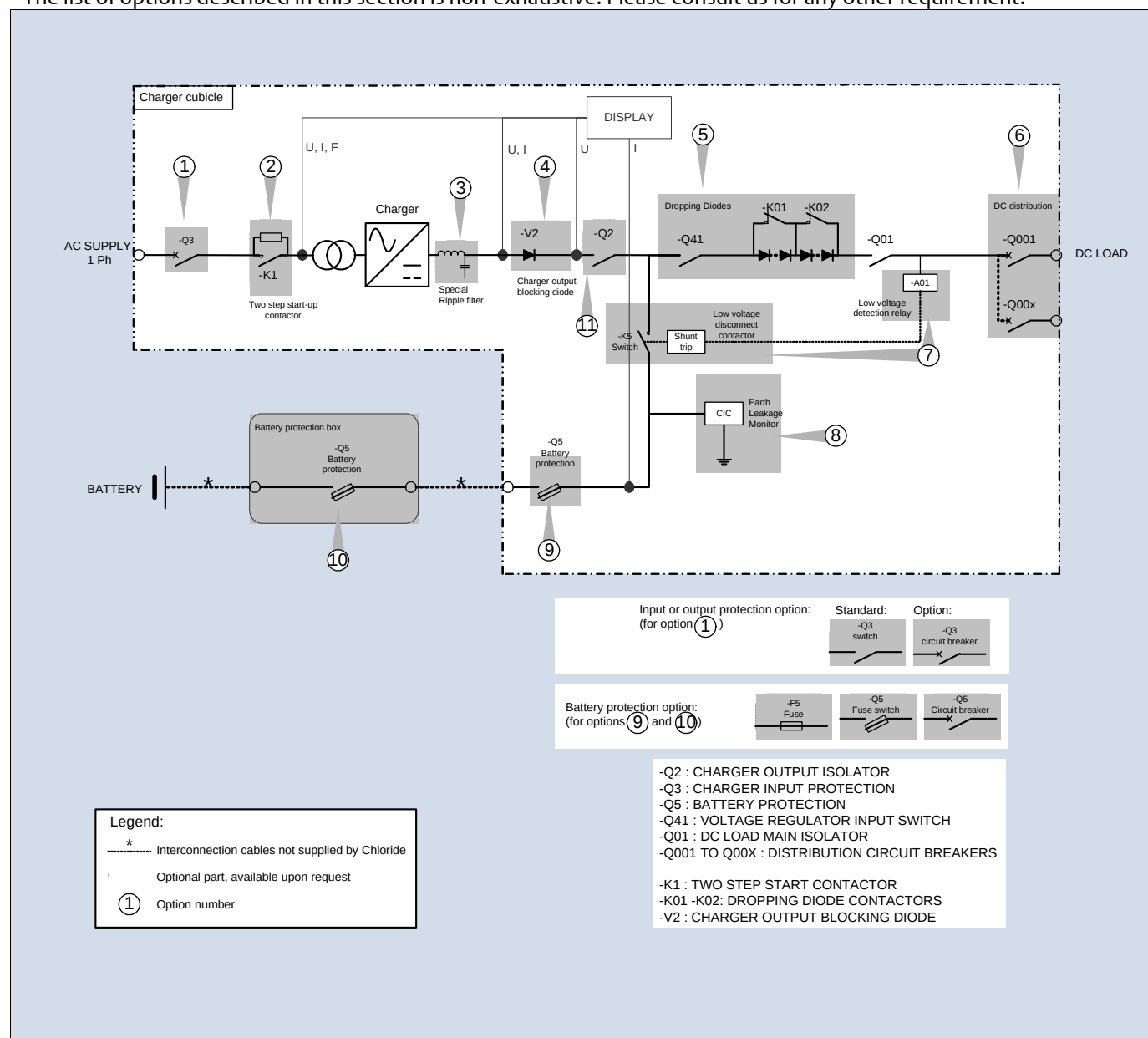


Figure 13: Apodys 1Ph-2P rectifier charger – overview of electrical options

# Chloride Apodys rectifier-charger 1Ph-2p

| Option No. | Option name                                  | Function / description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ①          | Charger input protection                     | Protect the input of the DC UPS system by a double-pole input circuit breaker.<br><br><i>Chloride's standard is a double-pole input switch on the input.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| ②          | Two-step start-up contactor                  | Limit the inrush current on starting up the system to 8 times the nominal input current (15 times as standard).<br>Addition of a two-steps start-up device to limit the inrush current due to the magnetisation of the transformer.<br><br><i>Please note that the rectifier dimensions mentioned in this document may not be maintained with this option.</i>                                                                                                                                                                                                                                                                                                                                                                                                                               |
| ③          | Additional ripple filter                     | Reduce the DC voltage ripple below the Chloride standard of 1% RMS.<br>2 filters configurations are made available to reach the following data:<br>– Telecommunication filter. CCITT curve.<br>– Current ripple 0.1C/10 rms, battery connected, for VRLA batteries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| ④          | Blocking diode                               | Operate two or more rectifiers-chargers in parallel.<br><br><i>See paragraph 0 for further details.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| ⑤          | Dropping diodes                              | Adapt the system output voltage to make it compatible with the DC connected loads.<br><br>Operating conditions and technical data of some batteries are often not compatible with the critical DC load connected to the UPS output. This is particularly the case when operating the DC UPS with Nickel Cadmium batteries, with which the gap between charge voltage and discharge voltage is wide. The dropping diodes option allows answering to these operating conditions.<br>The dropping diodes are successively shunted in order to respect the DC voltage accepted by the load. One or more voltmetric relays measure the battery voltage and control the contactors to smoothly drop the output voltage.<br><br><i>This option may affect the overall dimensions of the system.</i> |
| ⑥          | DC distribution                              | Ensure the distribution, protection and segregation of the DC load.<br>Distribution boards may be included in the UPS system or installed in a separate cabinet. These distribution boards may be customised according to the customer's requirements. MCB, MCCB, or fuses are available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| ⑦          | Low voltage disconnect contactor (LDV)       | Protect the battery from deep discharges and thus enhance battery lifetime.<br>The LDV option includes an output contactor controlled by voltage relay in order to disconnect the load at the end of battery autonomy period. Reconnection of the load is automatic at the charger restoration and upon the resumption of normal conditions.                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| ⑧          | Earth leakage monitor (DC earth fault alarm) | Monitor the insulation resistance on the DC bus.<br>Used in conjunction with the isolation transformer, this option is made of an electronic circuit "Chloride CIC" (or equivalent). It is fitted into the rectifier/charger cubicle and delivers remote indication by a changeover voltage-free contact. Local indication (inside the cabinet) by two LED's is available on the PCB (or moulded device) to indicate the polarity on fault. A local test push-button is also available on the device to simulate fault conditions (+ or -).                                                                                                                                                                                                                                                  |
| ⑨          | Battery protection                           | Prevent any short-circuit that could occur on the battery circuit and therefore prevent the battery cables from fire risks.<br>3 types of protections are made available:<br>– Fuse: fully rated fuse with auxiliary contact for the monitoring of its operating status.<br>– Fuse switch: fully rated fuse switch with auxiliary contact for the monitoring of its operating status.<br>– Circuit breaker: fully rated circuit breaker and an additional auxiliary contact for the monitoring of its position.                                                                                                                                                                                                                                                                              |
| ⑩          | External battery protection                  | Protect the battery circuit as for option 9.<br>The battery protection device is housed in a wall-mounted metal box for battery systems mounted on racks and it is supplied with the battery cabinet, when the battery is fitted in a matching cubicle. Furthermore, this device serves as a safety element for the cross section of the power cable between the UPS and the remotely placed battery system. Therefore, the wall-mounted box must be installed as close as possible to the battery and the length of cables between battery and UPS system must be the shortest.                                                                                                                                                                                                             |
| ⑪          | Charger output switch                        | Isolate the charger output.<br>The adjunction of this switch allows safe maintenance of the charger module. By opening the charger input circuit and the charger output circuit, it becomes possible to safely maintain the charger module.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## 11.2. Environment-related options

### 11.2.1. External cubicle protection

According to IEC 60529 (Degrees of protection provided by enclosures-IP Code), it is possible to protect the rectifier/charger cubicle from solid or liquid intrusion. The protection levels available are:

- IP 21
- IP 22
- IP 40
- IP 41
- IP 42

In all cases, even for standard IP 20 level, the third number shall be 7, representing mechanical protection.

### 11.2.2. Special enclosure finishing

Standard finishing of the enclosure is RAL 7032 (grey) textured semi gloss. Any other type of painting specification is also achievable upon request, in compliance with AFNOR, RAL or BS standards.

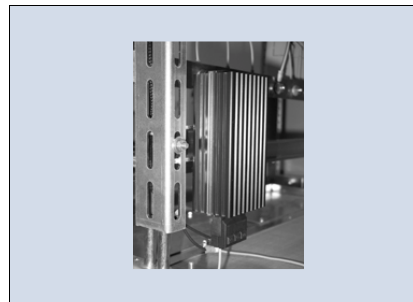
### 11.2.3. Specific ambient operation conditions

- Specific temperature conditions: Upon request, the Apodys charger is able to operate above 40°C (and up to 55°C) or below 0°C.
- Special seismic design: Specific modifications of the system may be added to allow the UPS to operate in seismic risks areas. Please consult us.

In such extreme conditions, the customer must specify the required

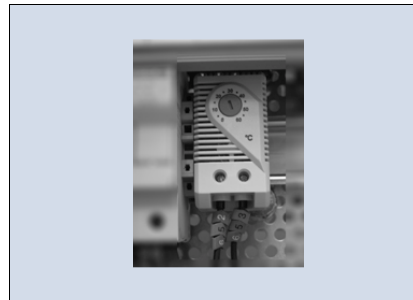
service conditions, as specified in IEC 60146-2, §5.

### 11.2.4. Anti-condensation heater



This option includes a heater which is fitted inside the cubicle, to prevent internal components from condensation, mainly when the UPS is stored for a long period.

### 11.2.5. Temperature monitoring



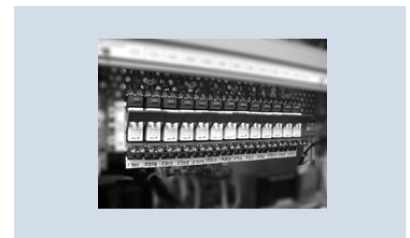
This option consists in a thermostat fitted inside the cubicle to indicate abnormal heating in the UPS. This device is adjustable below 90°C and includes a remote indication available on a normally open, voltage-free contact.

### 11.2.6. EEx battery protection box

Eex-classified battery protection box is available when battery and DC UPS systems operate in an area where there is a risk of explosion. This box includes the external battery protection option.

## 11.3. Monitoring options

### 11.3.1. Customer interface relays



It is possible to increase the number of outputs described in paragraph 6 by providing additional output relays. These outputs can be used to monitor several parameters specified by the user.

### 11.3.2. Modbus / Jbus

Upon request, Apodys charger is able to remotely deliver information through Modbus/Jbus protocol (2 or 4 wires).

This additional feature includes:

A hardware kit: an additional communication board is included into the Apodys charger. Customer connections are described in paragraph 6.

A software kit: The Apodys charger is delivered with Chloride's standard Modbus/Jbus code (embedded into the system) and fully detailed protocol coding documentation.

#### NOTE:

**The communication cable between the UPS and the monitoring station is not part of Chloride's supply.**

### 11.3.3. Monitoring software PPVIs

Software solution is available to remotely monitor all Chloride's UPS from the Apodys range (DC and AC systems).

The PPVis software (windows based) offers several features, such as:

- Current state of components
  - Display of output voltage, rectifier performances, load current
  - Number of power failures
  - Available back-up time
  - Data storage function
- The figure hereafter shows a PPVis screenshot for a DC UPS system.

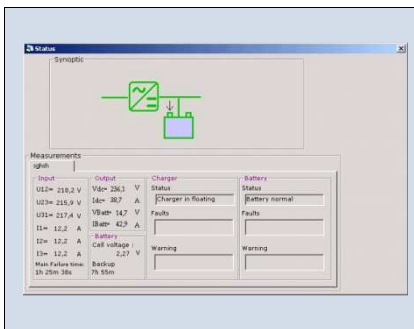


Figure 14: PPVis software screenshot.

### 11.3.4. Battery Monitoring

The associated battery can be connected to the battery management system from Chloride. This system provides the following features:

- Voltage measurement of each battery block by mean of separate battery measuring modules.
- Analysis of each battery block with measuring of the minimum and maximum voltage values.
- Graphic visualisation and analysis by means of dedicated software

This system brings the following benefits:

- Early detection of faults in the battery circuit, increasing the safety of the DC UPS system

- On-time fault recognition, enhancing the reliability of the system
- Easy detection of the defective battery block, reducing correction and maintenance costs
- Compatible with Nickel Cadmium and Lead acid batteries.

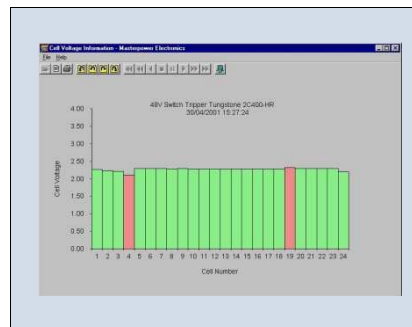


Figure 15: Battery Monitoring System screenshot

## 11.4. Other options

### 11.4.1. Special identification of internal components

As standard, the Apody charger includes internal sub-assemblies identification with self-adhesive vinyl labels. As an option, it is possible to change these labels to engraved traffolyte labels, black signs on white background.

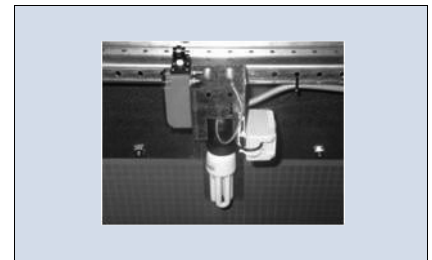
### 11.4.2. Top cable entry

The option allows power cable entry from the top of the DC-UPS, by adding an external cabinet to drive the cables down to the bottom of the UPS.

#### NOTE

**This option may affect the overall dimensions of the system.**

### 11.4.3. Internal lighting



Internal lighting is available upon request to improve internal visibility of the system.

### 11.4.4. Battery cubicle

Matching battery cubicles are available to provide a fully-enclosed DC UPS system. The battery cubicle includes the following:

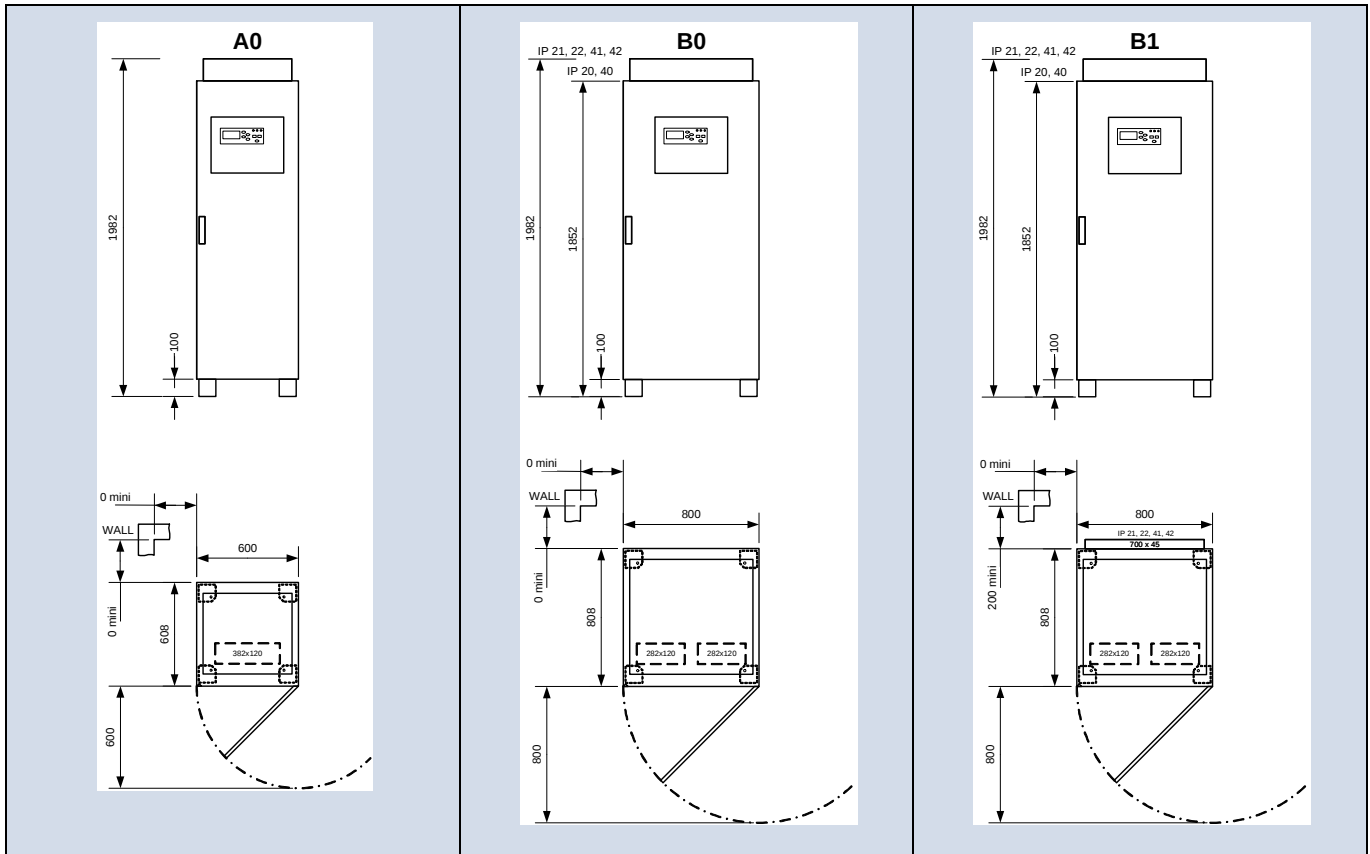
- Cubicle
- Disconnecting means
- Fuses
- Power terminal blocks

### 11.4.5. Lifting eyes



Upon request, the rectifier-charger cubicle can be equipped with lifting eyes to facilitate its installation on site.

## 12 General arrangement drawings



[illegible]

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