



INGENIERIA  
ELECTRONICA, MICROPROCESADORES, ENERGIA

T. DE LOQUI 58 - 9400 RIO GALLEGOS

C3b / Cathodic Protection - Page 1 of 6

## TECHNICAL DOCUMENTATION

# ELECTRONIC SYSTEM FOR WIND- POWERED CATHODIC PROTECTION SITES CHIMEN AIKE (CH-AK 12) AND SUR RIO CHICO (SR-CH 7)

Client: Pérez Company S.A. / UTE S.C. II  
Date: January 1998

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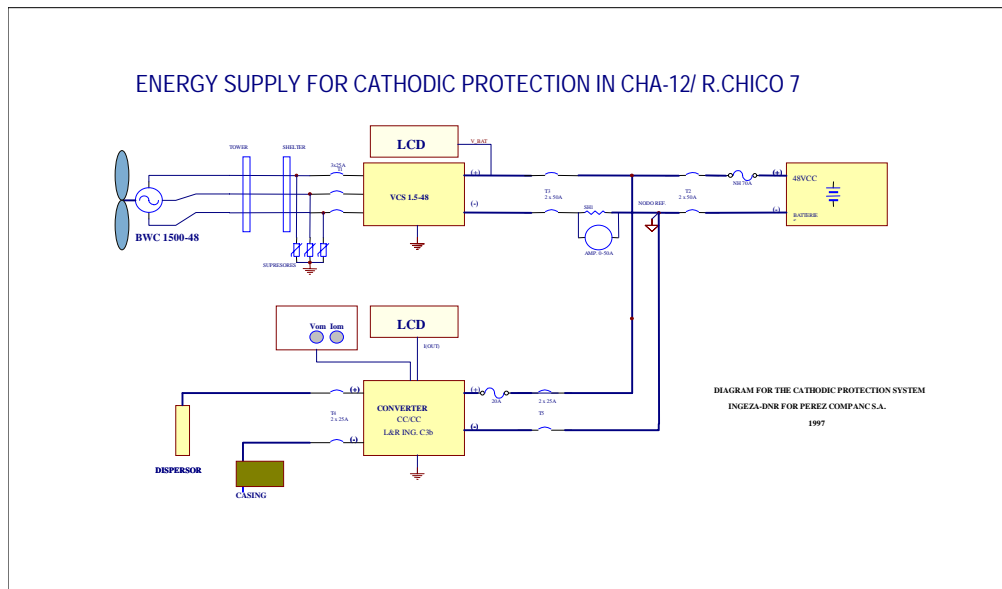
## 1. Wind-Powered Systems for Cathodic Protection (Perez Companc S.A.)

This cathodic protection system was installed in January and February 1998 for both of the drilling holes Ch-Ak 12 (Chimen Aike) and SR-Ch 7 (Sur Río Chico) by INGEZA and L&R Ingeniería.

The system has the following components:

1. Wind turbine Bergey BWC 1500-48 E.S.
2. Tower, 8.4m
3. Voltage regulator (Thyristor – based) Bergey VCS 1.5-48
4. Circuit board
5. "Deep Cycle" Batteries SOLAR T2200 American Battery /Trojan
6. Converter DC/DC Switching C3b by L&R Ing.
7. Metal shelter for elements 3 - 6.
8. Disperser and casing connections.

The following diagram shows the arrangement of the elements:



## 2. General Description

1. VCS1.5-48 Regulator: Converts the three-phase current of the wind generator into direct current, in a controlled manner to protect the batteries. The LCD display shows the voltage of the battery system. Under normal conditions, the green LED (System Available) and the amber LED (Normal Regulation) are turned ON. In times of strong winds and low charge the red LED (High Regulation) lights up, indicating a voltage of more than 2.65 Volt (per cell) in the battery system. Normal operation is resumed once the battery system returns to

2.3 Volt per cell. If no LEDs are on, with normal T3 and battery connections, please contact L&R Ingeniería.

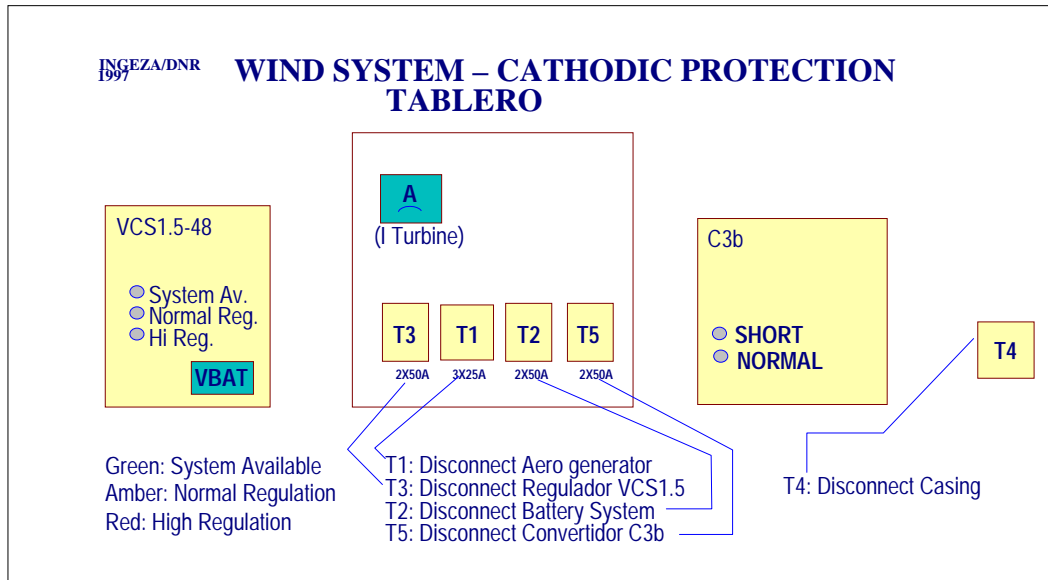


Diagram 1: Main Panel

2. Main Panel: This panel contains the DC-Bus (48V) conductors, and from left to right the following switches are installed:
  - a) T3: Disconnection between Regulator VCS and DC-Bus.
  - b) T1: Disconnection between wind generator and Regulator VCS
  - c) T2: Disconnection between DC-Bus and Battery System
  - d) T5: Disconnection between DC-Bus and Converter C3b.
 Furthermore there is an Ampere-meter for measuring the charge from the wind turbine and a LED, which indicates the connection of the battery system.
3. Converter DC/DC model C3b from L&R Ingeniería: On the front panel you can see the LED for "Normal Operation" (green) and "Shut Down" (blinking red). A Shut Down can have several reasons. For more information see: **Converter DC/DC** later.
4. In an extra box you can find switch T4 for the disconnection of the converter from the casing cables.
5. Under the Regulator VCS at ground level a fuse-box (70A) can be found, which protects the whole system from a short circuit.

Diagram 2 shows the electric connections of the system.

### 3. DC/DC Converter:

On the converter C3b Main Board the following elements can be found:

In the lower left corner, the disconnect switch for the 48 Volt (DC) "input" (current from the battery system) can be found, side by side with a 20A fuse (DIN).

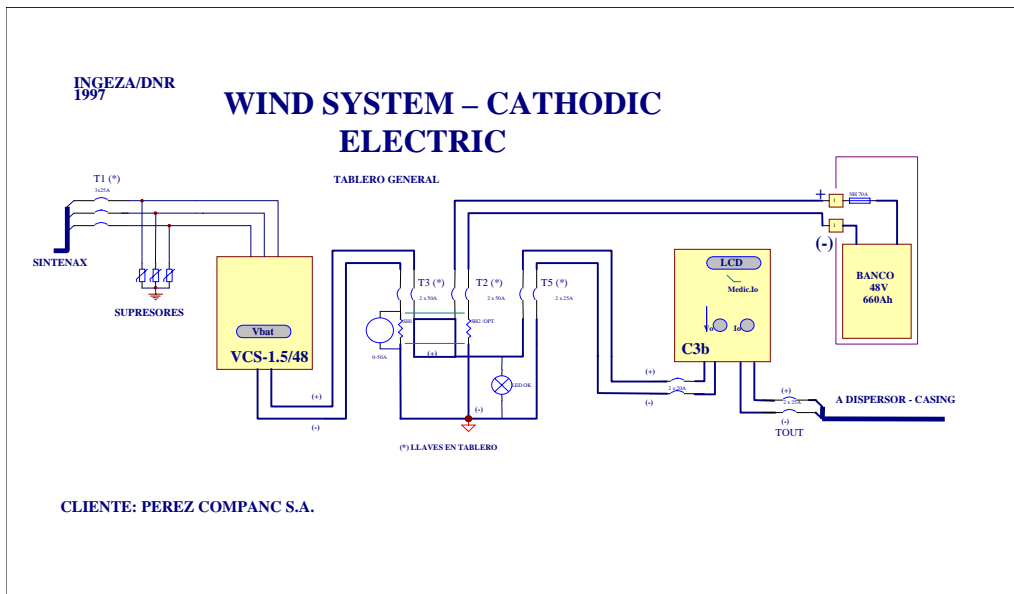
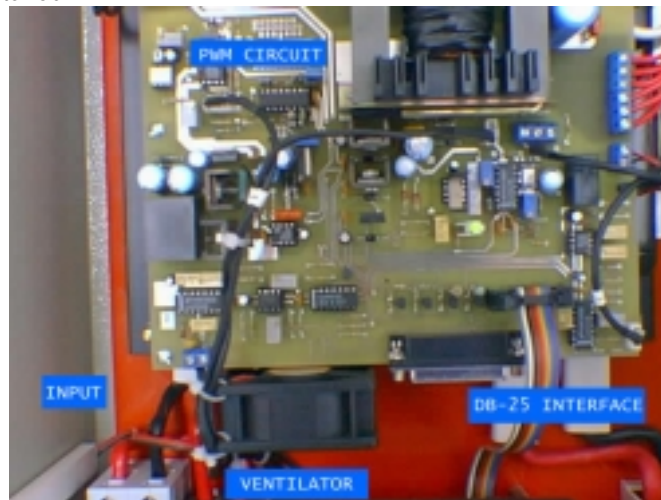
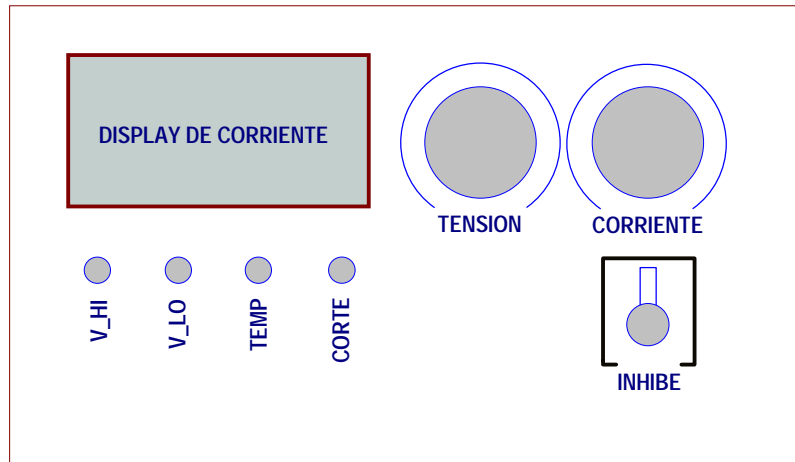


Diagram 2: Electrical Circuit

- The middle and upper part is occupied by the Main Board which has no user-adjustable parts and should not be altered or manipulated under any circumstances. This part also includes a cooling system with ventilator. This ventilator is started automatically when the temperature exceeds a preset value. On the Main Board also a green LED which indicates operation is installed.



- On the lower right side the connection with the casing can be seen.
- In the lower middle part a sub-panel with controls can be found, which allow adjusting the level of protection current and checking the state of the system. The sub-panel with all switches and indicators is shown in the next figure.



From left to right the controls are:

1. LCD Display: Shows the final current en Amperes.
2. LED red V\_HI: Indicates a Shut Down provoked by battery over-voltage. It will light up together with the flashing green LED for "general" Shut Downs.
3. LED red V\_LO: Indicates a Shut Down provoked by battery under-voltage. It will light up together with the flashing green LED for "general" Shut Downs.
4. LED red TEMP: Indicates a Shut Down provoked by over-temperature in the C3b. It will light up together with the flashing green LED for "general" Shut Downs.
5. LED flashing green CORTE: Indicates malfunction or manual Shut Down.
6. Potentiometer for regulating the output voltage.
7. Potentiometer for regulating the output maximum current.
8. Switch (CORTE) for producing a manual Shut Down.

#### 4. System Operation:

Order of connection of the System (all switches initially off):

1. Connect switch T2 to the battery system and to the DC-BUS. The "test light" (green 10mm LED on the central board) should light up now.
2. Connect switch T3 with the regulator VCS (from the wind turbine) and with the DC-BUS. Now, the green LED "System Available" on the regulator VCS should light up. On the LCD-display of the regulator VCS now the voltage of the battery system can be observed (values from 48V nominal to 58V are normal).
3. Connect switch T1, which links the wind turbine to the whole system and provides it with current. If there is wind non-zero values in the main ampere-meter can be observed.
4. Open the cover of the Converter DC/DC C3b. In the sub-panel turn both potentiometers (CURRENT and VOLTAGE) to the minimum (anticlockwise), and leave the switch (corte manual) in the upper position (inactive). Later connect the external switch T4 (connection converter – casing) on the right side of the Converter DC/DC C3b.

5. Finally, activate switch T5 in the central board, which connects the DC-Bus with the C3b. Now, you can observe in the display of the sub-panel a current of 1.5 to 3.5A and in addition the green LED (ACTIVATION) on the main board should light up now. Over the cover of the C3b the green LED (NORMAL) should also light up now.
6. For getting the desired current, turn the potentiometer (CURRENT) to  $\frac{3}{4}$  of the maximum and then adjust the potentiometer (VOLTAGE) until the display shows the desired current.



NOTES:

- The green flashing LED (CORTE) on the sub-panel indicates that the switch (CORTE MANUAL) is in the lower position (activated).
- If the green flashing LED lights up together with one of the red LED then an automatic Shut Down has occurred:
  - a) Because of over-voltage (more than 69V from battery system).
  - b) Because of under-voltage (less than 36V from the battery system).
  - c) Because of over-temperature in the DC/DC Converter C3b.

After these abnormal situations, operation is reestablished as soon as normal parameters are again present in the system.

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