



- For Applications up to SIL4 (EN5012x) or SIL3 (IEC61508)
- Certified safe CPU board with 3 CPUs
- Safe I/O boards
- QNX safe operating system available
- Certification packages available
- Extensible by distributed safe I/O boxes connected via real-time Ethernet
- Optional MVB, RS232, RS422, RS485, CAN, GPS
- Compact 40 HP application-ready system
- Rack-mounted or wall-mounted
- For rolling stock and wayside applications



MH50C is a central controller of the duagon SAFE CONTROL (d-SC) System. It is a modular system platform usable for safety-critical train applications like train control, automatic train operation (ATO) and automatic train protection (ATP) up to SIL 4 (EN5012x) or SIL3 (IEC61508).

MODULAR I/O CONFIGURATION

Being based on modular 40 HP CompactPCI, the system is always configured with a safe system CPU, a real-time Ethernet card, a power supply unit and a shelf controller. Other cards are added as built-to-order (BTO) options or by the user. The safe I/O cards support the common I/O requirements requested in trains.

The composition of safe CPU card, safe train I/Os and interfaces, such as MVB, CAN or serial interfaces to connect to legacy train equipment makes the controller ideal for use in safety-critical rolling stock applications.

APPLICATION-READY, OPEN PLATFORM

The MH50C is an application-ready, open platform. This means that the user adds his application based on the basic operating system and driver software.

PART OF DUAGON SAFE CONTROL SYSTEM

d-SC is a modular SIL 4 certifiable family of CompactPCI-based 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.

d-SC communicates via standard real-time Ethernet and can be configured to interface to any type of consist fieldbus network like MVB, CANopen, Profinet etc. This makes it easy to integrate into a TCN network as well as into regionally different Train Control Systems like ETCS, CTCS, ATCS or Klub-U. The high level of flexibility of d-SC results in significant cost and time savings during computerization of the train.

CERTIFICATION AND STANDARDS COMPLIANCE

d-SC components come with certification packages and complete support for the safe operating system QNX, including safe protocols, and provides the technical possibility to run a safety PLC, again saving cost and time for implementation and for certification of the final system. d-SC is developed according to EN 50128 and EN 50129 standards and complies with the environmental requirements for railway applications: shock, vibration, humidity, dust, isolation, PSU hold-up times, EMC regulations etc.

MOUNTING AND COOLING OPTIONS

The system can be wall or rack-mounted, and is cooled using an additional fan tray at the bottom of the system. Cooling is independent of the mounting position.



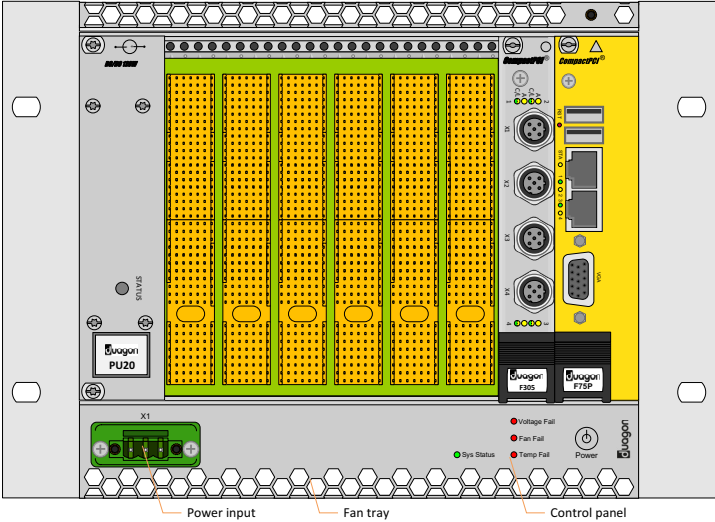
www.duagon.com/products/mh50c/

DATA SHEET



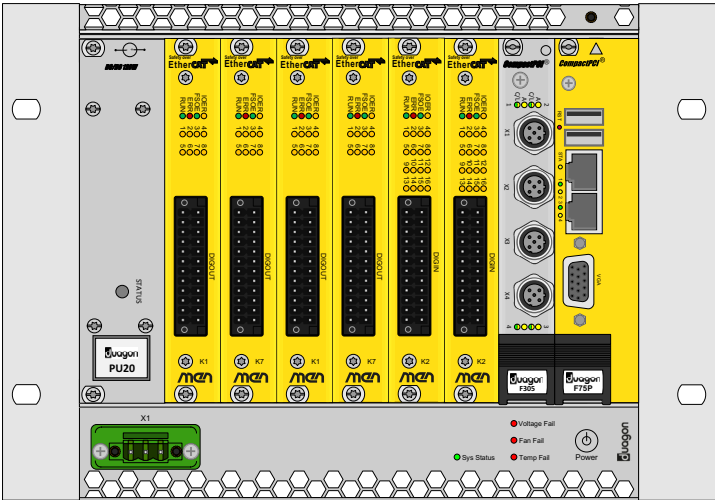
MH50C | DIAGRAM

Slot		1	2	3	4	5	6	RT Ethernet	CPU
	PSU	I/O	I/O	I/O	I/O	I/O	I/O		



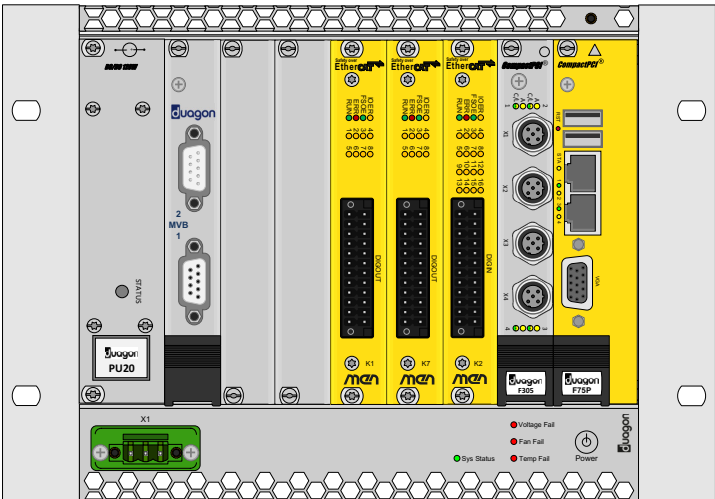
MH50C Barebone Configuration

- Safe CPU card F75P
- -40°C to +85°C
 - 3 Intel Atom processors
 - 2 RJ45 (general purpose Ethernet)
 - mSATA 8 GB, -40 to +85°C
- Real-time Ethernet interface card
- 4 M12, connects distributed safe I/O
- Wide range power supply
- System supervision: temp, fan, power
- Forced-air cooling
- Option slots for
- Safe I/O
 - MVB ESD+ Device/Bus Administrator
 - MVB EMD Device/Bus Administrator
 - General-purpose interfaces (RS422/RS485, RS232, CAN, GPS)



MH50C Configuration Example 1

- Option slots populated with safe I/O
- 2 x 8 digital outputs, SIL 4, through K1/K7 combination: high-side and low-side switching
 - 16 digital inputs, SIL 4, through 2 x K2
- Safe CPU, RT Ethernet card etc. as in barebone configuration



MH50C Configuration Example 2

- Option slots populated with safe I/O
- MVB master
 - 8 digital outputs, high-side switching, SIL 2
 - 8 digital outputs, low-side switching, SIL 2
 - 16 digital inputs, SIL 2
- Safe CPU, RT Ethernet card etc. as in barebone configuration
- This configuration targets SIL 2 safe I/O applications: each safe I/O card is only assembled once.

MH50C | TECHNICAL DATA

GENERAL SYSTEM CHARACTERISTICS

- Modular design, built-to-order configuration
- Slot and backplane set-up of the system
 - 1 PSU slot
 - 1 CompactPCI PlusIO system slot
 - 6 CompactPCI peripheral slots
 - 1 CompactPCI peripheral slot reserved for F305
- ▶ **Please contact duagon sales for component combination possibilities.**

CPU BOARD

- F75P CPCI 3U Board
- Configurable: no
- **3x Intel Atom E680T (1.6 GHz), 2x 512 MB, 1x 1 GB DDR2 DRAM, 6 HP, front: 1 VGA, 2 USB, 2 Fast Ethernet (RJ45), -40 °C to +85 °C, air-cooled, conformal coating**
- Mass Storage
 - SSD mSATA, 8 GB, -40 °C to +85 °C

REAL-TIME ETHERNET

- F305 CPCI 3U Board
- Configurable: no
- **4 Fast Ethernet (M12); rear: real-time Ethernet (EBUS); -40 °C to +85 °C, conformal coating**

SAFE I/O

- K1, K2 or K7 d-SC I/O Board
- Configurable: yes
- Possible in CompactPCI slots: 1, 2, 3, 4, 5, 6
- Possible Configurations
 - **8 digital outputs, high-side switching, SIL 2 (SIL 4), -40° to +85°C, conformal coating**
 - **8 digital outputs, low-side switching, SIL 2 (SIL 4), -40° to +85°C, conformal coating**
 - **16 digital inputs, SIL 2 (SIL 4), -40° to +85°C, conformal coating**

MVB MULTIFUNCTION VEHICLE BUS

- D215 CPCI 3U Board

- Configurable: yes
- Possible in CompactPCI slots: 1
- Possible Configurations
 - **MVB ESD+ Device, Process and Message Data, -40°C to +70°C, conformal coating**
 - **MVB ESD+ Bus Administrator, Process and Message Data, -40°C to +70°C, conformal coating**
 - **MVB EMD Device, Process and Message Data, -40°C to +70°C, conformal coating**
 - **MVB EMD Bus Administrator, Process and Message Data, -40°C to +70°C, conformal coating**

SERIAL I/O

- F215 CPCI 3U Board
- Configurable: yes
- Possible in CompactPCI slots: 1 to 2, 2 to 3
- **8 HP FPGA-based universal interface for direct connection of 2x CAN (first slot), 2x UART and 1x 8-bit GPIO (second slot) at front as standard FPGA content plus space for user-defined functions, -40 °C to +85 °C, interface SA-Adapters to be ordered separately**
- Possible Configurations
 - **RS422/485, full duplex, optically isolated, -50 °C to +85 °C, conformal coating**
 - **RS232, optically isolated, -40 °C to +85 °C, conformal coating**
 - **CAN bus ISO high-speed, optically isolated, -40 °C to +85 °C, conformal coating**

POWER SUPPLY

- PU20 or PU21 PSU 3U
- Configurable: yes
- **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, conformal coating**
- **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, conformal coating**
- One power inlet connector

SUPERVISION AND CONTROL

- AF2 Dedicated shelf controller monitors power, CPU status, temperature; controls fan; provides status LEDs and power button

- **Shelf Controller for CompactPCI Systems**

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)
 - 24 V, 36 V, 48 V DC nominal; 16.8 to 60 V (= 0.7 x Un, min. to 1.25 x Un, max.) (EN 62368)
 - Power interruption class S2 (10 ms) (EN 50155)
- Power consumption
 - 60 W typ. (barebone configuration and 2x K1, 2x K2, 2x K7)
 - 100 W max.

MECHANICAL SPECIFICATIONS

- Dimensions
 - (W) 214 mm, (D) 225 mm, (H) 175 mm max. without brackets
 - 4U, 40 HP
- Mounting Possibilities
 - Wall-mount, or
 - Rack-mount in 19" cabinet
 - Two systems side-by-side to build a single 19" chassis
- Cooling concept
 - Air-cooled, forced convection with fan tray at system bottom
- Weight
 - 5.7 kg (barebone configuration and 2x K1, 2x K2, 2x K7)
- International Protection Rating (IEC 60529): IP20

PRODUCT COMPLIANCE: RAIL - WAYSIDE SAFETY RELATED OR CLOSE TO THE TRACK

- Compliance level: The product is tested and qualified on product model level. Compliance varies between different product models.
- Operating temperature: -40 °C to +70 °C (EN 50125-3:2003, class T2, cubicle, with class T2 maximum extended by 5 °C)
- Storage temperature: -40 °C (EN 60068-2-1:2007, Ab) to +85 °C (EN 60068-2-2:2007, Bb)

- Altitude: +3000m max. (EN 50125-3:2003, class AX)
- Humidity: 100 % RH max. (EN 50125-3:2003, shelter N.C.C., class T1/T2/TX) Non-condensing
- Pollution degree: EN 50124-1:2017, class PD3
- Overvoltage category: EN 50124-1:2017, class OV1
- Shock: 11 ms @ 20 m/s² (EN 50125-3:2003, in a switch cabinet 1 m to 3 m from the track)
- Vibration: 2.3 m/s² (EN 50125-3:2003, in a switch cabinet 1 m to 3 m from the track)
- Electrical safety
 - EN 50124-1:2017
 - EN 62368-1:2014 + AC:2015
- EMC emission
 - EN 50121-4:2016
 - EN 61000-6-4:2007 + A1:2011
 - EN IEC 61000-6-4:2019
- EMC immunity: EN 50121-4:2016
- Fire protection: for compliance to EN 62368-1:2014 + AC:2015 a fire enclosure is required

PRODUCT COMPLIANCE: RAIL - ROLLING STOCK

- Compliance level
 - The product is tested and qualified on product model level. Compliance varies between different product models.
 - The product is prepared for use in EN 50155 systems. Some parameters are system-dependent and are specified on system level.
- Operating temperature: -40 °C to +70 °C, +85 °C for 10 min (EN 50155:2021, class OT4, ST1)
- Rapid temperature variations: EN 50155:2021, class H1, no requirements
- Storage temperature: -40 °C (EN 50155:2021) to +85 °C (EN 60068-2-2, Bb)
- Altitude: +3000 m max. (EN 50125-1:2014, class AX)
- Pollution degree: EN 50124-1:2017, class PD2
- Overvoltage category: EN 50124-1:2017, class OV1
- Humidity: +55 °C and +25 °C, 100 % RH max. (EN 50155:2021)
- Shock: 30 ms @ 50 m/s² (EN 61373:2010/AC:2017-09, vehicle body, cat. 1, class B)



- Vibration: 10 min @ 2.02 m/s² (functional) and 5 h @ 11.44 m/s² (long-life) (EN 61373:2010/AC:2017-09, vehicle body, cat. 1, class B, double acceleration)
- Electrical safety
 - EN 50155:2021
 - EN 50153:2014 + A1:2017 + A2:2020
 - EN 50124-1:2017
 - EN ISO 13732-1:2008
- Fire protection: EN 45545-2:2020, EL9, HL3
- EMC emission: EN 50121-3-2:2016 + A1:2019
- EMC immunity: EN 50121-3-2:2016 + A1:2019
- Protective coatings: EN 50155:2021, class PC2 (Any PCB protected on both sides) except mSATA SSD assembled on F75P
- Useful life: 20 years (EN 50155:2021, class L4)
 - The system uses components which may have a shorter useful life. For details contact duagon.

FUNCTIONAL SAFETY

- Certifiable up to SIL 4 according to EN 50129/EN 50128 and up to SIL 3 according to IEC 61508, depending on I/O board configuration

- Hazard rate for safety functions $\leq 1\text{E-}9$ / h
- System maintains safe state after a failure

RELIABILITY

- MTBF:
 - 31804 h predicted @ 40 °C according to IEC/TR 62380 (RDF 2000)(barebone configuration with fans)
 - 108413 h predicted @ 40 °C according to IEC/TR 62380 (RDF 2000)(barebone configuration without fans)

SOFTWARE SUPPORT

- I/O Domain
 - Linux
- Safe Domain
 - QNX
 - PACY (Process Data Framework for Cyclic Applications)
- Further Resources
 - See the product User Manual for details on software support: www.duagon.com/products/mh50c/#doc
 - See section Software on the product web page for available packages: www.duagon.com/products/mh50c/#downl

MH50C | ORDERING INFORMATION

STANDARD MODELS

- 19MH50CB0** The MH50C is a build-to-order system which is delivered with an example operating system image. The image contains a non-safe standard QNX operating system. The product consists of the 40 HP basic system including backplane and mounting rails and provides:

- 1 slot for PSU
- 1 CompactPCI PlusIO slot for the CPU board
- 6 CompactPCI peripheral slots
- 1 CompactPCI peripheral slot reserved for F305

The barebone configuration comprises a number of standard, non-configurable components such as the PSU and CPU board. I/O boards are completely configurable. The Technical Data list all components that can be implemented in the system. Choose the functionality you need and contact duagon's sales team to verify which board combinations are feasible.

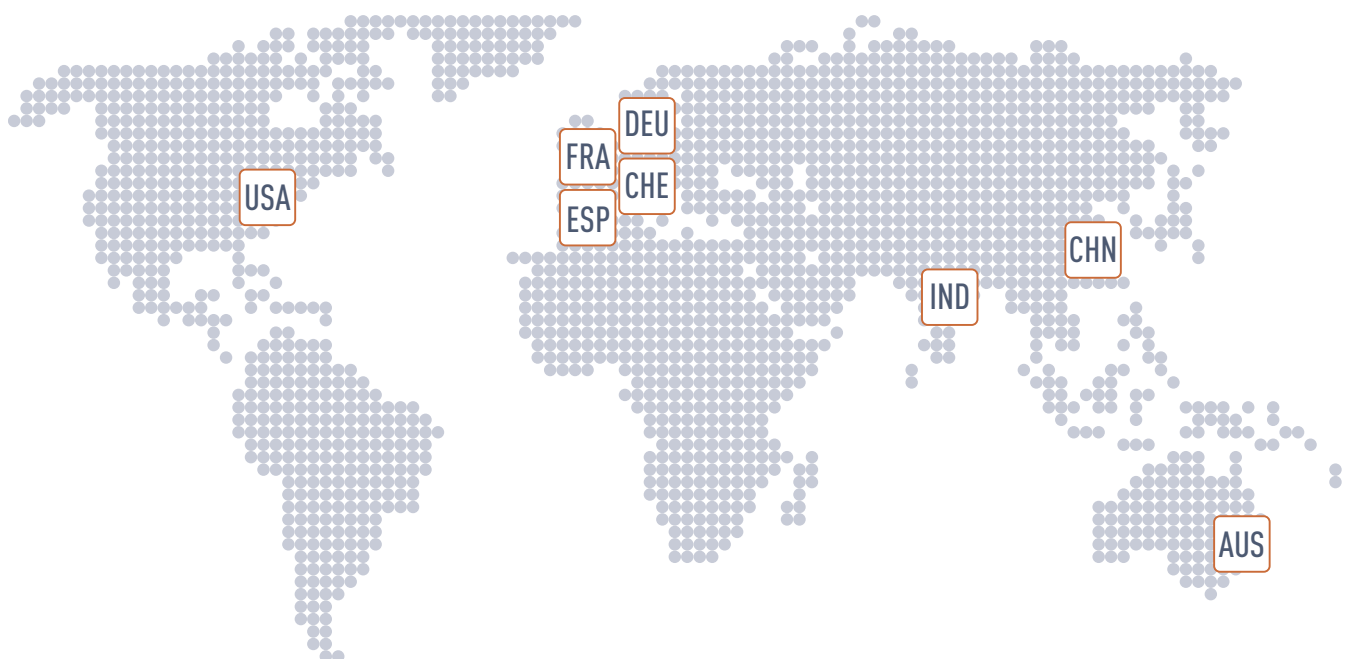
- MH50C product page with an up-to-date list of standard models and available accessories:
www.duagon.com/products/mh50c/



LEADING THE EMBEDDED FUTURE

duagon WORLDWIDE

duagon has a global presence with support and sales representatives across eight countries. With three decentralized engineering and production sites, our customers take advantage of the added competence and flexibility.



www.duagon.com

Copyright © 2024 duagon AG.
All rights reserved.

All data is for information purposes only and not guaranteed for legal purposes. Information has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Specifications are subject to change without notice. duagon is not responsible for the results of any actions taken on the basis of information in the publication, nor for any error in or omission from the publication.