

# K7

## 8 Safe Digital Outputs, Low-Side Switching for menTCS SIL 2 to SIL 4 Modular Train Control System I/O Board

- » 8 digital outputs, 24 V, 48 V, 72 V, 96 V, 110 V
- » 300 mA per channel, 1200 mA total
- » Low-side switch outputs (load to supply voltage)
- » Optical isolation from other cards
- » Fail-safe board architecture
- » Currently in certification process with TÜV SÜD
- » Developed acc. to EN 50129, EN 50128, IEC 61508
- » Extensive supervision functions
- » EN 50155 fully compliant
- » -40°C to +85°C
- » Conformal coating



### Digital Outputs for menTCS

The K7 is a safe digital output card for use in the menTCS MEN Train Control System. The menTCS platform performs safe train control functions in rolling stock applications like Automated Train Protection (ATP) or CBTC (Communications Based Train Control). It usually consists of a controller system, e.g., **MH50C**, and safe remote I/O boxes, e.g., **KT8**. The K7 can be plugged into any of these systems, with one card providing 8 safe digital outputs with read-back and testing capabilities.

### Safe Communication using EtherCAT and FSoE

menTCS I/O boards are EtherCAT devices, connected to the host via a backplane "EBUS" link. On top of EtherCAT, a safety layer called FSoE (Fail Safe Over EtherCAT) provides safe real-time Ethernet communication between the host system and the I/O board.

### Made for Rail I/O Functions

The K7 can switch voltages from 24 V to 110 V nominal as specified by EN 50155. Typical loads are relay coils, digital inputs of other systems or LED indicators. The outputs are low-side switching, i.e. the load is connected to the high side. A typical application uses a K7 together with a high-side switching K1, to switch the load between the two cards.

The I/O card's fail-safe behavior provides functional safety: it enters the safe state if it detects an error. Front I/O is connected via a 24-pin PCB plug for fast installation thanks to reduced wiring.

### Soon To Be Certified up to SIL 4

The K7 is certified to CENELEC standards EN 50128 and EN 50129. Developed in a SIL 4 process, the systematic capability of the K7 is SIL 4. However, to control a SIL 4 function, the system design must provide a second cut-off path to put the load into a safe state, e.g., by switching the load's high side with a relay or via a high-side switching **K1 I/O card**. A single K7 provides a maximum safety level of SIL 2.

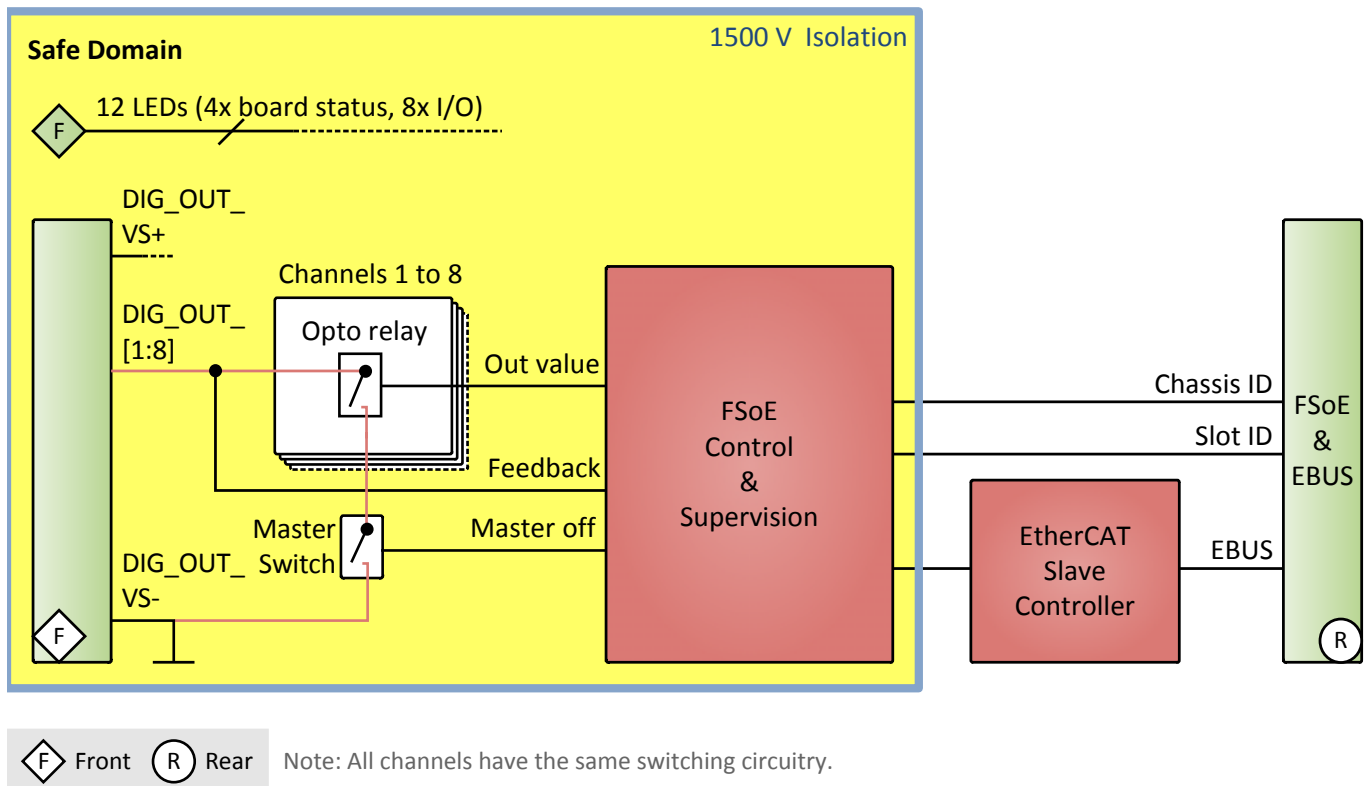
All menTCS I/O components come with dedicated SIL 4 certification packages from TÜV SÜD, reducing the integrator's certification effort and risk, and resulting in lower integration costs.

### EN 50155 Rolling Stock Compliance

Being usable in all types of different trains optimizes the card's interoperability. It supports operating temperatures of -40°C to +85°C according to EN 50155 class TX. Standard boards include conformal coating. With its full EN 50155 compliance and long-term availability of a minimum 10 years, the K7 is a rail-ready I/O component.

### Safe Software Concept

All menTCS components are supported by certified QNX BSP and driver software. Application software accesses the K7 via the PACY software framework (Process Data Framework for Cyclic Applications). Its API allows the application to control and monitor all features of the K7.



**Digital Outputs**

- Eight channels
- Output voltage
  - 24 V, 48 V, 72 V, 96 V, 110 V nom. (EN 50155)
  - Voltage supplied from external source
- Output current
  - 300 mA max. per channel
  - 1200 mA max. total
- Output type
  - Low-side switch outputs (load to supply voltage)

**Front Interfaces**

- Digital I/O
  - One 24-pin PCB plug
  - Eight output channels
- Status LEDs
  - Binary channel status, one LED per channel
  - I/O error
  - FSoE activity
  - Real-time Ethernet error
  - Real-time Ethernet state indication

**Rear Interfaces**

- EBUS
  - Two real-time Ethernet channels, ETG.1000
- menTCS FSoE
  - Slot ID and chassis ID for unique FSoE address

**Supervision and Control**

- Safe supervisor
  - Check for overvoltage, undervoltage, excess temperature
  - Watchdog
  - Monitor self-test

**Backplane Standard**

- ETG.1000 EBUS

**Electrical Specifications**

- Supply voltage
  - +12 V (10.8 to 13.2 V)
- Power consumption
  - 1.6 W typ.
  - 2.5 W max.
- Isolation voltage
  - 1500 V AC

**Mechanical Specifications**

- Dimensions
  - 100 mm x 100 mm, 4 HP
- Weight
  - 196 g (model 06K007-10)

## Environmental Specifications

- Classification for railway applications
  - EN 50155: Rolling stock, vehicle body
  - EN 50125-3: Wayside, at least 1 m off the track inside a switch box, low temperature class T2 and high temperature class TX
- Temperature range (operation)
  - -40°C to +85°C (EN 50155, class TX)
- Temperature range (storage): -40°C to +85°C
- Cooling concept
  - Air-cooled, airflow 0.5 m/s
- Humidity
  - EN 50155: Rolling stock, vehicle body
- Vibration/Shock
  - EN 50155: Rolling stock, vehicle body class B
- Altitude: -300 m to +3000 m

## Reliability

- MTBF
  - 750 935 h @ 40°C according to IEC/TR 62380 (RDF 2000) (model 06K007-10)

## Safety

- Functional Safety
  - Certifiable to SIL 2, SIL 3 or SIL 4 according to EN 50129 (currently in certification process with TÜV SÜD)
  - Hazard rate (THR) for safety functions  $\leq 1\text{E-}8 / \text{h}$  (single card configuration)
  - Board maintains safe state after a failure
- Electrical Safety
  - EN 50155: Rolling stock, vehicle body
- Fire Protection
  - EN 45545-2, hazard level HL3

## EMC

- EN 50155: Rolling stock, vehicle body

## Software Support

- PACY (Process Data Framework for Cyclic Applications)
- QNX
- [For more information on supported operating system versions and drivers see Software.](#)

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[www.men.de/products/k7/](http://www.men.de/products/k7/)

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