Siemens Energy & Automation, Inc.	Installation and Service Instruction

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QUADLOG®
Critical Control Module Plus (CCM+)

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We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual is reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.
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Technical data subject to change.

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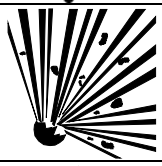
Significant Change for Revision 4

Section	Description
	Preface (Conventions and Symbols)—new section
1.2	Product Support—contact information updated
2.6	Electrical Installation—DANGER alert added
3	Maintenance—DANGER alert added
6.1	Specifications--Supply Input Current maximum value corrected

PREFACE

Conventions and Symbols

The following symbols may appear in this manual and may be applied to the equipment. The reader should become familiar with the symbols and their meaning. Symbols are provided to quickly alert the user to safety related situations, issues, and text.

Symbol	Meaning
	Indicates an immediate hazardous situation which, if not avoided, *will* result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, *could* result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, *may* result in minor or moderate injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.
NOTICE	Indicates a potential situation which, if not avoided, may result in an undesirable result or state.
Important	Identifies an action that should be taken to avoid an undesirable result or state.
Note	Identifies additional information that should be read.
	Electrical shock hazard. The included Warning text states that the danger of electrical shock is present.
	Electrical shock hazard. Indicated that the danger of electrical shock is present.
	**Explosion hazard.** Indicates that the danger of an explosion hazard exists.
	Electrostatic discharge. The presence of this symbol indicates that electrostatic discharge can damage the electronic assembly.

Qualified Persons

The described equipment should be installed, configured, operated, and serviced only by qualified persons thoroughly familiar with this publication. The current version, in Portable Document Format (PDF), is available at http://sitescape.sea.siemens.com/.

For the purpose of this publication and product labels, a qualified person is one who is familiar with the installation, construction, and operation of the equipment, and the involved hazards. In addition, he or she has the following qualifications:

- Is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.
- Is trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.
- Is trained in rendering first aid.

Scope

This publication does not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to one of the support groups listed in the Product Support section of this manual.

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements continued herein do not create new warranties or modify the existing warranty.

General Warnings and Cautions

This equipment contains hazardous voltages, and it has been certified for use in the hazardous locations specified on the product nameplate and in the Model Designation and Specifications section. Death, serious personal injury, or property damage can result if safety instructions are not followed. Only qualified personnel should work on or around this equipment after becoming thoroughly familiar with all warning, safety notices, and maintenance procedures contained herein. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation, and maintenance.

The perfect and safe operation of the equipment is conditional upon proper transport, proper storage, installation and assembly, as well as, on careful operation and commissioning.

The equipment may be used only for the purposes specified in this publication.

CAUTION

Electrostatic discharge can damage or cause the failure of semiconductor devices such as integrated circuits and transistors. The symbol at right may appear on a circuit board or other electronic assembly to indicate that special handling precautions are needed.

- A properly grounded conductive wrist strap must be worn whenever an electronics module or circuit board is handled or touched. A service kit with a wrist strap and static dissipative mat is available from Siemens (PN15545-110). Equivalent kits are available from both mail order and local electronic supply companies.

- Electronic assemblies must be stored in anti-static protective bags when not installed in equipment.

DANGER

Explosion hazard

Will cause death, serious injury or property damage

- In potentially hazardous atmosphere, remove power from equipment before connecting or disconnecting power, signal, or other circuit, or extracting/inserting module.
- Observe all pertinent regulations regarding installation in hazardous area.
- Ensure all devices are rated for hazardous (classified) locations.

■

1 Introduction

This Instruction provides installation and service information for the QUADLOG® Critical Control Module Plus (CCM+) models QLCCM22AAN and QLCCM24AAN. The module's companion transition boards are also covered.

This instruction is divided into six major sections as follow:

- Section 1, Introduction - Summarizes the information presented in this document. In addition, it presents a description of the product, product support information, definitions and usage of international symbols, and a list of related literature.

- Section 2, Installation - Describes the mechanical and electrical installation of the product and its associated transition board. This includes procedures for proper preparation, identification, and handling of the product. It also lists environmental considerations and provides overview information about software-based product configuration.

- Section 3, Maintenance - Provides information about preventive maintenance, troubleshooting techniques, assembly replacement, and choosing spare and replacement parts.

- Section 4, Circuit Description - Contains a brief block diagram level description of the product. It explains the module's main circuit functions.

- Section 5, Model Designation - Provides model designation and tables of accessories and options.

- Section 6, Specifications - Lists the product's mechanical, electrical, and environmental specifications.

1.1 Product Description

The QUADLOG Critical Control Module Plus (CCM+), shown in Figure 1–1 is part of the QUADLOG family of safety critical control modules. The CCM+ uses standard QUADLOG module packaging. It plugs into either a MODULRAC or SIXRAC where it performs logic solving and advanced control functions while interfacing with other QUADLOG modules as well as modules from the APACS+™ process control system. Each CCM+ has a dedicated IOBUS on which QUADLOG I/O modules reside. The CCM+ also exchanges data with other control and communication modules via the MODULBUS. It is an intelligent (microprocessor-based), configurable control module. A CCM+ is shown in Figure 1–2 along with its associated transition hardware. As shown, the CCM+ plugs into either a standard or extended transition board. Three bezel-mounted LEDs indicate the module's operating status.

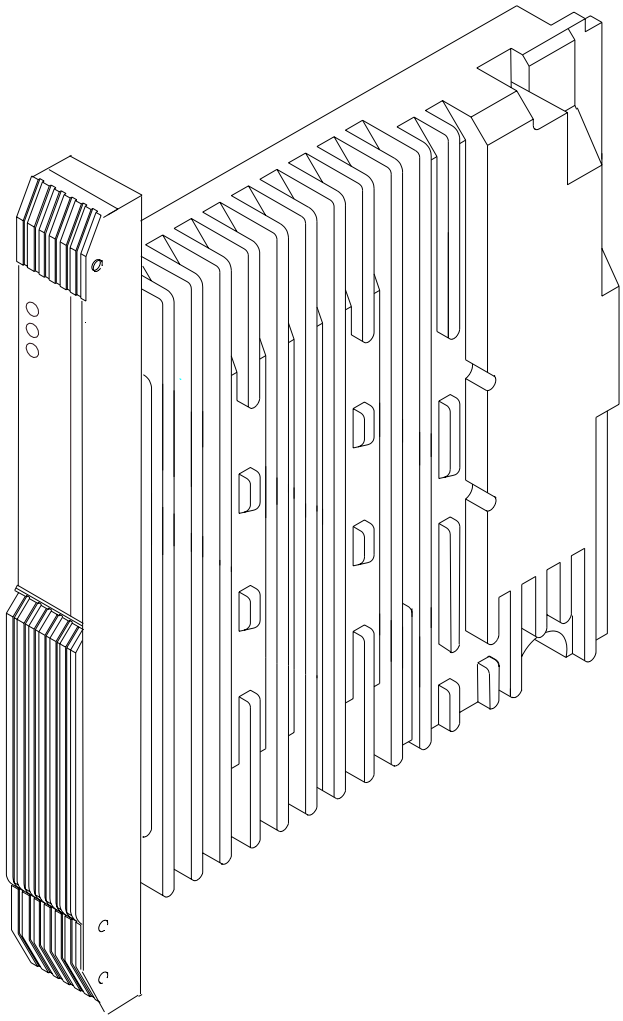


Figure 1–1 Critical Control Module Plus (CCM+)

The CCM+ has the following product features:

- TÜV “safety critical rating” for AK application levels 1 to 6.
- Operates 30 to 40% faster (reduced scan rate) than traditional Critical Control Module (CCM) product offerings.
- Continuously runs extensive diagnostics to quickly detect potentially dangerous failures.
- Provides diagnostics analyzed by failure modes and effects analysis (FMEA) and verified by full fault injection testing for easy problem resolution.
- Utilizes the high strength QUADLOG module packaging for uninterrupted service.
- Eases process safety management documentation control by maintaining a master graphical configuration within the module itself.
- Facilitates efficient and intuitive protection strategy design by allowing four standard configuration languages to be mixed within module.
- Supports redundant one-out-of-two diagnostic (1oo2D) architecture for safety integrity level three (SIL3) safety and highest availability.
- The module can be inserted or removed while powered (hot swap) without disturbing system wiring to reduce servicing time.
- Supports on-line replacement of the redundant module with automatic re-configuration to reduce servicing time.
- Complies with the European Union’s Electromagnetic Compatibility (EMC) Directive, which requires process control equipment to be immune to electromagnetic interference (EMI) and limit the amount of electromagnetic emissions. (See Table 6–2 for detailed information.)

Redundancy

The QUADLOG architecture incorporates flexible redundancy options to maximize safety and availability while minimizing cost. The CCM+ facilitates this with two types of system redundancy: module-to-module and rack-to-rack.

- In module-to-module redundancy, a pair of CCM+s must be located in adjacent slots of a rack. The two CCM+s share a common set of I/O modules. This arrangement provides higher availability of the control function in an economical configuration and allows interprocessor comparison of critical data and calculation results for increased safety.

- In rack-to-rack redundancy (1oo2D architecture) there are two complete sets of hardware – each consisting of a CCM+ and its I/O subsystem. This provides high availability of both the control module and the I/O. The redundant CCM+s execute the protection logic and compare results and I/O scan data. The comparison is accomplished through a dedicated interprocessor communication cable that connects between the two CCM+s. The two independent racks can be located in different cabinets to maximize common cause strength. This further increases system safety and availability.

Module Diagnostics

The CCM+ is a safety critical rated device. This means no known dangerous, undetected failures are permitted. This requires extremely effective self-diagnostics verified by full Failure Modes and Effects Analysis (FMEA) and fault injection testing. The purpose of the diagnostics is to:

- notify the appropriate personnel of a module malfunction.

- perform automatic switch over between calculate\verify units in a fully redundant (1oo2D) QUADLOG system.

- perform automatic shutdown of a channel, module, or system if a dangerous fault is detected (for fail-safe operation).

Microprocessor Diagnostics

The main microprocessor in the CCM+ is online-tested to assure that potentially dangerous failures are detected. The microprocessor registers, instruction decoder, data bus interface, address bus interface, and ALU (Arithmetic-Logic Unit) are self-tested using special routines supplied by the manufacturer.

Two watchdog timers, external to the microprocessor, monitor execution timing. A series of calculations performed by the diverse microprocessors in I/O modules are compared with identical calculations made in the main processor. Program execution in the microprocessor is self-checked using task sequence and execution time monitoring. These extra diagnostic techniques provide a way to detect transient and permanent failures in the microprocessor circuitry.

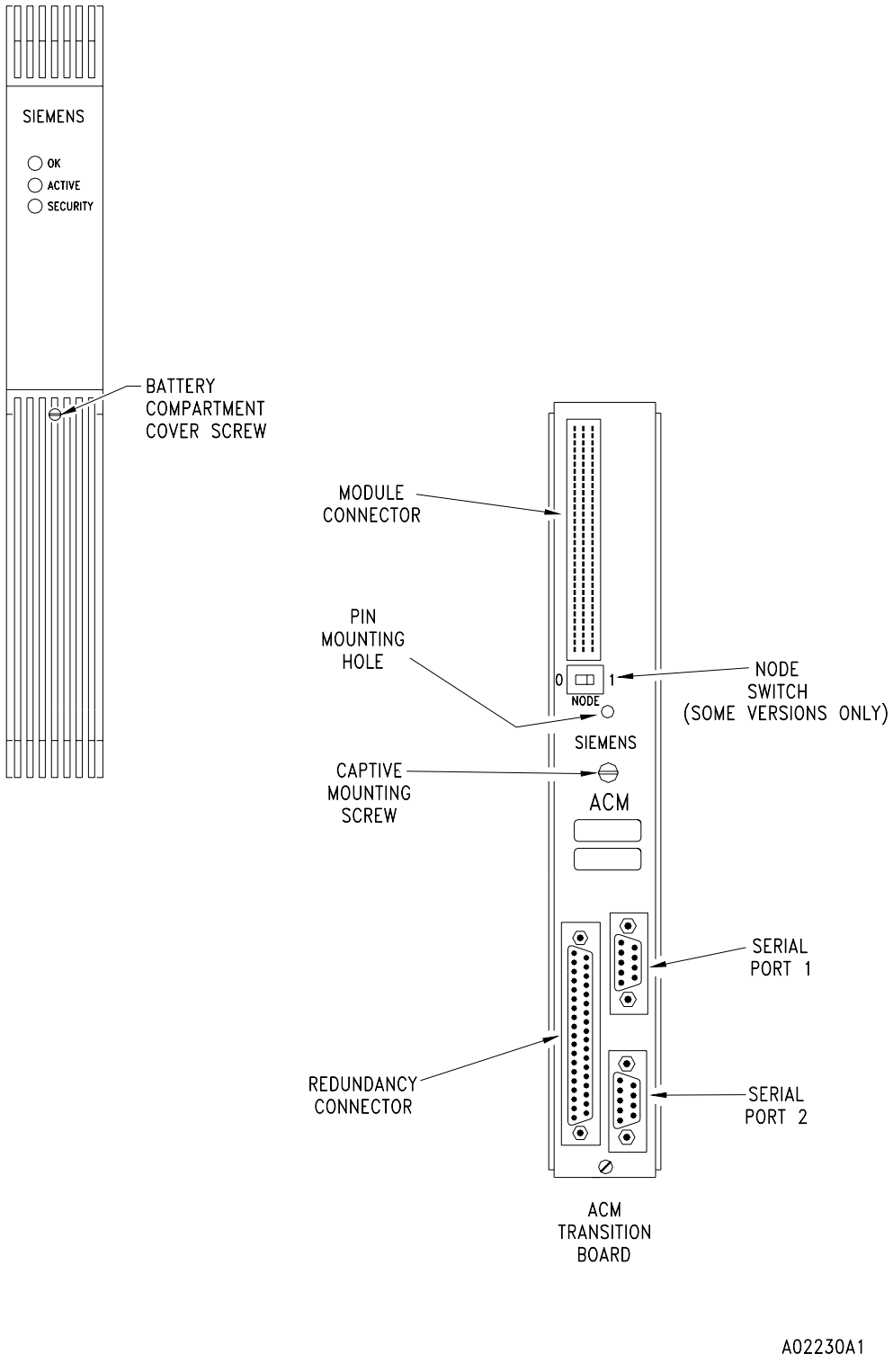


Figure 1–2 CCM+ and its Transition Board

Memory Diagnostics

The ROM in the CCM+ is online-tested by calculating test patterns (CRC32) on critical data and program areas, and comparing to stored values. This detects single and multiple bit failures, as well as selection logic failures. This calculation and compare testing also detects occurrences of data, address, and control bus failures.

The RAM within the CCM+ is internally duplicated, redundant with hardware comparison done on each read cycle. This secure memory detects transient and permanent failures. The comparison circuits are tested online to verify that they are properly operating. Additional RAM testing is done by checking the integrity of data tables using CRC32 comparisons and online pattern checking.

Communication Diagnostics

MODULBUS and IOBUS communication failures are detected by a number of diagnostic techniques, including:

- CRC32 message integrity checking
- Message type checking
- Message format verification
- Message address verification
- Message timeout checking
- Message sequence verification

In redundant CCM+ architectures, message parameters are compared to assure that all communications are accurately received.

IOBUS is a safety-critical communication bus. It has the following features:

- Isolated
- Single-fault tolerant
- Constantly switched between A and B sides
- Tolerates I/O module failure

Common Circuit Diagnostics

The CCM+ receives power from the power buses within a module rack. The voltage levels on each power bus are monitored. Outputs from the on-board power system are monitored for over-voltage and under-voltage failures. The module's internal battery voltage is periodically sampled (under load) to verify its operating status.

Redundancy and safety control signals are online-checked for invalid bit patterns. These signals are also compared against the same information diversely sent through communication buses.

Software Diagnostics

Failures in software systems are defined as "systematic" failures. Special diagnostic techniques can be used to detect systematic failures. CCM+ online software employs program flow control, a technique where the execution of each piece of critical software is measured. The execution time and execution sequence must agree with predefined patterns.

CCM+ software also uses data integrity verification at essential points during execution. This technique requires critical variables be checked to verify they are within permitted ranges. Variables within the CCM+ are data-typed. Data type consistency checking is done for calculations.

The CCM+ maintains a log of current and historical errors that can be reviewed using the Diagnostic Logger Utility or the *4-mation*™ configuration software. In addition, errors are indicated by the module's LED indicators located on its front panel.

LED Indicators

The module's front panel LEDs support local troubleshooting without the need for an operator interface. There are three LEDs for indicating the following module statuses:

- Module OK
- Module faulted
- Module unconfigured
- Module failed
- Module active (calculate mode)
- Module inactive (verify mode)
- Security enabled
- Security disabled

Configuration

The CCM+ and its related I/O modules are configured using the *4-mation*̣ configuration software. This software runs on an MS Windows-based workstation. The program provides four configuration languages to configure a control strategy. The configuration can be based on any mix of these languages, which are based on the IEC specification for programmable controllers (IEC 61131-3). These languages are:

- Function Blocks
- Ladder Logic
- Sequential Function Charts
- Structured Text

They allow a configuration to be created using the tool(s) most effective for each application. The configuration can be developed offline then transferred from *4-mation* to the CCM+ or it can be created within an online CCM+ during the initial design phase. On-line configuration is possible because all of the information needed to configure a CCM+ is stored in its database, thus eliminating the need to have a disk-based master database for viewing or editing a configuration. Several different restriction levels are available. In either case, the I/O module portion of the configuration is automatically copied from the CCM+ to the appropriate I/O module(s). A backup copy of each I/O module's configuration is maintained by the CCM+. This backup feature allows automatic configuration of an I/O module when installed (or replaced) in a rack.

CCM+ security can be configured to prevent unauthorized or inadvertent changes to a configuration. When the security feature is active, a configuration can only be opened in "read-only" mode.

In addition to using *4-mation*, QUADLOG systems can also be configured with the QUADLOG Safety Matrix configuration tool. This tool automatically programs QUADLOG using cause and effects diagrams.

The CCM+ also includes features to simplify start-up should operation be disrupted. An internal battery backs up the controller configuration kept in the CCM+'s memory so that no configuration data is lost in the event of power loss. In addition, variables within a CCM+ can be assigned warm start and cold start values. When power is lost, the CCM+'s internal real-time clock continues to run so that warm start and cold start states can be determined and acted upon once power is restored.

Terminations

A transition board (also called a termination strip) connects a CCM+ to its redundant backup and is depicted in Figure 1–1. A redundancy cable extends between each CCM+'s transition board.

1.2 Product Support

Our Technical Support Centers (TSC) offer a variety of technical support services that are designed to assist you with Siemens products and systems. Our support engineers have experience with troubleshooting, development, system startup, and system test. They will help you to solve your issues in an efficient and professional manner.

Customers in North America can contact Siemens Technical Support Center at 1-800-333-7421, on the web at: http://support.automation.siemens.com, or by e-mail: techsupport.sea@siemens.com

Customers outside North America can contact their local Siemens subsidiary; addresses and telephone numbers are listed on the Internet at the web site: http://support.automation.siemens.com.

When contacting Siemens, customers will be asked to provide site-contact information (name, address, and phone number), the product involved and detailed information regarding the nature of the issue.

Product documentation is now located in the Library forum of the Process Automation User Connection at: http://sitescape.sea.siemens.com/. The Process Automation User Connection is a secure site. Registration is open to all verified users of Siemens process automation systems. If you are not already, and would like to become a member, please visit our Process Automation User Connection web page at: http://www.sea.siemens.com/process/support/papauc.html

Contained within the Process Automation User Connection is the APACS+/QUADLOG Secure Site at: http://sitescape.sea.siemens.com/forum/aca-1/dispatch.cgi/f.apacsquadlo forum. This site is only open to customers with an active service agreement. It contains all service manuals, service memos, service notes, configuration manuals, etc. for the APACS+ and QUADLOG family of products. If you are experiencing technical difficulties with the site, please contact SiteScape technical support at: toll free 1-877-234-1122 (US) or 1-513-336-1474.

A&D Technical Support

Worldwide, available 24 hours a day:

United States: Johnson City, TN	**Worldwide:** Nürnberg	**Asia / Australia**: Beijing
Technical Support and Authorization Local time: Monday to Friday 8:00 AM to 5:00 PM Telephone:+1 (423) 262 2522 or +1 (800) 333-7421 (USA only) Fax:+1 (423) 262 2289 Mail to: techsupport.sea@siemens.com GMT: -5:00	**Technical Support** 24 hours a day, 365 days a year Phone:+49 (180) 5050-222 Fax:+49 (180) 5050-223 E-Mail: ad.support@siemens.com GMT:+1:00 **Authorization** Local time: Monday to Friday 8:00 AM to 5:00 PM Phone: +49 (180) 5050-222 Fax: +49 (180) 5050-223 Mail to: ad.support@siemens.com GMT: +1:00	**Technical Support and Authorization** Local time: Monday to Friday 8:00 AM to 5:00 PM Phone:+86 10 64 75 75 75 Fax:+86 10 64 74 74 74 Mail to:ad.support.asia@siemens.com GMT:+8:00
Automation and Drives Service and Support International http://www.siemens.com/automation/service&support		
The languages of the SIMATIC Hotlines and the authorization hotline are generally German and English.		

1.3 Related Literature

The following documents are available to complement the installation, configuration, and maintenance of the CCM+. Generally, all needed documentation is supplied with your equipment. It may be supplied in electronic form in the Adobe™ portable document format (PDF), printed form, or both. Refer to these documents as needed or as called for in text. Documents may be located on your workstation's hard drive or on a CD supplied with your system.

- *Using the 4-mation Configuration Software* (document number CG39-20)
- *4-mation Software Messages and Error Codes* (document number CG39-21)
- *Module Diagnostic Error Codes* (document number CG39-19)
- *QUADLOG I/O Module Configuration* (document number CGQL-4)
- *QUADLOG CCM/ACM+ Standard Function Blocks* (document number CGQL-3)
- *QUADLOG Safety Manual* (document number CGQLSAFETY-1)
- *QUADLOG Safety Matrix* (document number CGQL-7)

■

2 Installation

This section describes installation of the CCM+ and its associated transition board. Review and complete the preparatory steps in Section 2.2 before proceeding with the installation.

IMPORTANT

The CCM+ installation should be performed in accordance with the National Electrical Code (NEC) and other applicable construction and electrical codes.

The CCM+ is only to be used for the purposes described by Siemens.

2.1 Hardware Identification

The CCM+ is identified by the three-letter "CCM+" designation on the bezel and by two nameplate labels. One nameplate label is large, similar to that shown in Figure 2–1, located on the left side of the module. A smaller label is located inside the bezel door of the battery compartment. Access this compartment by loosening a captive screw in the hinged compartment door. Both labels contain the CCM+'s model designation, part number/issue level, ROM version number, and serial number (S/N). The larger label also lists the power requirements, and space is provided for information such as agency certifications.

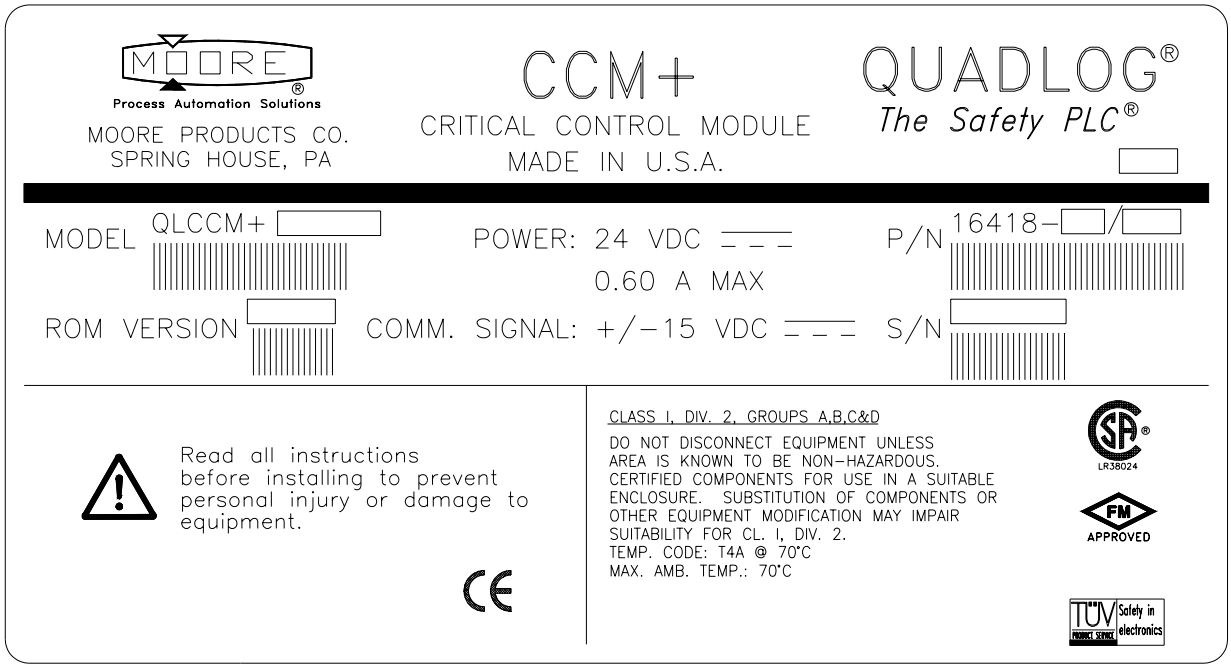


Figure 2–1 CCM+ Identification Label

2.1.1 Transition Board Identification

The CCM+ is compatible with standard versions of the Advanced Control Module (ACM) Transition Board (also called a termination strip) shown in Figure 1–2. This assembly is identified by the following information printed on each board's front surface.

ACM
ADVANCED
CONTROL MODULE
SIEMENS ENERGY & AUTOMATION, INC.
TRANSITION BD
P/N16147-21 or P/N 16147-51

2.2 Preparations and Considerations

2.2.1 EMC Directive Considerations

For installations of QUADLOG modules that require adherence to the European Union's Electromagnetic Compatibility (EMC) Directive, refer to the end of this document for the "Declaration of Conformity" statement. If this statement is present, it lists the certificate number of the Technical Construction File issued for the QUADLOG Critical Control Module Plus (CCM+). Compliance with the directive requires some or all of the following criteria:

- QUADLOG systems must use enclosures having sufficient RF attenuation.
- AC power input conductors to the enclosure must be filtered.
- MODULBUS (M-BUS) cables that enter or exit the enclosure must be filtered.
- The "shield" of all shielded cables that exit the enclosure must be connected to the enclosure.

Consult the factory for additional information concerning EMC Directive installation and the availability of enclosures and needed hardware.

2.2.2 Installation Preparations

1. Install the MODULRAC (or SIXRAC) in the cabinet where the CCM+ is to be installed. The CCM+ should not be installed in the rack at this time; however, its designated slot number should be known.
2. Designate a specific slot for the CCM+ based on the following criteria:
    - I/O modules that are slaved to a specific CCM+ must be installed in slots to the right of the CCM+'s slot. Generally, higher number slots or slots in the next IOBUS-connected rack can be slaved to that CCM+.

- Only an empty slot, Power Supply Module (PSM), Bus Continuation Module (BCM), or Bus Diverter Module (BDM) may be between a CCM+ and any of its slaved I/O modules. Empty slots are not permitted on the IOBUS of rack-to-rack redundant systems.

- Terminate the IOBUS before using any remaining slots for a subsequent CCM+ and its I/O modules.

3. Determine whether redundant CCM+s are to be installed. If so, CCM+ hardware and software can be used to provide either module-to-module or rack-to-rack redundancy (1oo2d) as described here.

   Module-to-Module Redundancy - Two CCM+s are mounted in adjacent odd-even (e.g. 1-2, 3-4, 7-8) slots in a MODULRAC (or SIXRAC) sharing common I/O modules. One CCM+ is in the calculate mode, the other is in the verify mode and can instantly assume control should a failure occur in the calculate module. Each CCM+ accesses I/O modules (CAM, CDM, or SAM) in the rack across the IOBUS. The redundant CCM+s communicate with each other via a dedicated Interprocessor Communications Cable connected between their respective transition boards.

   Rack-to-Rack Redundancy - Two CCM+s are mounted in two MODULRACs (or SIXRACs) that are complete hardware duplicates of each other. During operation, one rack operates in the calculate mode while the other operates in the verify mode. The verify controller can instantly assume control should a failure occur in the calculate controller. The redundant CCM+s communicate with each other via a dedicated Interprocessor Communications Cable connected between their respective transition boards.

   A transition board's NODE switch provides for the setting of a node address for each CCM+ in the special case where the local MODULBUS is not connected to a MODULBUS Extender (MBX) and the MODULNET.

2.3 Environmental Considerations

- Many industrial environments create severe operating conditions. The conditions at each CCM+ location must be within the specifications stated in Section 6.2.

- To ensure operator safety, Marshalled Termination Assemblies shall be installed in enclosures, which require a key or special tool to gain access to the equipment.

- To ensure reliable data communications, it would be prudent to locate CCM+ hardware as far as possible from sources of interference, such as high current electrical equipment which emits strong electromagnetic fields and switching transients.

2.4 Equipment Delivery and Handling

The following subsections provide information of interest to shipping, receiving, and warehouse personnel.

2.4.1 Predelivery Test

Each CCM+ is fully tested and inspected to ensure proper operation. If the module is ordered factory-installed in a MODULPAC or other enclosure, the module is tested as part of the system and inspected to ensure proper operation.

2.4.2 Factory Shipment

Each CCM+ is enclosed in a static shielding bag and packaged for shipment. Accessories are packaged separately. If a CCM+ is ordered factory-installed in a MODULPAC or other enclosure, the enclosure is bolted to a pallet and wrapped for protection during shipment.

2.4.3 Receipt of Shipment

All cartons should be inspected at the time of their delivery for possible external damage. Any visible damage should be immediately recorded on the carrier's copy of the delivery slip.

Each carton should be carefully unpacked and its contents checked against the enclosed packing list. At the same time, each item should be inspected for hidden damage that may or may not have been accompanied by exterior carton damage.

If it is found that some items have been damaged or are discovered missing, refer to Sections 2.4 or 2.5 and notify Siemens immediately, providing full details. In addition, damages must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

2.4.4 Return of Equipment within North America

US Customers:

- Call the Repair Order PAS Inside Sales/Order Management Group at (215) 646-7400, ext 4RMA (4762) weekdays between 8:00 a.m. and 4:45 p.m. eastern time to obtain an RMA number. Mark the RMA number prominently on the outside of the shipment.

- When calling for an RMA number, provide the reason for the return. If returning equipment for repair, a detailed description of failure symptoms and system behavior will be requested. Supply a purchase order number for repairs. Follow the TSC specialist's recommendation for battery connection, if applicable.

- If applicable, you must supply a Material Safety Data Sheet (MSDS) with each item being returned if it was stored or used in a location where hazardous materials were present.

- Package items to be returned in their original shipping containers. Otherwise, package it for safe shipment or contact the factory for shipping recommendations. A module must be placed inside a static shielding bag to protect it from electrostatic discharge.

Canadian customers:

Contact Siemens Canada.

2.4.5 Return of Equipment outside North America

Contact your Siemens Representative.

2.4.6 Equipment Handling and Storage

The CCM+ is completely enclosed and can be safely handled without undertaking special ESD (electrostatic discharge) handling procedures provided the bezel compartment door is closed and secured. DO NOT touch the connector pins on the back of the module. Handle the module carefully and do not subject it to excessive shock or vibration.

The storage temperature and humidity parameters listed in Section 6 must be met for storage of a CCM+.

2.5 Mechanical Installation

2.5.1 Transition Board Installation

An ACM Transition Board (Figure 1–2) must be installed in a MODULRAC/SIXRAC at the rack-slot location of its companion CCM+ when I/O modules employ marshalled I/O termination hardware. In this case, a Local Termination Panel is not required.

Refer to Figure 2–2 and the following mounting instructions:

To install a transition board:

1. Consult user documentation and note the slot location assigned to the CCM+(s).

2. Note the following on the MODULRAC (or SIXRAC) and on the transition board:

    - At the rear of the rack, locate and identify the extruded spacer to which the lower edge of the backplane is mounted. Note that the bottom of the extruded spacer is grooved. The top edge of the transition board is to rest in this groove.

    - Identify alignment pins located below the rack's frame that span the width of the rack. The left-most pin corresponds to rack slot #1. One of these pins engages a hole located on the transition board above the printed logo.

- A transition board's captive mounting screws project from the bottom of the plastic extrusion panel.

3. Mount the transition board at its assigned slot location as follows:

    a) Angle the top edge of the board toward the backplane's extruded spacer and insert the tip of the board in the spacer's groove.

    b) Slide the board in the groove until it is vertically and horizontally aligned with the appropriate pin.

    c) Carefully lower the transition board and engage the alignment pin with the extrusion and board pin mounting holes. Firmly push down to seat the board on the pin. When the board is properly seated, the pin is flush with, or projects slightly above the board's surface.

    d) Tighten the captive mounting screws, which automatically align with their respective panel mounting holes.

2.5.2 CCM+ Installation

Modules are shipped individually packaged in protective, sealed, static shielding bags. Refer to Section 2.4.6 for module handling considerations.

Each slot in the MODURAC (or SIXRAC) **and** each module must be keyed to prevent accidental installation of a module into an incompatible slot, which may impair system performance. **Module and rack keying is highly recommended**. See Figure 2–3.

- Modules are keyed at the factory. The keying pattern is unique to each module type.

- A factory-assembled rack is keyed at the factory. If you are setting up a rack on site, you must key each slot according to the module type assigned to it. Slot assignments can usually be obtained from system drawings. The slot keying pattern complements the module's keying pattern. Stop plugs are supplied with the rack.

- Before adding a module to a rack, be sure to first key its slot.

Section 2.5.2.1 describes keying a slot. Section 2.5.2.2 describes installing the module in the rack.

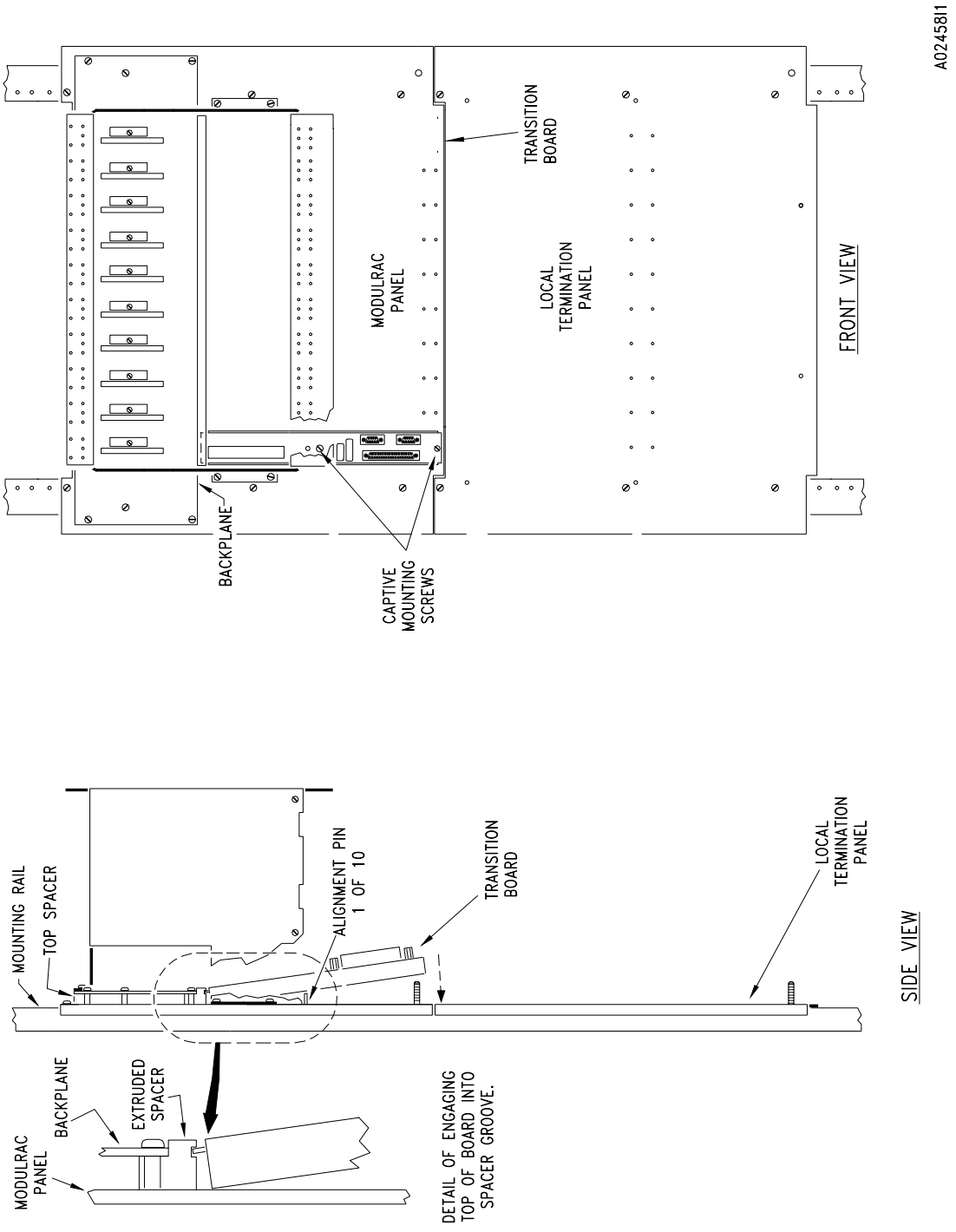
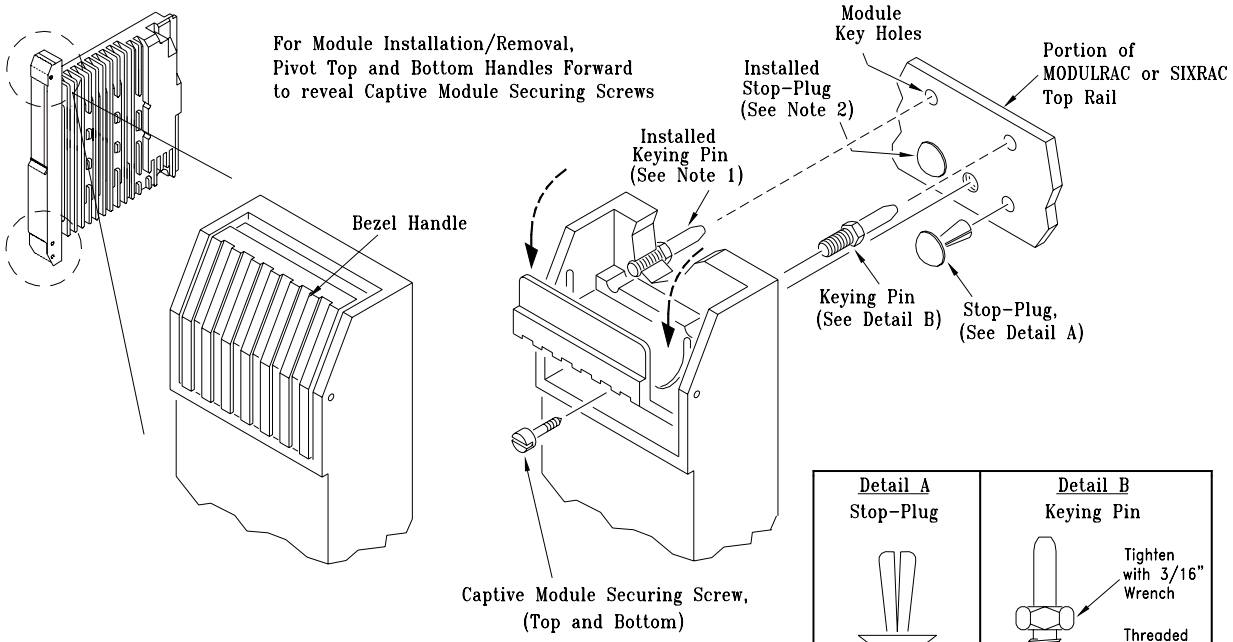
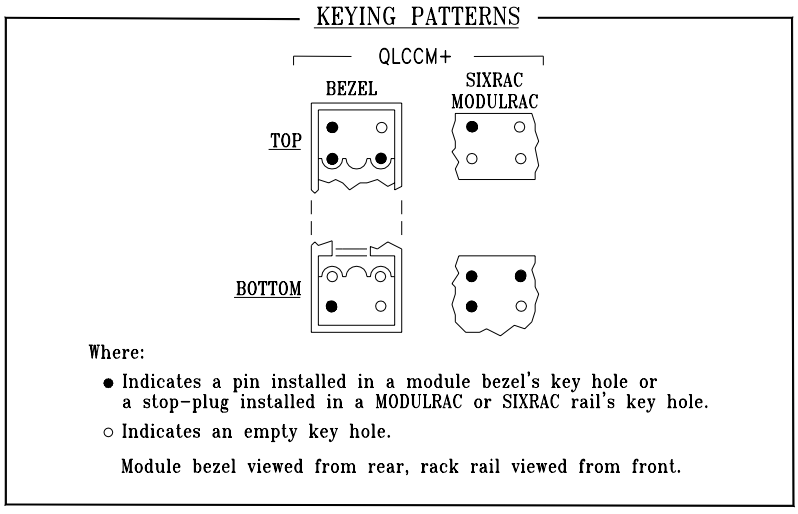


Figure 2–2 Transition Board Mounting



NOTES:

1. Keying pins are threaded into 4 of the 8 holes in the rear top and bottom sections of the module's bezel.
2. Plastic stop-plugs are pressed into top and bottom rail holes at a particular slot to match a keyed module to a slot.



SA_008_02.DWG

Figure 2–3 Module and Rack Keying

2.5.2.1 Module Rack Mechanical Keying

This section details how to key a specific slot in a MODULRAC (or SIXRACK) by installing stop plugs. This prepares the slot so it only accepts a properly keyed CCM+.

To key a slot:

1. Get the Keying Kit supplied with the rack. It contains the needed stop plugs.

2. Refer to Figure 2–3and note the slot-keying pattern applicable to the CCM+.

3. On the rack, locate the slot designated for a CCM+ then locate the keyhole area in the rack's top and bottom rails.

4. Press the stop plugs into the appropriate keyholes of the top and bottom rails as identified by the solid dot keying patterns shown in the figure.

2.5.2.2 Module Installation

This section details how to install a CCM+ in properly keyed slot in a MODULRAC (or SIXRAC). Module keying information is provided in Figure 2–3.

To install the module:

1. Where applicable, refer to your system documentation and note the assigned rack and slot number for the module to be installed.

2. Remove the module from its static shielding bag and ensure that it is properly keyed.

3. At the rack where the module is to be installed, locate the module's designated slot and make sure it is also keyed. If required, refer to Section 2.5.2.1 for rack keying information. The slot must have a transition board. For an installation that uses module-to-module redundancy, the redundant CCM+s are to be installed in adjacent odd-even (e.g. 1-2, 3-4, 7-8) slots.

4. Insert the module in the designated slot. Use uniform pressure to firmly seat the module in the backplane and transition board connectors. If the module does not seat properly, check its keying components against the pattern provided in Figure 2–3. A properly seated module has the rear of its bezel flush against the rack's front rails. A keyed module that is not matched to a slot does not engage the rack's backplane or transition board connectors or seat flush against the rack's front rails.

5. As shown in Figure 2–3, pivot open the bezel's pivoting top and bottom handles to expose the slotted captive mounting screws then secure the module to the top and bottom rails. Close the bezel's handles when finished.

CAUTION

Do not use the captive mounting screws to seat the module. Doing so can damage its bezel. Properly seat the module **before** tightening the captive screws.

2.6 Electrical Installation

DANGER

Explosion hazard

Will cause death, serious injury or property damage

- In potentially hazardous atmosphere, remove power from equipment before connecting or disconnecting power, signal, or other circuit, or extracting/inserting module.
- Observe all pertinent regulations regarding installation in hazardous area.
- Ensure all devices are rated for hazardous (classified) locations.

The following subsections provide the details needed for connecting cables, setting switches, and enabling the RAM backup battery. These items support or setup the following module features:

- Redundancy
- Security
- Node addressing
- Configuration backup

2.6.1 Redundancy Cable

A redundancy cable is required for installations employing module-to-module or rack-to-rack redundancy. It provides a communications path between redundant CCM+s and connects between each CCM+'s transition board as shown in Figure 2–4. The cable has a 25-pin female "D" connector on each end and is available in three lengths to accommodate different types of physical installations as follows:

- Redundancy Cable 3.3 ft. (1 m)

- Redundancy Cable, single cabinet 6.6 ft. (2 m)
- Redundancy Cable, two cabinets 19.7 ft. (6 m)

For reference, information on CCM+ redundancy is presented in Section 2.2.2.

If the controller's rack(s) were assembled at the factory, it is likely that this cable has been installed. If a rack is to be assembled on-site, refer to Figure 2–4 and install the cable as described here.

To install a redundancy cable:

1. Consult your system documentation and identify the specific rack(s) and assigned slots for each redundant pair of CCM+s.
2. Install the redundancy cable between the transition boards of each redundant pair of CCM+s. Mate and secure the cable connectors with the J2 connectors on the transition boards.

2.6.2 Serial Port Cables

Serial Ports 1 and 2 are RS-232 industrial (isolated) serial communication ports with a software-selected transfer rate of between 300 and 38400 Baud. They provide an interface to the CCM+ for serial communications applications. Serial port connectors (9-pin male subminiature D type) are located on the CCM+'s companion transition board. An example is shown in Figure 2–4.

Serial ports can be connected to foreign devices non-redundantly or redundantly. For non-redundant installations, use the P/N 16137-191 Serial Port Cable to Converter. For redundant installations, use the P/N 16137-221 Redundant Serial Port Cable to Converter. For users wishing to fabricate serial cable, Table 2-1 lists serial pin designations.

Table 2–1 CCM+ Serial Ports 1 and 2 Pin Assignments

PIN	DESCRIPTION	DIRECTION
1	No Connection	
2	Transmitted Data (TD)	Output
3	Received Data (RD)	Input
4	Data Carrier Detect (DCD)	Input
5	Signal Ground (Common Return)	
6	No Connection	
7	Clear To Send (CTS)	Input
8	Request To Send (RTS)	Output
9	Serial Port 2 - Reserved Serial Port 1 - Reserved	------ ------

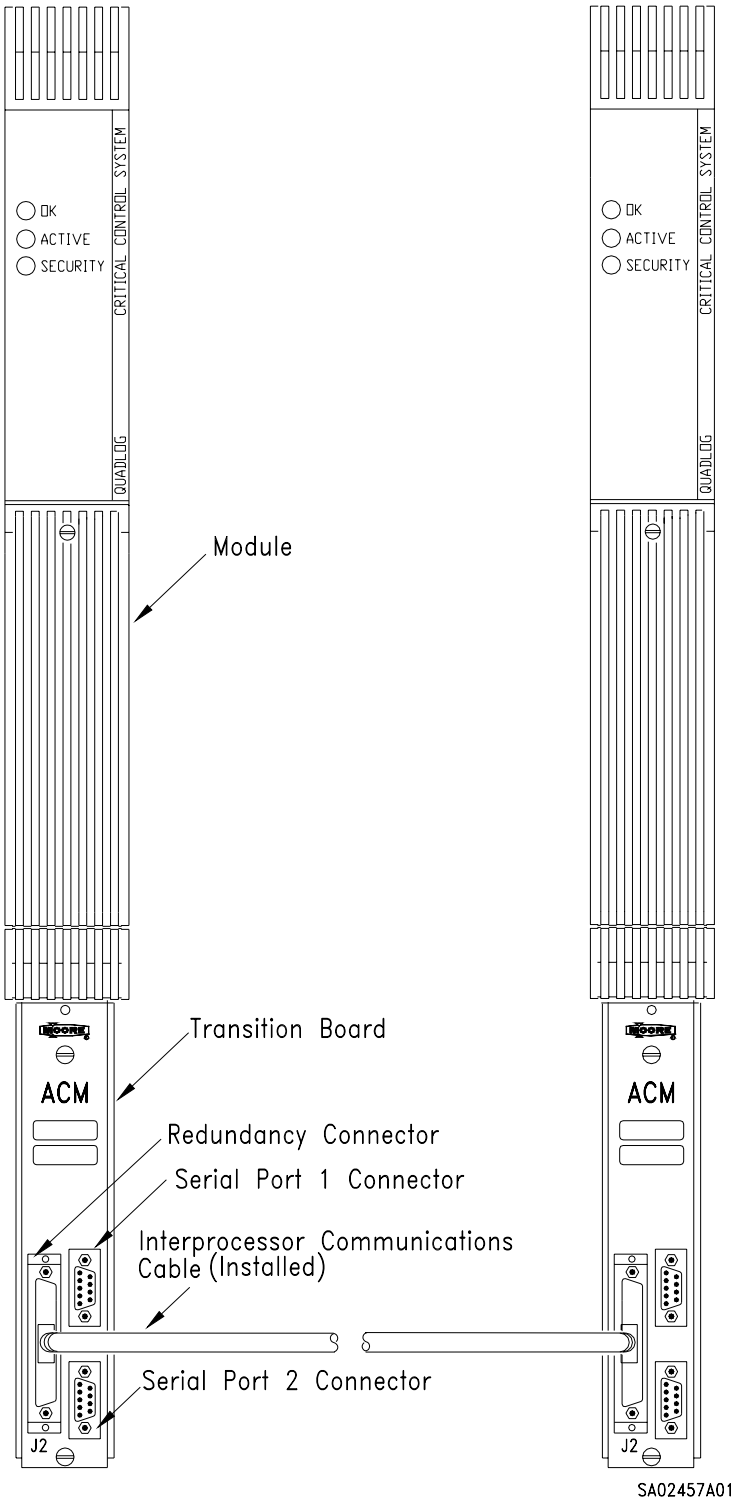


Figure 2–4 Redundancy (Interprocessor Communications) Cable Connections

2.6.3 SECURITY ENABLE Switch Setting

The CCM+ has a SECURITY ENABLE switch, shown in Figure 2–5, that is used in conjunction with the Security function block within module's configuration. The function block is configured using the *4-mation* configuration software. It can be configured to:

- Protect the data and/or configuration database stored in the CCM+ from being changed by another MODULBUS-connected station (control module or *4-mation* workstation)
- Allow transfers that overwrite the data and/or configuration database

The security level is determined by the configuration of the Security function block. For detailed switch setting instructions, refer to *QUADLOG CCM/ACM+ Standard Function Blocks* (document number CGQL-3) and the *QUADLOG Safety Manual* (document number CGQLSAFETY-1).

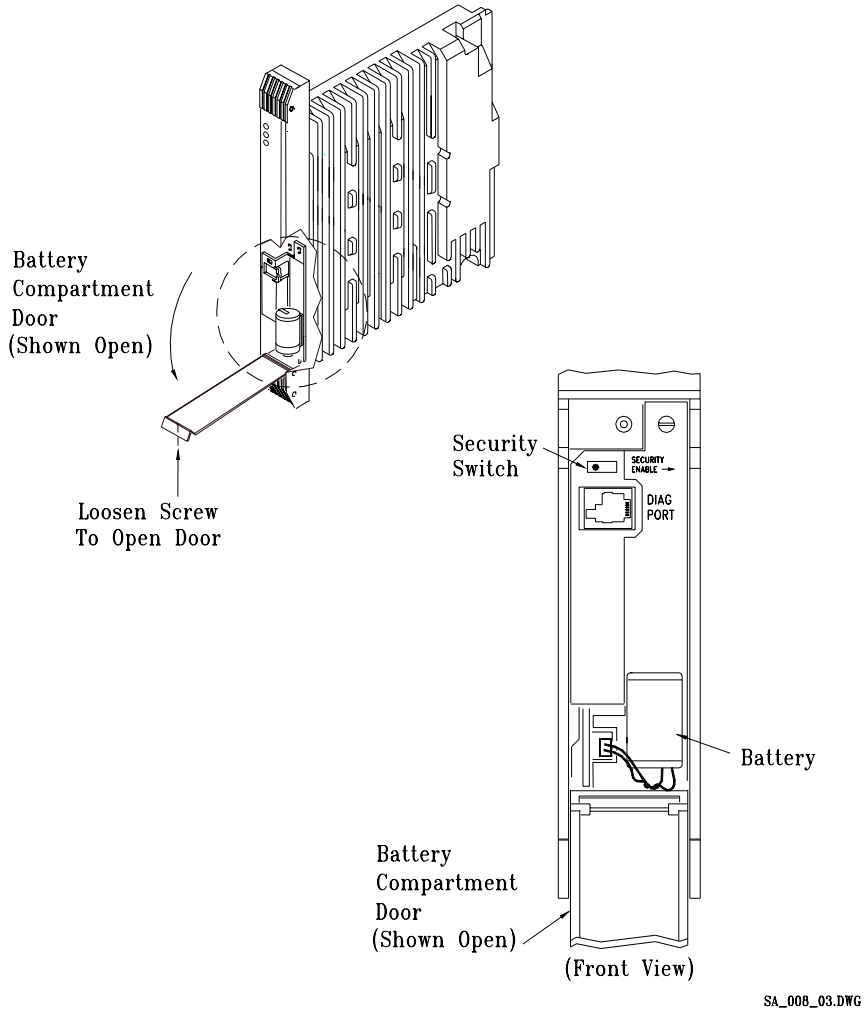


Figure 2–5 SECURITY ENABLE Switch

2.6.4 NODE Switch Setting

A transition board's NODE switch, shown in Figure 1–2, is only used when rack-to-rack redundancy is employed, and the local MODULBUS is **not** connected to a MODULBUS Extender (MBX) and the MODULNET. The switch has no effect in non-redundant installations and other types of redundant installations.

To set the NODE switch:

1. Select either of the two MODULRACs (or of SIXRACs).

2. If it is necessary to remove an installed CCM+ for access to the switch, reverse the installation steps in Section 2.5.2.

3. Set the transition board NODE switch to the "0" position.

4. In the second rack, set the transition board's NODE switch to the "1" position.

2.6.5 RAM Backup Battery

The purpose of the RAM backup battery is to maintain the CCM+'s memory contents and keep its real-time clock operating in case of a power interruption. The battery should be connected just prior to applying power to the module. See Section 6 for battery life data.

To preserve battery life, it is **recommended that the battery be disconnected** when the module is placed in storage or stock. The **battery is disconnected** when the module is shipped from the factory.

To connect the battery:

1. Loosen the battery compartment cover screw and open the hinged cover.

2. Refer to Figure 2–6and note the location of the battery and its plug.

3. If the battery is not connected to the module, orient its keyed plug and gently push it onto the circuit board connector pins. If the battery is connected, proceed to step 4.

4. Proceed to Section 2.6.3 to set the SECURITY ENABLE switch. Remember to close the battery compartment door.

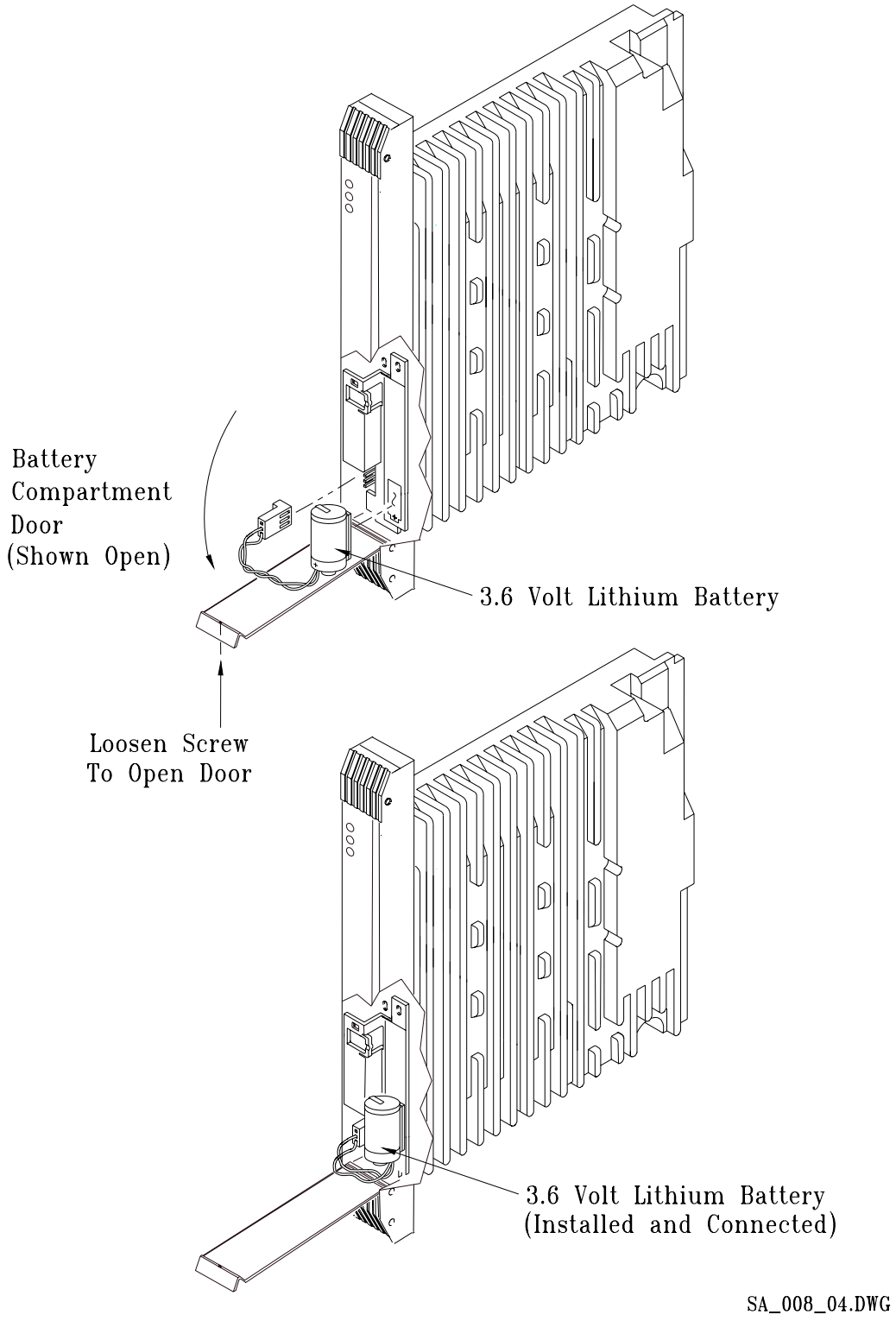


Figure 2–6 Battery Connection

2.7 Configuration

The CCM+ and its associated I/O modules must be configured using the *4-mation* configuration software along with the appropriate QUADLOG software. The *4-mation* software runs on an MS Windows-based personal computer (PC). It is a graphical software tool for configuring control, communications, and I/O modules within a QUADLOG-based process control or safety system. When the configuration is complete, it is to be transferred from *4-mation* to the CCM+. Once the configuration is resident within the CCM+, each I/O module's portion of the configuration is automatically forwarded from the CCM+ to the appropriate I/O module. During online operation, the CCM+ executes the configuration while controlling the operation of its I/O modules.

There are many computer platforms possible for setting up a *4-mation*-based configuration station. Two examples are listed here:

- Run *4-mation* on a Rack-mounted Industrial Server (RIS)
- Run *4-mation* on a personal computer (PC)

For additional information about *4-mation*, refer to the related literature listed in Section 1.2. Configuration information for the CCM+ is presented in *QUADLOG I/O Module Configuration* (document number CGQL-4).

■

3 Maintenance

DANGER

Explosion hazard

Will cause death, serious injury or property damage

- In potentially hazardous atmosphere, remove power from equipment before connecting or disconnecting power, signal, or other circuit, or extracting/inserting module.
- Observe all pertinent regulations regarding installation in hazardous area.
- Ensure all devices are rated for hazardous (classified) locations.

This section describes how to maintain the Critical Control Module Plus (CCM+) and its associated transition board. These items require minimal maintenance. Some routine maintenance is recommended in the form of a visual inspection and possible cleaning. A module's operating status is shown by light emitting diodes (LEDs) located on its bezel. Replacement procedures are provided for the CCM+ and its associated transition board.

CAUTION

Safety procedures required by corporate procedures or regulations must be followed when maintaining safety instrumented systems.

3.1 Tool Requirements

The following tools are necessary for servicing a CCM+:

- Common electronic servicing hand tools
- Digital multimeter
- Safety glasses and rubber gloves (for handling a leaking lithium battery)

3.2 Visual Inspection

The CCM+ and its associated transition board and I/O modules should be subjected to periodic visual inspection. The frequency of inspection is dependent on the severity of the operating environment. The primary aim of the inspection is to reveal any excessive accumulation of dust, dirt, or other foreign

material adhering to the surfaces of the transition board. Excessive accumulation of dirt and dust prevents efficient heat dissipation and may eventually contribute to module or system failure. The CCM+ will alarm on an over-temperature condition long before an over-temperature failure is a possible threat. Note that a CCM+ installed in a NEMA 12/IP55 compliant cabinet need not be inspected for cleanliness. Refer to Section 3.3 for cleaning instructions.

The operating status of the CCM+ is indicated by LEDs located on its bezel. Refer to Section 3.4 for LED indications.

3.3 Cleaning

Cleaning the CCM+ involves brushing or vacuuming the protective covers to restore cooling efficiency that degrades by the accumulated dust, dirt, or other foreign materials.

Cleaning a transition board involves careful brushing and vacuuming to remove accumulated dust and dirt harboring chemical particulate that can accelerate terminal or connector contact corrosion. When cleaning the transition board area, be careful not to disturb the wiring.

WARNING

Electrical shock hazard.
Remove power from all involved wires and terminals.

3.4 Troubleshooting

Fault analysis focuses on identifying a failure as reported by diagnostic messages sent to the operator interface or the CCM+'s status LEDs located on its bezel. LED indications are listed in Table 3–1. If the operator interface's alarm blocks have been configured, module errors are reported. *4-mation* configuration software and the Diagnostic Logger utility also display error codes and related diagnostic messages. Details of error codes and messages are available in *4-mation's* help file and the following documents:

- *4-mation Software Messages and Error Codes* (document number CG39-21, located in binder UM39-11)

- *Module Diagnostic Error Codes* (document number CG39-19, located in binder UM39-14)

Failure annunciation and fault analysis is also available within the *4-mation* software and the Diagnostic Logger Utility. Refer to *QUADLOG I/O Module Configuration* (document number CGQL-4). The on-line display of the Module Tree tool in *4-mation* graphically represents both the hardware modules that comprise a system and the function that hardware performs. There is an entry in the Module Tree for each module, which includes its node, rack, and slot address. A module's address is displayed using the following color code:

- **White -** indicates that error information could not be obtained from the module
- **Red -** indicates the module has errors
- **Green -** indicates the module does not have errors

The errors can be viewed for more detailed information including a description of the error and possible user action. When a fault is identified, correct the fault by replacing the failed CCM+ or associated hardware item with a known good replacement. Refer to Sections 2.4.4 and 2.4.5 to return an item to Siemens for repair or replacement.

Module status LEDs are located on the CCM+'s bezel. Note LED indications, then refer to Table 3–1 for CCM+ status and the listed documents to determine the appropriate course of action. There are no user-replaceable parts inside a CCM+.

Table 3–1 LED Status Indicators

LED LABEL	LED INDICATION	CCM+ OPERATING STATUS
OK	Steady GREEN Flashing GREEN Steady RED Flashing RED OFF	CCM+ OK CCM+ not configured CCM+ control functions inoperative CCM+ control functions partially operative CCM+ input power fault
ACTIVE	Steady GREEN OFF	CCM+ in calculate mode; lit on active CCM+ of redundant pair CCM+ in verify mode or functions inoperative if OK LED is steady RED
SECURITY	Steady GREEN OFF	Security enabled; cannot transfer data to CCM+ Security disabled; allows transfer of data to CCM+

Another way to troubleshoot the CCM+ and its associated I/O module(s) is to develop a test configuration using the *4-mation* configuration software. This test configuration is to be used in an off-line service environment. A test configuration can be used to exercise individual functions or each I/O channel's operation.

To obtain spare or replacement parts, refer to Section 3.9. To return a failed assembly to the factory for repair, refer to Section 2.4.4 and 2.4.5.

3.5 CCM+ Removal/Replacement

During operation, the CCM+ communicates with its associated I/O module(s) (such as a CAM, CDI, CDO, etc.) over the IOBUS. This bus runs continuously along the backplane of a MODULRAC or SIXRAC. This means a CCM+ can be removed from or installed in a rack without removing power from the module slot, from I/O circuits, or from the rack. When redundant CCM+s are present, one unit may be replaced online while the other unit is in control. For a non-redundant application, replace the unit offline.

To remove a CCM+:

1. As detailed in Figure 2–3, open the bezel's pivoted top and bottom handles to expose the module's slotted captive mounting screws. Loosen the screws.

2. Grasp the top and bottom handles and pull the module from the rack.

3. Place the module in a static-shielding bag and package it for safe transport. Refer to Sections2.4 and 2.5 for return instructions.

To install a replacement CCM+:

1. Remove the replacement module from its protective static-shielding bag. The module can be safely handled, as the circuit card is shielded from access by protective covers. If present, set aside the keying pin kit.

2. If the module is already keyed, confirm that its keying pattern matches that of the removed module. If not keyed, key the replacement module as described in Section 2.5.2.

3. Where applicable, open the battery compartment door on the front of the module, as detailed in Section 2.6.5 and connect the RAM backup battery.

4. Insert the CCM+ in its rack slot. Carefully seat the module in the rack's backplane and transition board connectors. A properly seated module engages the backplane and transition board connectors and has the rear surface of its bezel flush against the rack's rails.

NOTE

An improperly keyed module that is not matched to a slot does not engage the back plane and transition board connectors or sit flush against the rack's front rails.

5. As shown in Figure 2–3, open the bezel's pivoted top and bottom handles to expose the module's slotted captive mounting screws and secure the module to the top and bottom rails. Close the bezel's handles when finished.

IMPORTANT

To avoid bezel damage, do not use the captive mounting screws to seat the module.

3.6 Transition Board Removal/Replacement

Follow the procedure below and refer to Figure 2–2 to remove a transition board.

1. As necessary, take appropriate steps to shutdown the processes monitored or controlled by the field devices controlled by the CCM+.

2. To make sure the CCM+ will maintain its configuration and keep its real-time clock running when it is removed, refer to Figure 2–5, open the battery compartment door, and make sure the module's RAM backup battery is connected.

3. Remove the associated CCM+ from its slot in the rack; see Section 3.5. Place the module in a static-shielding bag for protection.

4. Where applicable, disconnect all communications cables from the transition board.

IMPORTANT

All cables should be labeled for correct reconnection.

Loosen the transition board's captive mounting screws. Gently lift the bottom of the board in an arc until the board is free of its alignment pin located immediately above the printed logo. Pull the top of the transition board from the grooved backplane spacer and lift it from the rack.

To install a replacement transition board:

Refer to Section 2.5.1 and Figure 2–2 and Figure 2–4 to physically install the replacement transition board.

1. Reconnect all transition board communications cables.

2. Where applicable, refer to Section 2.6.4 and set the transition board's NODE switch.

3. Install the CCM+ as detailed in Section 2.5.2.

IMPORTANT

Be sure that the RAM backup battery is connected as detailed in Section 2.6.5.

3.7 RAM Backup Battery Replacement

A 3.6V lithium battery is housed in the module's bezel battery compartment as shown in Figure 2–6. It is physically mounted to the back wall of the compartment by a hook-and-loop fastener. When power is removed from the rack supplying the CCM+ or the module is removed from the rack, the battery supplies power to the module's memory so it retains the configuration and executable code. It also powers the module's real-time clock.

The condition of the battery is monitored by software. System Service Code (SSC) 28 and Error Code (EC) 01 – "Battery Low" – report a weak or disconnected battery. The codes and related messages are displayed on the computer running *4-mation* or the Diagnostic Logger Utility.

If the battery is weak and the CCM+ stores a configuration, replace the battery while CCM+ power is on. If the configuration is lost, it can be quickly transferred to the module again through *4-mation* software.

To replace the RAM backup battery:

1. Loosen the captive screw on the compartment door and open the door. See Figure 2–6.

2. Inspect the battery before handling it. If it is leaking, put on a pair of safety glasses and a pair of rubber gloves for safety.

3. Unplug the battery from the module while noting how the connector is keyed.

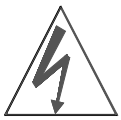
4. Carefully pull the battery to separate the hook-and-loop fastener that attaches it to the compartment wall. Remove it from the compartment.

5. The replacement battery is supplied with a new hook and loop fastener. Separate the fastener halves.

6. If the compartment-mounted portion of the fastener is damaged, remove it and install the separated fastener half.

7. Mount the battery in the compartment. Orient the keyed battery connector and gently plug it into the three-pin connector.

8. Close and secure the compartment door. Battery handling and disposal precautions are listed below.



WARNING

Be advised of the following with regard to lithium battery handling and disposal.

- Properly dispose of a removed battery
- Do not burn a battery
- Do not short circuit battery terminals
- Do not attempt to charge the battery
- If electrolyte is exposed, wear safety glasses and rubber gloves when handling the battery

3.8 Software Compatibility

The CCM+ has two nameplate labels: a large label, shown in Figure 2–1, and a small label inside the battery compartment on the back of the door. Both labels contain the module's software compatibility (ROM Version) as well as the model designation, part number, and serial number.

Observe the following guidelines to ensure software compatibility between CCM+s:

- **Module-to-Module Redundancy** – Both CCM+s should have the same software level installed.
- **Rack-to-Rack Redundancy** – Both CCM+s should have the same software level installed.
- **Spare CCM+s** – The software level of modules in service and those reserved as spares should agree.

Questions concerning the compatibility of different releases of software (kernel and operating system software) with a particular CCM+ should be directed to the Technical Support Center (TSC). Refer to Section 1.2 for product support and TSC contact information.

3.9 Spare and Replacement Parts

One spare CCM+ should be stocked for every 1 to 20 in service. Spare and replacement assemblies can be ordered from one of the addresses in the Warranty statement or through a local Siemens representative. Assembly part numbers are stated in Section 5 and printed on most modules.

Refer to Section 5 for the part numbers of optional and accessory items. Assembly part numbers are printed on most modules and associated hardware. The backup battery part number is listed below.

Part Number	Description
14743-2	Battery, 3.6 V Lithium

When ordering, provide the model number from the module's nameplate label to be replaced or stored as a spare. A purchase order number should also be included. There are no user-serviceable parts within the CCM+ or on its associated transition board.

3.10 Maintenance Records

An accurate record keeping system for tracking maintenance operations should be established and kept up to date. Data extracted from the record can serve as a base for ordering maintenance supplies, including spare parts. The record can also be useful as a troubleshooting tool. In addition, maintenance records may be required to provide documentary information in association with a service contract. It is suggested that the following information be recorded:

- Date of service incident
- Name or initials of service person
- Brief description of incident symptoms and repairs performed
- Replacement part or assembly number
- Software compatibility code of original part
- Software code of replacement part
- Serial number of original part
- Serial number of replacement part
- Issue number of original circuit module
- Issue number of replacement circuit module
- Displayed error codes from status LEDs, user interface, and configuration software
- Date of completion

■

4 Circuit Description

This section describes the circuitry of the CCM+. Refer to the block diagram in Figure 4–1 as required.

4.1 CCM+ Functional Elements

Functionally, the CCM+ consists of the following elements:

- 68030 Central Processing Unit (CPU) with 68882 Floating Point Coprocessor
- 68302 Peripheral Controller
- 68824 Token Bus Controller
- Boolean Coprocessor
- IOBUS Modem with redundant drivers
- MODULBUS Modem with redundant drivers
- Redundant 2 or 4 megabyte battery-backed RAM
- 512 kilobytes of Boot Flash ROM
- 1 megabyte (operating system) Flash ROM
- Dual Direct Memory Access (DMA) RS-232 Serial Communication Ports
- Watchdog Timer

The 68030 CPU (operating at 40 MHz) provides code compatibility with the 68000-based logic and controller devices, while offering the computing power of a 32-bit architecture and instruction and data caches. The floating-point coprocessor performs floating-point computations, which allows the CPU to execute its program tasks more quickly.

4.2 Watchdog/Reset Circuit

During CCM+ power-up, the Watchdog Timer circuit generates a system reset while the IC supply voltage from the on-board power supply is rising to its operating value. During operation of the CCM+, if at any time the IC supply voltage drops below 4.5V, the Watchdog Timer generates a reset to protect the RAM from invalid access during a power supply failure.

The Watchdog Timer is periodically triggered by software. It is configurable. If a software failure occurs and the Watchdog Timer does not receive its expected trigger signal, it “times out” based on its time out value setting and resets the module.

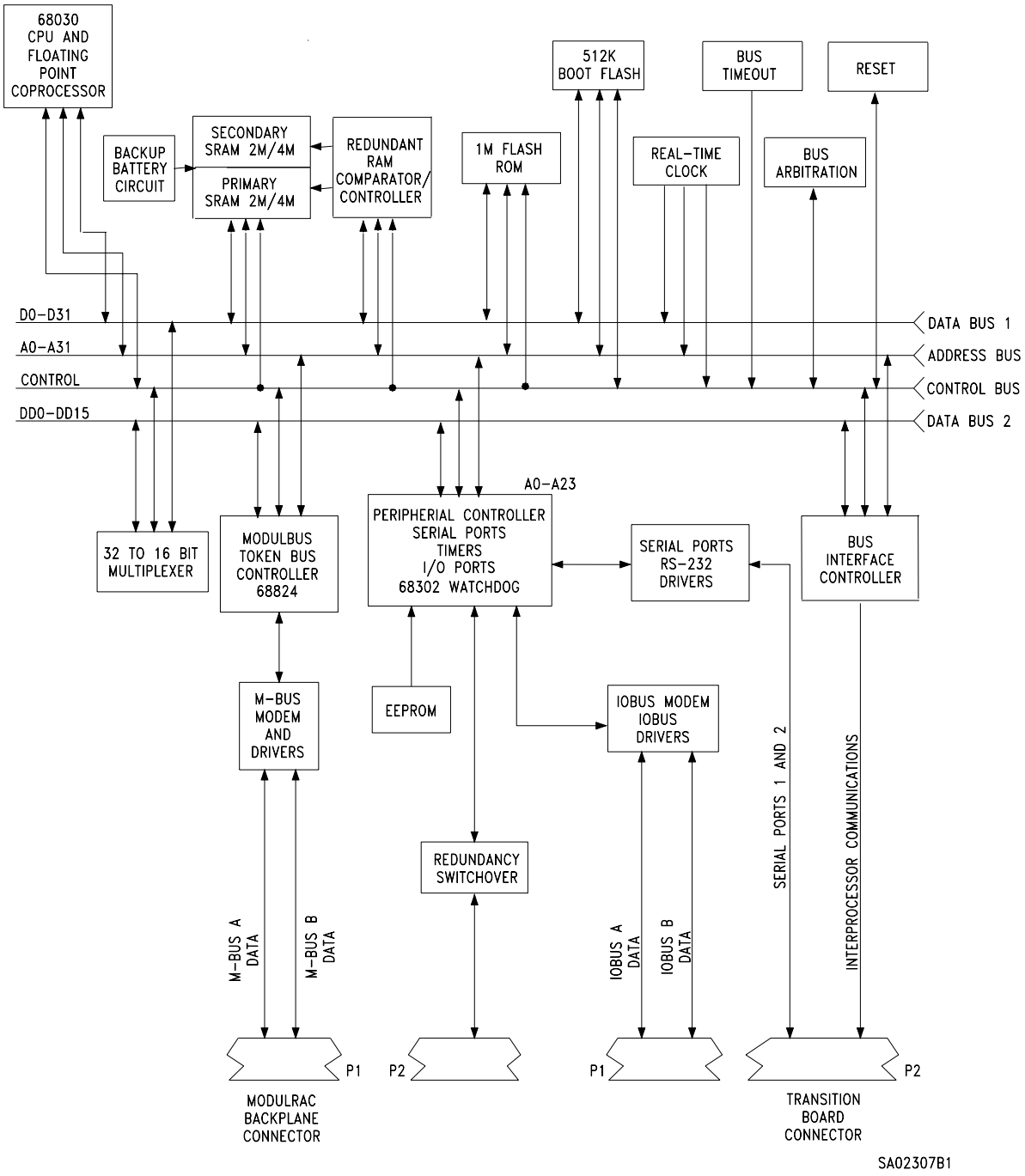


Figure 4–1 CCM+ Block Diagram

4.3 Memory

The CCM+ has redundant banks of either 2 megabyte or 4 megabyte battery-backed RAM, 512K bytes of Boot Flash ROM, and 1 megabyte of Flash ROM.

4.3.1 RAM

The 2 megabyte or 4 megabyte RAM banks are redundant for detecting RAM errors. RAM write operations from the 68030 CPU are performed on both RAM banks. During RAM read operations by the CPU, only one bank is read while the other is used for comparison in a hardware compare circuit. Any discrepancy between the two RAM banks is considered a fault and is reported to the CPU.

The CCM+'s configuration code is transferred to it from a *4-mation* workstation or a redundant unit. In either case, the configuration is stored in the modules's RAM. A 3.6 Volt lithium RAM backup battery maintains the RAM contents when power is removed from the module. A weak or disconnected battery is detected and reported by the module's diagnostic software.

4.3.2 Flash ROM

The CCM+'s executable code is stored in its Flash ROM. The non-volatility of Flash ROM is such that its contents are retained when power is removed from the module.

4.3.3 Boot Flash ROM

The CCM+'s operating instructions are stored in a 512 kilobyte Boot Flash ROM.

4.4 Serial Ports

The CCM+'s serial ports are routed through the module's companion transition board. They are intended for direct connections to the COM port of a personal computer. Connection to a printer requires a null modem cable (an RS-232 cable used to connect two devices together for file transfer. It attaches to the serial ports of both machines and crosses the sending wire with the receiving wire). The module's on-board Peripheral Controller and RS-232 line driver/receiver circuits control each serial port.

4.5 MODULBUS

MODULBUS (M-BUS) elements consist of a Token Bus Controller (TBC), modem, and line drivers/receiver circuits.

The TBC is an intelligent peripheral device that operates under the supervision of the Peripheral Controller. The TBC implements the media access control portion of the IEEE 802.4 token passing bus standard. The TBC communicates serially with the modem, which is interfaced to MODULBUS through dual line driver/receiver circuits.

The TBC performs the following functions:

- Manages the ordered access to the token bus medium (MODULBUS)
- Provides a means for the admission and deletion of I/O modules
- Handles fault recovery

The modem does the following:

- Converts received MODULBUS data into a form compatible for data processing
- Converts serial data from the TBC into a form compatible for transmission over the MODULBUS

4.5 IOBUS

IOBUS elements consist of a modem and dual line driver/receiver circuits. The 68302 CPU supervises IOBUS communications through handshaking operations with the IOBUS modem. The modem and dual line driver/receiver circuits perform the same tasks as described for the M-BUS.

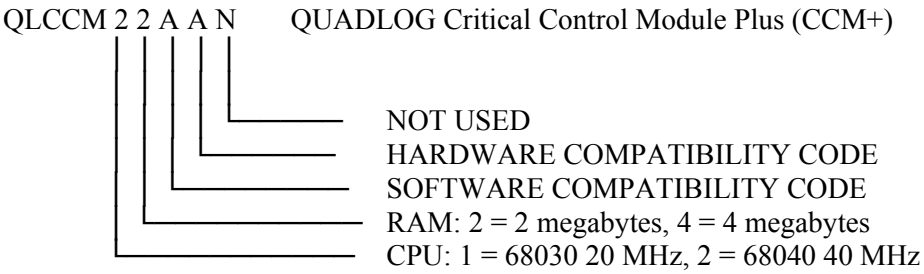
4.6 Interprocessor Communications

Redundant CCM+s communicate with each other over the high-speed Interprocessor Communications Bus.

■

5 Model Designation

Refer to the following legend to decode the CCM+ model designation:



5.1 Accessories

Table 5-1 lists the available CCM+ accessories.

Table 5–1 CCM+ Accessories

Part Number	Description
14743-2	RAM Backup Battery, 3.6 V Lithium
16137-144	19.7 ft. (6m) Redundancy Cable
16137-188	6.6 ft. (2m) Redundancy Cable
16137-189	3.3 ft (1m) Redundancy Cable
16137-191	CCM+ Serial Port Cable to Converter
16137-221	Redundant CCM+ Serial Port Cable To Converter

5.2 Options

Table 5-2 lists the available CCM+ options.

Table 5–2 CCM+ Options

Part Number	Description
16147-51	Transition Board with NODE switch

■

6 Specifications

This section lists specifications for the QUADLOG Critical Control Module Plus (CCM+).

6.1 Module Specifications

Table 6-1 lists the CCM+'s mechanical and electrical specifications.

Table 6–1 CCM+ Specifications

Category	Specification	Data
Mechanical	Module Weight	4.5 lbs. (2.04 kg)
Electrical	Supply Voltage	24 Vdc ± 10% (from MODULRAC/SIXRAC backplane)
	Supply Input Current	0.52 Ampere typical 0.60 Ampere maximum
	Power Dissipation	12.5 Watts (42.74 Btu/hr) ± 10%
	CPU	68030 w/external floating-point coprocessor
	Clock Speed	40 MHz (bus operations)
	Internal Caches	Dual 256 bytes
	I/O Coprocessor	68302 CPU
	Real-Time Clock	Battery-backed
	Memory	Redundant 2Mb or 4 Mb RAM, battery-backed
	Battery Life Expectancy: CCM+ in powered rack Storage w/battery disconnected Storage w/battery connected	 10 Years 10 Years @ 23 degrees C 9.5 Years @ 71 degrees C 8.5 Years @ 85 degrees C 1 Month
	Communication Buses: Backplane I/O Serial Ports 1 and 2	 Redundant MODULBUS interface Redundant IOBUS interface RS-232, 300 to 38,000 baud (software selected)

6.2 Environmental Specifications

Refer to Table 6-2 for the CCM+ environmental specifications.

Table 6–2 CCM+ Environmental Specifications

SPECIFICATION	DATA	REFERENCE STANDARDS
Ambient Temperature Range Operating Storage	 -25 to 70°C, 0.5°C/min -25 to 85°C, 10°/min	IEC 68-2-2 Test Bb IEC 68-2-14 Tests Na, Nb IEC 68-2-1 Tests Ab, Ad
Relative Humidity Operating: Storage	 5 to 95%, non-condensing 0 to 100%, condensing	IEC 68-2-3 Test Ca IEC 68-2-30 Test Db
Vibration	10-150 Hz 2 g. max	IEC 68-2-6 Test F_c
Mechanical Shock Accleration Duration	 15 g. 11 ms	IEC 68-2-27 Test E_A
Corrosives	Class G3, 10+ years	ANSI/ISA S71.04
Radiated Emission, E-Field	30 MHz-230 MHz 30 db (µV/m) at 30 m 230 MHz-1000 MHz 37 db (µV/m) at 30 m	EN 55011 EN 50081-2
Conducted Emission Power Lines	0.15 MHz-0.5 MHz 79 dBm quasi-peak 0.5 MHz-30 MHz 73 dBm quasi-peak	EN 55011 EN 50081-2
Immunity, Conducted Electromagnetic Field	150 KHz-80 MHz, 10 V 10 k Hz-50 MHz, 1V	IEC 801-6/IEC 1000-4-6 IE 801-6
Immunity, Power Lines Surge	4 kV	IEC 801-5
	2 kV	ANSI/IEEE C62.41 (IEEE 587)
Immunity, Electrical Fast Transients and Signal Line Surge	4 kV Power Lines, 2 kV I/O	IEC 801-4/IEC 1000-4-4
	2.5 kV I/O	ANSI/IEEE C37.90 (Formally IEEE 472)
Immunity, Radiated E-Field	10 V/m, 27 MHz-1000 MHz	IEC 801-3
	10 V/m, 80 MHz-1000 MHz	IEC 1000-4-3
	10 V/m, 30 kHz-150 kHz	IEC 801-3
Immunity, Electrostatic Discharge	8 kV contact, 15 kV air	IEC 61000-4-2`
Altitude: IEC 1131-2	Up to 2000 meters	

6.3 Electrical Classification

Before installing, applying power to, or servicing a CCM+, check the module's nameplate label for electrical classification.

This product has been tested per the European Union's EMC Directive. See the Declaration of Conformity statement at the back of this Instruction. Refer to Section 2.2.1 for considerations affecting EMC compliance.

Environmental Conditions, Per IEC 664, Installation Category II, Pollution Degree 2

The following are agency approvals and pending approvals:

- ABS Approval Pending
- CE Approved
- CSA Approved for installation in Class I Div. 2 Hazardous Locations
- FM Approved for installation in Class I Div. 2 Hazardous Locations
- TÜV Approved
- UL Approval Pending

DECLARATION OF CONFORMITY

according to EN 45014

Siemens Energy & Automation, Inc.
Sumneytown Pike
Spring House, PA 19477

Declare under our sole responsibility that the product,

Critical Control Module Plus when labeled with the CE mark

to which this declaration relates is in conformity with the following standards or other normative documents:

- EN50081-2, Electromagnetic compatibility: Generic emission standard Industrial environment
- EN50082-2, Electromagnetic compatibility: Generic immunity standard Industrial environment

following the provisions of the:

- EMC Directive 89/336/EEC and amended by 91/263/EEC, 92/31/EEC and 93/68/EEC

Manufactured in Spring House, PA U.S.A.

Date: July 26, 1999

William Goble
Director, Critical Systems

European Community Representative:
Siemens Energy & Automation (UK), Ltd.

Date: July 30, 1999

Ian McKnight
Engineering Manager
SE&A UK