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Cordex HP Controller

Controller Redundancy Integrator Guide

Technical Guide: 0350142-J0

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1. Introduction

This procedure describes the **Controller Redundancy** feature on the CXC-HP Controller. The procedure includes the basic operation, and configuration of both the hardware and software.

For the rest of this document, the following terms will be used to describe the two controllers:

Main controller: This controller runs during normal operation. When operational, it controls the CAN modules.

Reserve controller: This controller monitors the status of the main controller, and takes over control if the main controller fails.

2. Theory of Operation

The reserve controller needs to be:

- Connected to the same Ethernet network as the main controller.
- Connected to each CAN network for each CAN bus on the main controller to be taken over during failure.

  Example: If the main controller only has modules on CAN1 (CAN2 is not in use), the reserve controller only needs to have CAN1 on same network as main controller CAN1.

During normal operation, any CAN buses that will be taken over during failure will be disabled on the reserve controller. The reserve controller will monitor the main controller via Ethernet, and also detect CAN traffic to determine failure.

Communication over Ethernet is used to synchronize configuration from the main controller to the reserve controller. If there are any configuration changes on the main controller, the reserve controller will update to match the configuration. This is done once every minute.

Configuration **cannot** be edited on the reserve controller while the main controller is operational. If the reserve controller does not get a response from the main controller over Ethernet, it will indicate an **Ethernet Failure**, and raise an alarm.

If CAN communication has failed on the main controller, the reserve controller will attempt to take over control of the modules via CAN. After the reserve controller has taken control of the CAN bus(es), any configuration or maintenance tasks will need to be performed from the reserve controller.

If the main controller becomes operational again (or is replaced), the reserve controller will disable its CAN buses and give control back to the main controller.

During normal operation, the reserve controller will only display alarms and send out notifications relating to the status of the reserve controller, as well as any alarms related to controller redundancy. If the main controller fails, and the reserve controller takes control, all alarms will operate normally.

3. Procedures

3.1 Hardware Configuration

The Controller Redundancy feature requires Ethernet and CAN configuration on both controllers.

3.1.1 Ethernet Configuration

Both controllers need to be connected to the same network so they can communicate with each other over Ethernet.

3.1.2 CAN Configuration

The reserve controller needs to be connected to the CAN network(s) of the main controller. This can be done by daisy-chaining the reserve controller to the end of the last module. See figures below:

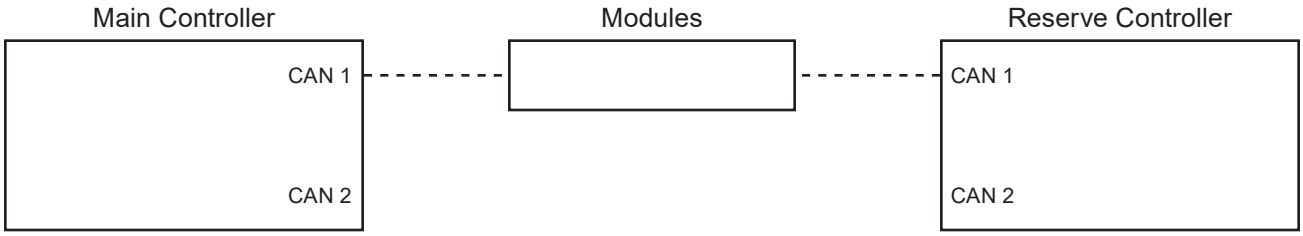

Figure 1 — Controller Redundancy with all modules on one CAN bus

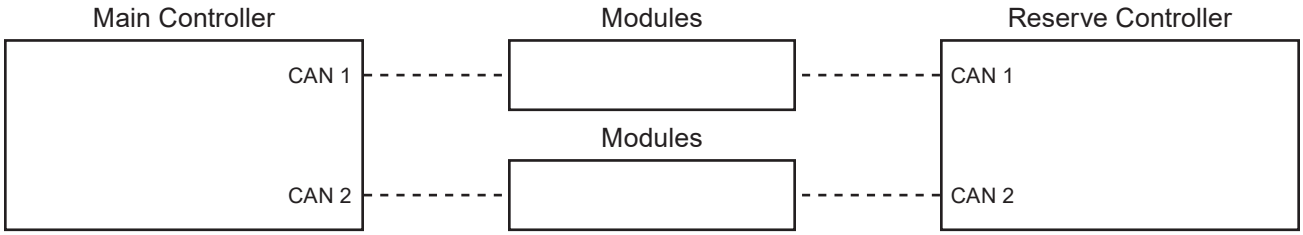

Figure 2 — Controller Redundancy with all modules on each CAN bus

3.2 Software Configuration

For the software configuration, some settings will need to be configured on both the main and reserve controllers.

NOTE:

This procedure only explains the configuration of the **Controller Redundancy** feature. It is expected that the main controller is already fully configured (systems created and configured, etc). The reserve controller can be blank, as configuration will be synchronized to it from the main controller.

3.2.1 Main Controller Software Configuration

To configure the main controller, perform the following steps from the Web UI:

1. Go to **Controller > Advanced Functions > Controller Redundancy**.
2. In the **Configuration** table, click **Configure Controller Redundancy**.
3. Read through the Preview, then click **Next**.
4. Select **Main** as the value for **Role of this Controller**, then click **Next**.
5. Enter the IP address of the reserve controller, then click **Next**.
   - Entering the IP address of the reserve controller will allow it to communicate with the main controller.
6. Review that the information is configured correctly, then click **Next**.
7. On the Results step, click **Done**.

After this information has been entered, the main controller will be able to indicate the status of the reserve controller.

3.2.2 Reserve Controller Software Configuration

To configure the reserve controller, perform the following steps from the Web UI:

1. Go to **Controller > Advanced Functions > Controller Redundancy**.
2. In the **Configuration** table, click **Configure Controller Redundancy**.
3. Read through the Preview, then click **Next**.
4. Select **Reserve** as the value for **Role of this Controller**, then click **Next**.
5. Enter the IP address of the main controller, then click **Next**.
   - Entering the IP address of the reserve controller will allow it to monitor the status of the main controller, as well as receive configuration changes.
   - If the Main controller was configured first, the IP address will automatically be entered.
6. Review that the information is configured correctly, then click **Next**.
7. On the Results step, click **Done**.

After this information has been entered, the reserve controller will be able to monitor the main controller, indicate status, and take control of the CAN modules if a failure occurs.

NOTE:

When a controller is configured as a reserve controller, it will no longer:

- Allow any configuration. Configuration will be managed by synchronization of main controller configuration.
- Activate most alarms. While the main controller is operational, the reserve controller will only display alarms and send out notifications for a select few alarms relating to the status of the reserve controller, as well as any alarms related to **Controller Redundancy**. If the Main controller fails, and the Reserve controller takes control, all alarms will operate normally.

3.3 Commissioning Test

The commissioning test will confirm that the configuration has been done correctly. This test will simulate a failure causing the reserve controller to acquire all the modules. To perform this test:

1. Remove power from main controller (simulating a failure).
   - If removal of power is not possible, unplug all CAN cables from the main controller.
2. After a few minutes, the reserve controller will acquire all modules and start operation.
   - If the reserve controller does not acquire all modules, check the CAN wiring to ensure that the reserve controller is connected correctly.
3. After the reserve controller has acquired all modules and is operating, restore power to the main controller (or plug CAN cables back in).
4. After the main controller starts up, the reserve controller will give control back to main.

After performing this test, the reserve controller will now have all the modules acquired, and they will show **Communication Lost**. If in future a failure does happen, the reserve controller will quickly be able to re-acquire those same modules.

4. Levels of Redundancy

This section shows the different failure modes (hardware/software/communication), and how the **Controller Redundancy** feature will handle these failures.

Example: A system with an L-ADIO and three rectifier shelves on CAN1 (see picture below) will be used to illustrate different points of communication and hardware failure.

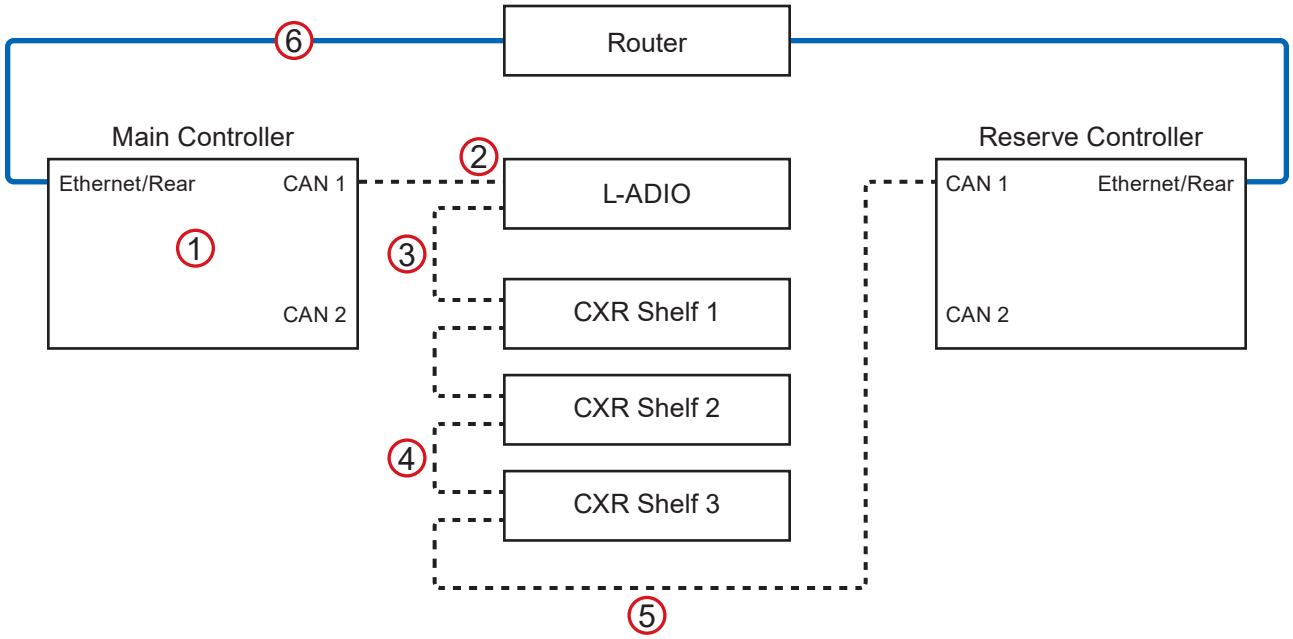

Figure 3 — Controller Redundancy setup showing possible failure locations

Failure Condition	What the System Does	What the User Does
Failure 1: Main controller fails (loses power or hardware failure).	• Reserve controller takes control of CAN modules, operates system normally. • Reserve controller indicates the main controller has failed through alarm.	Replace the main controller or troubleshoot power loss at earliest convenience. Redundancy has now been lost.
Failure 2: CAN cable between main controller and ADIO is broken or unplugged.	• Reserve controller takes control of CAN modules, operates system normally. • Reserve controller indicates the main controller has failed through alarm. • Main controller will have many alarms (has no modules).	Troubleshoot CAN cable between main controller and ADIO at earliest convenience. Redundancy has now been lost.
Failure 3: CAN cable between ADIO and rectifiers is broken or unplugged.	• Reserve controller attempts to take over control of CAN modules. • Reserve acquires all rectifiers, starts control. • Reserve controller indicates the main has failed through alarm. **ADIO Comms Lost** alarm is triggered. • Main controller will have many alarms (has no rectifiers).	Troubleshoot CAN cable between ADIO and rectifiers as soon as possible. The system functions (charge control, temperature compensation, etc) will no longer work, as they rely on an ADIO.

Failure Condition	What the System Does	What the User Does
Failure 4: CAN cable between rectifier shelves is broken or unplugged.	• Reserve controller will not attempt to take control, as the main controller is still controlling some CAN modules. • Reserve controller indicates **CAN Failure**, raises alarm. • Main controller will trigger **Rectifier Comms Lost** alarm (loss of some rectifiers).	Troubleshoot CAN cable between rectifier shelves as soon as possible. Rectifiers that are not being controlled will go to safe mode, which can cause problems for charge control.
Failure 5: CAN cable between rectifiers and reserve controller is broken or unplugged.	• Reserve controller will not attempt to take control, as main controller is still controlling CAN modules. • Reserve controller indicates **CAN Failure**, raises alarm. • Main controller will operate normally.	Troubleshoot CAN cable between rectifier shelf and reserve controller at earliest convenience. Redundancy has now been lost.
Failure 6: Ethernet communication fails between controllers (due to cable failure, cable being unplugged, IP change, etc).	• Both controllers will show **Ethernet Failure** for the other controller, and will trigger alarm. • Reserve controller will still provide redundancy if the main controller fails.	Troubleshoot Ethernet communication between the controllers at earliest convenience. The reserve controller will not be able to synchronize configuration until Ethernet restored.

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