

MA50C

menTCS Vital AAR System Controller

IP65 SIL 4 Modular Train Control System for Safety in Transportation

- » *SIL 4 modular Train Control System menTCS*
- » *Certified safe CPU board with 3 CPUs*
- » *Safe I/O boards (currently in certification process)*
- » *QNX safe operating system available*
- » *Certification packages available*
- » *Optional MVB, RS232, RS422, RS485, CAN, GPS*
- » *IP65 / NEMA-4 protected housing*
- » *For rolling stock and wayside applications*
- » *AAR S-9401 compliant housing concept - functional product only available in project context*



AAR Compliant menTCS Controller

MA50C is the first member of the AAR (Association of American Railroads) compliant sub-family of the **menTCS** Train Control System. The modular system platform is usable for vital train functions in train control, automatic train operation (ATO) and automatic train protection (ATP) up to SIL 4.

Modular I/O Configuration, Sturdy Design

Packed in an AAR S-9401 housing, the system has a **safe CPU**, real-time Ethernet card, power supply and shelf controller. Other cards such as safe train I/Os, MVB, CAN or serial I/O are added as needed. The system mechanics comply with the S-590 standard of the American Association of Railway Manufacturers. A 6 MCU (Modular Concept Unit) design is used to optimally host a single tower of standard 3U CompactPCI boards.

Vital Control Solution for Extreme Environments

The MA50C is made for railway applications in North America and other countries where extremely robust hardware is needed or require the standard AAR form factor. In dirty, humid and chemically harsh environments, air cooling is not an option. Therefore, all the boards inside the MA50C are conduction cooled. Conduction cooling frames transfer the heat out of the system by thermally coupling all the hot components to the enclosure frame. Machined side walls also help to make the enclosure hermetically tight, and provide a particular mechanical stability.

IP65 / NEMA-4 Protection

Fulfilling class IP65 of the IEC 60529 standard International Protection classification, the MA50C is completely tight against dust and water jets from any direction have no harmful effects on the system.

Part of menTCS Train Control System

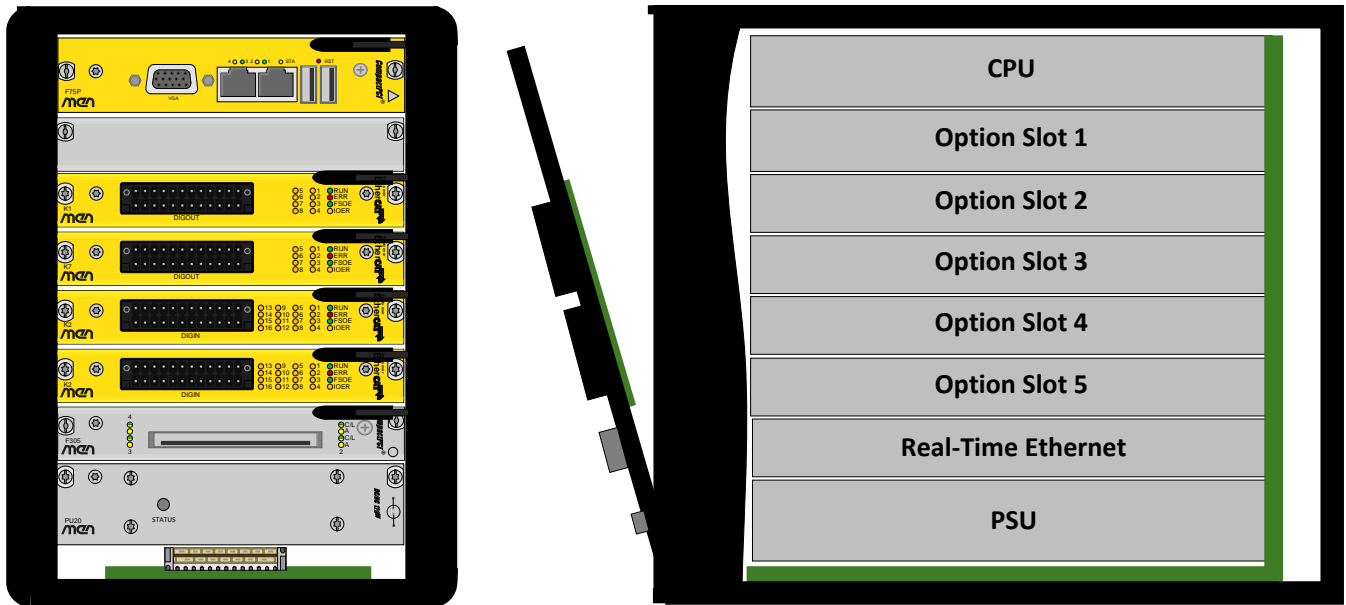
menTCS is a modular SIL 4 certifiable family of standard products usable for every kind of safety-critical railway application – from a single function to the main control system of the train. It can be configured to control anything in the train that requires functional safety – with requirements from SIL 1 up to SIL 4.

menTCS communicates via RT Ethernet and can be configured to interface consist networks like MVB, CANopen or Profinet. This makes it easy to integrate into a TCN network and into regionally different Train Control Systems. The high flexibility of menTCS significantly saves cost and time in railroad computerization.

The MA50C is functionally identical with the 40-HP **MH50C**. Both platforms are open and application-ready, allowing smooth integration of user applications with the basic operating system and device drivers.

Certification and Standards Compliance

menTCS components come with certification packages and complete support for the safe operating system QNX. The certification package includes safe protocols which shorten implementation time and reduce certification costs of the final system.



MA50C Configuration Example

Option slots populated with safe I/O

- 8 digital outputs, SIL 4, through K1/K7 combination:
high-side and low-side switching
- 16 digital inputs, SIL 4, through 2 x K2
- 1 slot reserved for future use

General System Characteristics

- 6 MCU housing with status display
- Slot and backplane set-up of the system
 - 1 PSU slot
 - 1 CompactPCI PlusIO system slot
 - 6 CompactPCI peripheral slots
- Please contact MEN sales for component combination possibilities.

CPU Board

- CPCI 3U Board
- Configurable: yes
- 3x Intel Atom E680T (1.6 GHz), 2x 512 MB, 1x 1 GB DDR2 DRAM, -40°C to +85°C, conduction-cooled
 - [More information on F75P Safe Computer](#)
- Mass Storage
 - SSD mSATA, 8 GB, -40 to +85°C

Real-Time Ethernet

- CPCI 3U Board
- Configurable: no
- 4 Fast Ethernet; rear: real-time Ethernet (EBUS); -40°C to +85°C, conduction-cooled
 - [More information on F305 Real-Time Ethernet Interface Card](#)

Safe I/O

- menTCS I/O Board
- Configurable: yes
- Possible in option slots: 2, 3, 4, 5
- Possible Configurations
 - 8 digital outputs, high-side switching, SIL 2 (SIL 4), -40° to +85°C, conduction-cooled
 - 8 digital outputs, low-side switching, SIL 2 (SIL 4), -40° to +85°C, conduction-cooled
 - 16 digital inputs, SIL 2 (SIL 4), -40° to +85°C, conduction-cooled

MVB Multifunction Vehicle Bus

- CPCI 3U Board
- Configurable: yes
- Possible in option slot: 1
- Possible Configurations
 - MVB ESD+ Device, Process and Message Data, -40° to +70°C, conduction-cooled
 - MVB ESD+ Bus Administrator, Process and Message Data, -40° to +70°C, conduction-cooled
 - MVB EMD Device, Process and Message Data, -40° to +70°C, conduction-cooled
 - MVB EMD Bus Administrator, Process and Message Data, -40° to +70°C, conduction-cooled

Serial I/O

- CPCI 3U Board
- Configurable: yes
- Possible in option slot: 1
- Possible Configurations
 - Flexibly usable, e.g., for different types of serial I/O like RS422/485, RS232, CAN bus, GPS, and others

Power Supply

- PSU 3U
- Configurable: yes
- Possible Configurations:
 - 120 W, 3U 6 HP PSU, wide range input 24 to 110 V DC, 24 V DC nom., output 12 V / 5 V / 3.3 V DC, -40°C to +85°C, conduction-cooled
 - 120 W, 3U 6 HP PSU, wide range input 100 to 240 V AC, output 12 V / 5 V / 3.3 V DC, -40°C to +85°C, conduction-cooled
- One power inlet connector

Supervision and Control

- Dedicated shelf controller monitors power, CPU status, temperature; controls fan; provides status LEDs and power button

Front Interfaces

- Ethernet
 - Four M12 connectors, 100BASE-T
- I/O
 - Four 32-pin MIL-C connectors
- Power
 - One power inlet connector
 - Power button
- Status LEDs
- Front display for system status and diagnostics information (optional)
- Ground connector

Electrical Specifications

- Supply voltage
 - 24 V, 36 V, 48 V, 72 V, 96 V, 110 V DC nominal; 14.4 to 154 V max. (EN 50155) or
 - 100 to 240 V AC
 - Cranking voltage range 20 to 130 V DC (nominal 74 V DC)
 - Power interruption class S2 (10 ms) (EN 50155)
- Power consumption
 - 100 W max.

Mechanical Specifications

- Dimensions
 - 6 MCU AAR conformal housing

Environmental Specifications

- Classification for railway applications
 - AREMA 11.5.1: Class I, Class J
- Temperature range (operation):
 - -40°C to +85°C (AREMA 11.5.1: Class I, Class J; EN 50155, class TX)
- Cooling concept
 - Air-cooled, natural convection
 - Conduction cooling inside the housing
- Temperature range (storage): -40°C to +85°C
- Humidity
 - AREMA 11.5.1: Class I, Class J; EN 60068-2-30; EN 50155
- Vibration/Shock
 - AREMA 11.5.1: Class I, Class J; EN 61373:2010
- Altitude: -300 m to +3000 m
- Protection rating
 - IP65 (IEC 60529)
 - NEMA-4

Safety

- Functional Safety
 - Certifiable to SIL 1, SIL 2, SIL 3 or SIL 4 according to EN 50129
 - Hazard rate for safety functions $\leq 1\text{E-}9 / \text{h}$
 - Control Processors configured for deterministic behavior, e.g., Hyper-Threading disabled, speed-step disabled, BIOS interrupts disabled
 - System maintains safe state after a failure
- Electrical Safety
 - EN 50153:2014
- Electrical Insulation
 - EN 50124-1:2001 + A1:2003 + A2:2005
- Flammability (PCBs)
 - UL 94 V-0

EMC

- EN 50121-3-2:2015: Rolling stock

Software Support

- I/O Domain
 - Linux
 - QNX
 - PACY (Process Data Framework for Cyclic Applications)
- Safe Domain
 - QNX
 - PACY (Process Data Framework for Cyclic Applications)

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