MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

ICS TRIPLEX

T8311

TRIPLE MODULAR EXPANDER INTERFACE

Used with the applicable Trusted TMR Expander Interface configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: ICS Triplex PD-T8311 Issue 12, March 2007

1. Description

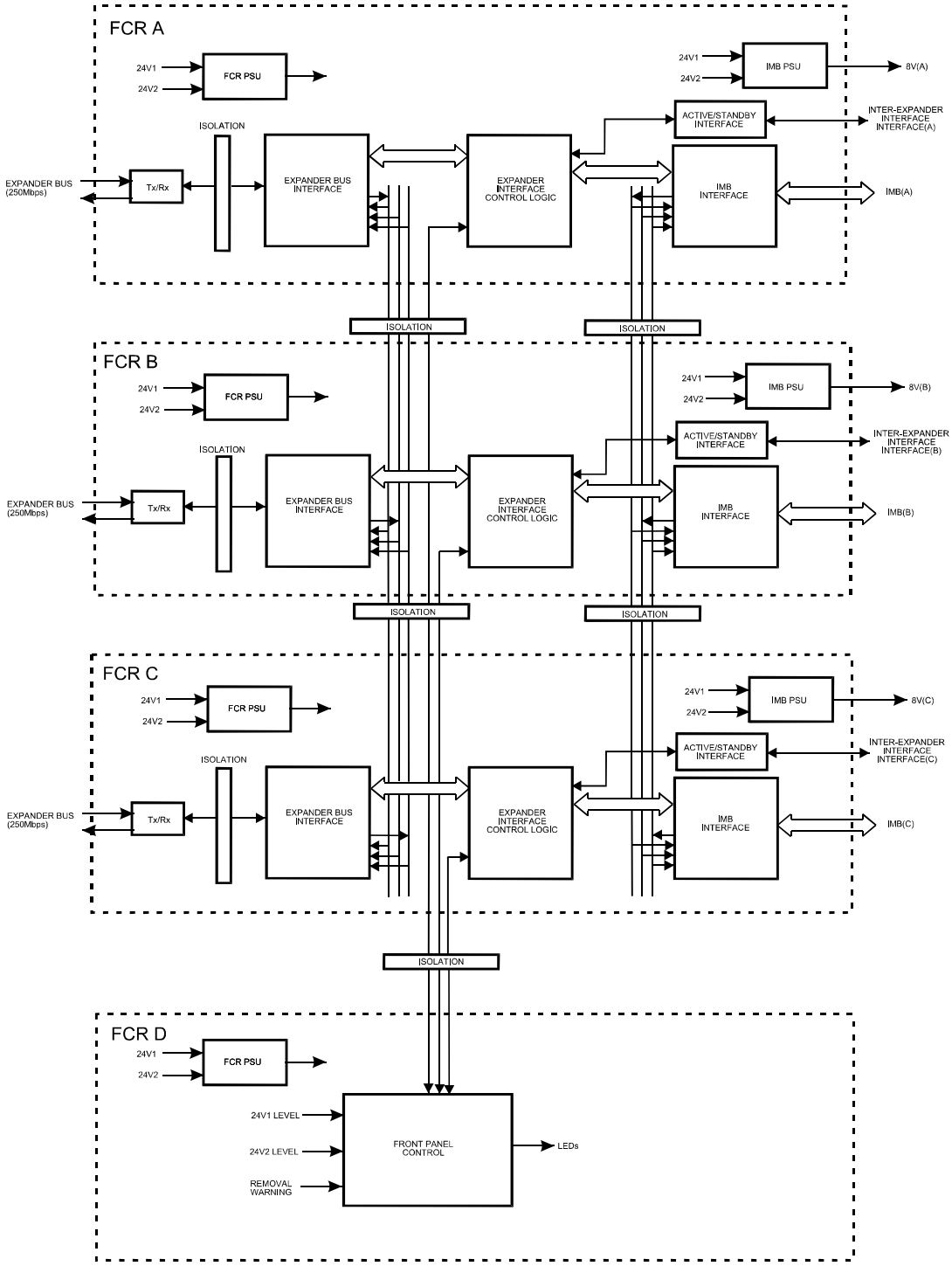


Figure 1 Functional Block Diagram

1.1. Overview

The TMR Expander Interface is a fault tolerant design based on TMR architecture arranged in a lock-step configuration. Figure 1 shows, in simplified terms, the basic structure of the TMR Expander Interface.

The module has three main fault containment regions (FCR A, B and C). Each of the main FCRs contains interfaces to the Expander Bus and Inter-Module Bus (IMB), an active/standby interface to the other TMR Expander Interface in the chassis, control logic, communications transceivers and power supplies.

Communication between the module and the TMR Processor is via the IMB on the backplane of the Controller Chassis. The IMB provides fault tolerance and high bandwidth communications between the Interface Modules and the TMR Processor. All transactions are voted, localising faults to the IMB should they occur.

Communication between the Interface Module and the TMR Expander Processor in the Expander Chassis is via the Expander Bus. The Expander Bus is triplicated, point-to-point architecture. Each channel of the Expander Bus comprises separate command and response media. Voting is provided at the Expander Bus Interface to ensure that cable faults are tolerated, and the remainder of the Expander Processor operates in a fully triplicated mode, even in case of cable faults occurring.

A fourth FCR (FCR D) provides the non-critical monitoring and display functions and is also part of the inter-FCR Byzantine voting structure.

Isolation is provided between FCRs wherever interfaces are required, to ensure that faults can not propagate between them.

1.2. Power Distribution

The TMR Expander Interface Module derives its internal voltages from dual redundant +24V dc power supplied via the module connector from the Trusted™ Controller Chassis backplane. Each FCR derives the required supplies independently.

5. Fault Finding and Maintenance

5.1. PCBS and Connectors

The TMR Expander Interface Module comprises a single PCB assembly fitted with two connectors, one each for the Expander Chassis IMB (SK1) and Expander Bus (PL4). These are detailed below.

5.2. Troubleshooting

Symptom	Possible Cause	Solution
All front panel indicators off	Lack of power	If all other modules within the chassis also show no indicators, check the power distribution and connection to the chassis.
	Front panel interface (FCR D) failure	Check if other modules within the chassis have LEDs illuminated. Check if it is possible to communicate with other modules within the chassis – using either the chassis board type (T8300) or the diagnostic utility. If communications is possible and this is the only Expander Processor installed, the failure is within FCRD and the module should be replaced, If another Expander Processor module is installed, check its status indication. If the other module is indicating active mode, check if communications with the potentially faulty module is possible (again using either the Expander Chassis board or diagnostic utility). If communications is possible, note the information returned as part of the Expander Processor board and then initiate the module replacement.
Single FCR indicator flashing RED	Single main FCR failure.	The module will continue to provide communications between the expander bus and the modules within the chassis. However, the module should be replaced as soon as practical.
Multiple FCR indicating flashing RED	Multiple failure.	This condition may be indicated briefly during module power-up, but in other circumstances, this indicates a failure beyond the modules fault tolerant capabilities. If the failed module is not the active module, it should be removed immediately. A replacement module should be installed as soon as practical. If the module was the active module, the system will attempt to switch to the standby, if it is installed and if the failures do not occur simultaneously.
Flashing standby indicator	Software detected fault	This indicates that the TMR Processor has detected a fault within the module and has switched to the previously standby module. The faulted module should be removed as soon as possible and a replacement installed as soon as practical.

Symptom	Possible Cause	Solution
Both active or standby LEDs OFF	LED failure	This condition may be indicated briefly during module power-up. If another Expander Processor module is installed within the same chassis, use its indicators to verify the active/standby mode of this module. To avoid confusion it is recommended that this module be replaced at some convenient time, initiating the active/standby changeover to the other module if necessary.
All other modules within the chassis indicate standby mode.	TMR Processor not running (faulted, or application not started).	Verify the condition of the TMR processor and start the application as necessary.
	Expander Processor Fault	Verify the Expander Processor is faulty by checking the reported condition within the T8300 chassis board or the diagnostic utility. If the module is shown not to be responding, replace the module immediately.
	Expander Bus Fault	Verify that the fault is not the result of a failed Expander Processor (see above). Check that the Expander Bus is connected correctly at both the Processor and Expander Chassis. Check that the Expander Processor(s) are installed in the correct slot(s).
	Expander Processor not installed.	Ensure a healthy Expander Processor module is installed in the correct slot.
Minor BIU errors counters incrementing	Interface Module Fault	The error counters for a single module will be incrementing. Check the values using the diagnostic utility. If the count exceeds a defined limit, the system will attempt to indicate this fault by setting the corresponding healthy LED on the module to red flashing. Replace the faulty interface module.
	Expander Processor Fault	The error counters for all the modules within the corresponding chassis will be incrementing. Check the values using the diagnostic utility. If the count exceeds a defined limit, the system will attempt to indicate this fault by setting the corresponding healthy LED on the module to red flashing. Replace the faulty Expander Processor module as soon as possible.

Table 3 Troubleshooting Guide

6. Specifications

Voltage Range	20 to 32V dc
Maximum Load	40W
Heat Dissipation	40W
Use with Chassis	T8300
Module Clocks	50MHz
Expander Bus Data Rate	250Mbps
I/O Interface	Expander Chassis backplane
Expander Comms Max Distance	
Using TC-301 copper cable	30m
Using fibre converters	10km
Operating Temperature	-5°C to 60ºC (13°F to 140°F)
Non-operating Temperature	-25°C to 70°C (-25°F to 158°F)
Operating Humidity	5 to 95% RH
Environmental Specifications	Refer to Document 552517
Dimensions	
Height:	266mm (10.5ins)
Width	31mm (1.2ins)
Depth:	303mm (12.0ins)
Weight	1.14kg (2.5lbs.)