TMH | SMART SYSTEMS

CTRL@LOCK 400

powered by HMR9

CBI for mainline railways

WE ARE TMH SMART SYSTEM

TMH Smart System –

Russian engineering group of companies focused on the creation of modern signaling and traffic control solutions

>120
EMPLOYEES

>50
PEOPLE
ENGINEERS

121
MLN RUB.
REVENUE*

5
COUNTRIES
MARKETS

4
COMPANIES
ASSETS

*in 2019

PART OF ONE BUSINESS ECOSYSTEM

ROLLING STOCK	Freight & Passenger rolling stock	TMH
SERVICE	Product Life Cycle Management	LocoTech
TRAFFIC MANAGEMENT	Digital Train Control Systems	TMH SMART SYSTEMS

TMH Smart System

part of the world's largest rolling stock manufacturer and service provider group - TRANSMASHHOLDING

CLOSE TO CUTOMERS ALL OVER THE WORLD

TMH SMART SYSTEMS

INDUSTRIAL TRANSPORT

MAINLINE TRANSPORT

URBAN TRANSPORT

РЖД
TMH
Московский метрополитен
Severstal
ROSNEFT
КУЗБАССРАЗРЕЗУГОЛЬ
DZ
АГМК
UNG Shurtan GKM
ҚАЗАҚСТАН ТЕМІР ЖОЛЫ
EESTI RAUDTEE

CTLR@LOCK 400

TMH SMART SYSTEMS

Computer-based interlocking for train traffic control on open lines and stations

In partnership with: CM

KEY FUNCTIONS

- **Automation and safety enforcement for station control and open lines**
- **New generation computing systems**
- **High flexibility level and good scalability**
- **Comprehensive control capabilities for any infrastructure: from LRT to HSL**

CUSTOMER BENIFITS

- **Package offer**
  (rolling stock, service, signaling, centralized traffic control)
- **Easily adapts to any conditions and lines**
- **Ease of commissioning, configuration and maintenance**
- **Standard IP and Ethernet protocols**
- **SIL4 safety level**

APPLICATION SCOPE

MAINLINE TRANSPORT

HMR-9 REFERENCES

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>50
STATIONS

>5 000
CONTROLLED OBJECTS

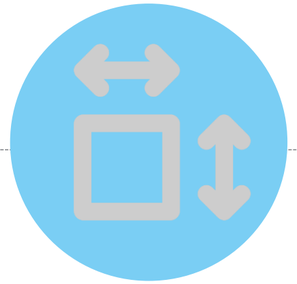
In operation with ETCS Level 1

WHAT OUR SOLUTION BRINGS TO YOU?

TMH SMART SYSTEMS

LOSSES REDUCTION IN TRANSPORTATION PROCESS

- ✓ Emergency situation risks minimization
- ✓ Increased availability rate due redundant IPU architecture



INDUSTRIAL SPACE REDUCTION

- ✓ Up to 50% of the relay rooms space release
- ✓ Possibility to build distributed control system

SYSTEM FUNCTIONALY EXPANSION

- ✓ Advanced diagnostics and WEB interface
- ✓ Extensive scalability
- ✓ Standard IP and Ethernet protocols to integrate adjacent subsystems

SYSTEM STRUCTURE

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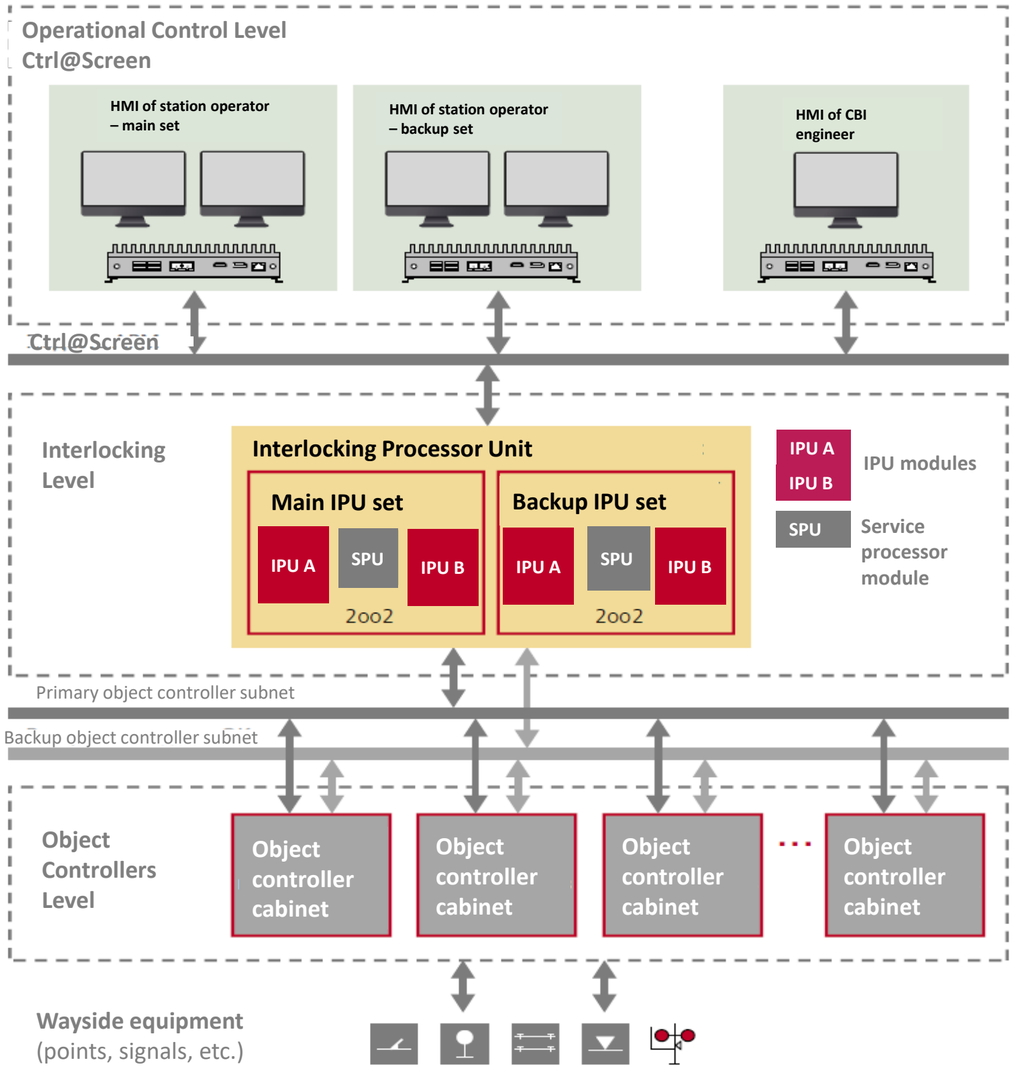
Architecture



Design configurable system – implementation of various architectures

Levels' key components

Human machine interface

- Automated workstation of station operator – main set
- Automated workstation of station operator – backup set
- Automated workstation of CBI engineer
- Main Database server*
- Backup Database server*

Transmission system

- Automated workstation subnet
- Object controllers - main subnet
- Object controllers - backup subnet

Interlocking processor unit

- Main Interlocking Processor Unit
- Backup Interlocking Processor Unit
- Hot-standby synchronization network

Object controllers

- Point object controller
- Signal object controller
- I/O object controller
- Object controllers interface with external systems*

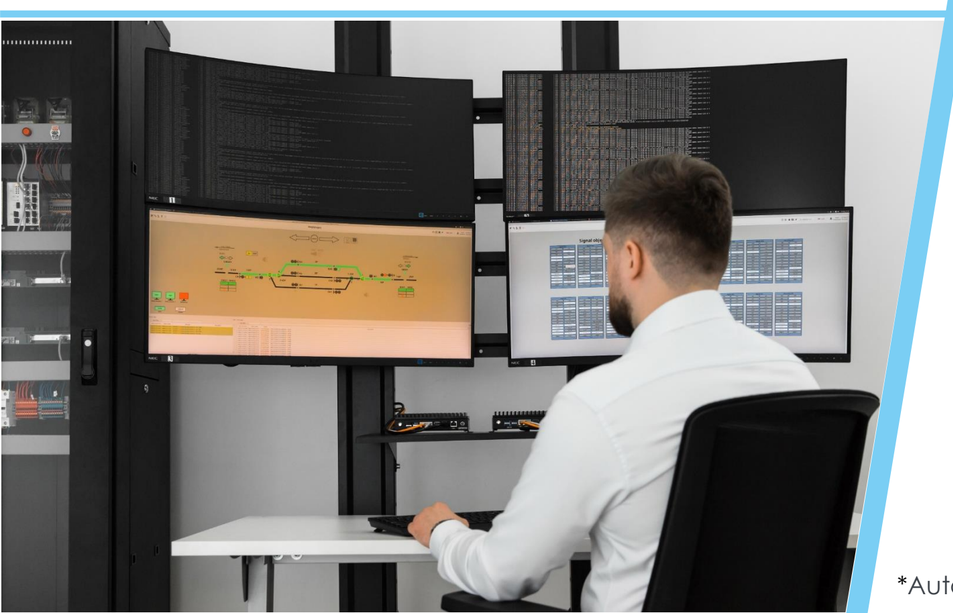
*project design

WORKSTATION SUBSYSTEM*

Interface to work with the system and store information

- Workstation Ctrl@Screen our in-house development
- Industrial computers are used

compatible with:
Windows, Linux (incl. Astra Linux), Android and Baikal Electronics



*Automated workstation

KEY FUNCTIONS

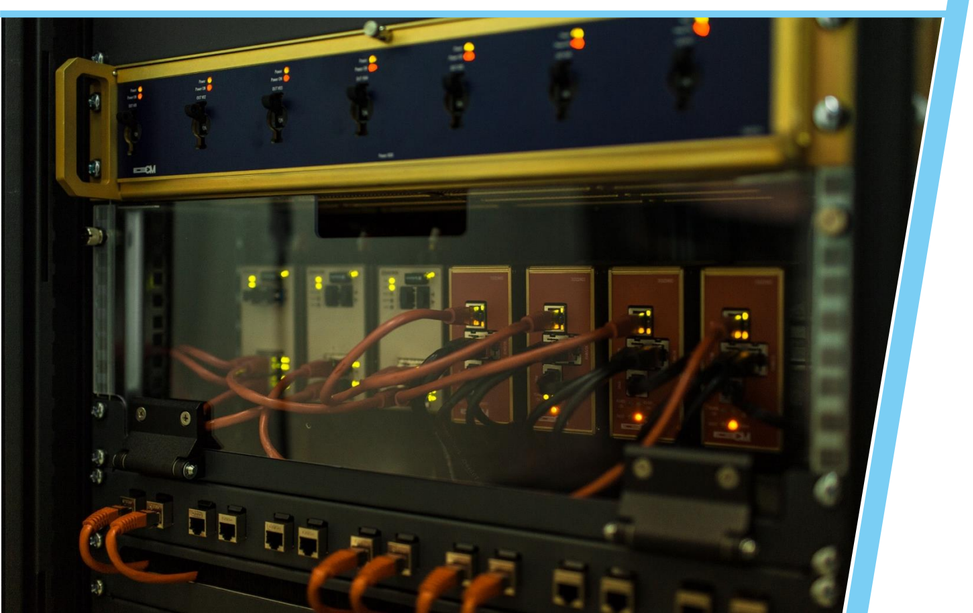
- **Automated workstation of station operator:** controls CBI equipment and shows its state on the display
- **Automated workstation of CBI engineer:** controls technical parameters of CBI equipment
- **Hot-standby of Workstation subsystem:** ensures continuous operation
- **Database servers:** collect, store and archive all information about train situation, state of controlled devices and provide it at the user's request

TECHNOLOGICAL BENEFITS

- **100% Russian SW**
- **Flexible hardware requirements**
- **Scalability across various architectures**
- **Possible to integrate with higher-level systems** (CTC, traffic control system)
- **Multilanguage support without restart**
- **Graphics scalability and adaptability regardless of the size and number of monitors**

DATA TRANSMISSION NETWORK

Exchanges data between CBI Ctrl@Lock400 subsystems



AUTOMATED WORKSTATION SUBNETWORK

- **Exchange data between the Automated Workstations, Database servers and Interlocking Processor Units**
- **Ethernet network based on «star» topology**
- **100% redundancy of Automated Workstation subnetwork: network HW and communication cables**
- **Possible to integrate with dispatcher CTC**

Local data exchange subnets are divided into:

OBJECT CONTROLLERS SUBNETWORK

- **Data exchange between Interlocking Processor Units and Object Controllers**
- **Ethernet/IP communication protocol**
- **2 Ethernet network based on «ring» topology**
- **Network redundancy protocol**
- **Possible to integrate with external lower level control and monitoring systems**

INTERLOCKING PROCESSOR UNIT

Process interlocking logical dependencies on the bases of preprogrammed control algorithms, operator commands and information from object controllers

KEY FUNCTIONS

- **Interlocking Processor Units redundancy ensure continuous operation**
- **Hot-standby synchronization network**
- **Check of the safety conditions of train traffic**

TECHNOLOGICAL BENEFITS

- **Each Interlocking Processor Unit contain:**
  - Interlocking processor unit A (IPU A);
  - Interlocking processor unit B (IPU B);
  - service processor module (SP).
- **Transition to a safe state is guaranteed by disconnecting power supply of the failed IPU**

OBJECT CONTROLLERS

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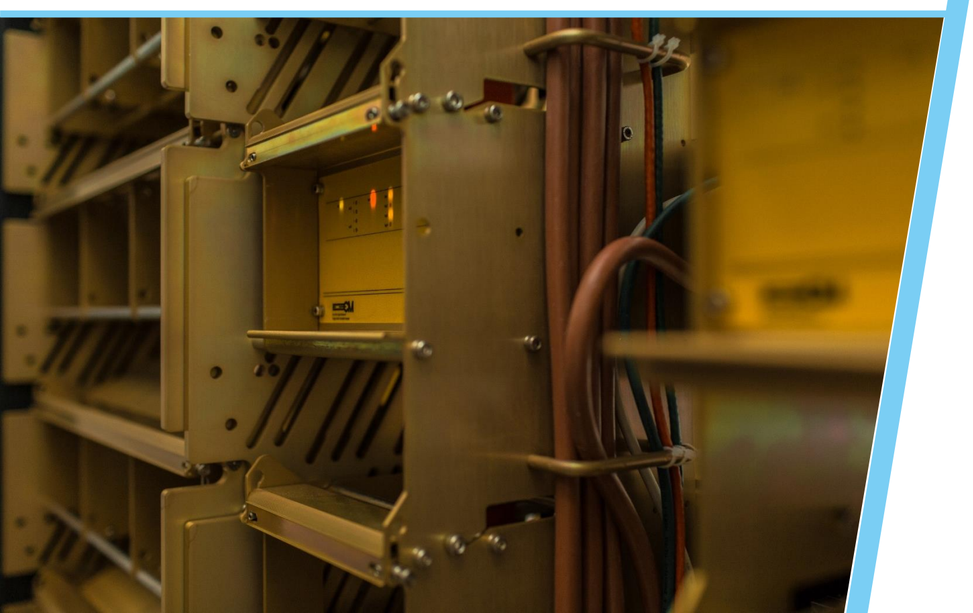
Receives command from Interlocking Processor Unit, analyzes status of field communications and executes command to control equipment

Include:

- Signal object controller
- Point object controller
- I\O object controller



KEY FUNCTIONS

- Object Controllers of various types
- Redundant Object Controllers subnetwork
- Information about command execution transmits to IPU after Object Controllers for wayside equipment fulfill the command

TECHNOLOGICAL BENEFITS

- Wayside equipment fully wireless control
- Unified supply voltage 48 V DC bus
- Industrial design with working temperatures range from –40 to +85 °C
- Can be placed in modular buildings or outdoor cabinets

SIGNAL OBJECT CONTROLLER

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Control of traffic signals aspects

Continuous control over traffic signal operability

Traffic signal operating modes:
- Continuously On
- Blinking

KEY FUNCTIONS

- **Control of LED light-optical systems of any complexity and number of lights.**
- **Up to 3 light signals of one traffic light can be connected to one module.**
- **Controller provides operation and control of traffic signal aspects in the «Day»\«Night» modes**

TECHNOLOGICAL BENEFITS

- **Number of control channels – 3:**
  - «day» mode – 110 V
  - «night» mode – 90 V
- **Channel output current – 0,55 A**
- **Channel output frequency – 50 Hz**
- **Overall dimensions (W x H x D) – 168 x 110 x 190mm**
- **Supply voltage – 36…60 V DC**
- **Current consumption at 48 V – 2 A**
- **Operating temperature range – minus 40… plus 85 °C**
- **Communication channels RS485 – 2**
- **Exchange rate – up to 115 kBit/s**

POINT OBJECT CONTROLLER

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Point position control

3 ways to switch the point:

- Operator's command
- Automatic command
- Rout command

CONTROL MODULE

- Control of point switch position
- Control of points' tongue end position («plus»\ «minus» position)
- Loss of control registration over point tongue position
- Switching from uncontrolled (middle) position into controlled position
- Control of point switch time limit and point engine shutdown in case of long effort to switch without result

POWER MODULE

- Electric drive has seven wire control circuit
- Nominal voltage: 220V DC or 220V AC three-phase voltage
- Control of three-phase asynchronous motors or DC motors
- Overall dimensions (W x H x D) – 168 x 110 x 190 mm
- Supply voltage – 36…60 V DC
- Current consumption at 48 V – 0,2 A
- Working temperatures range – from - 40… + 85 °C
- Communication channels RS485 – 2
- Exchange rate – up to 115 kBit/s

I\O OBJECT CONTROLLER

Controls status of electromagnetic relay contacts and generates control signals on the coils of the interface relays associated with functional safety

- Interface with related signaling systems via external circuits – «dry contact» type

TECHNICAL DATA

- Number of discrete inputs - 8
- Logic voltage «0» – 0…6,7 V
- Logic voltage «1» – 6,7 … 24 V
- Number of discrete outputs – 8
- Logic voltage «0» – 0 V
- Logic voltage «1» – 24 V
- Overall dimensions (W x H x D) – 168 x 110 x 190mm
- Supply voltage – 36…60 V DC
- Current consumption at 48 V – 0,2 A
- Operating temperature range – minus 40… plus 85 °C
- Communication channels RS485 – 2
- Exchange rate – up to 115 kbit/s

DESIGHN SPECIFIC

- Connectors for external digital I / O circuits are located on the BFVI backplane
- Up to two VIO9 controllers can be placed on one BFVI backplane
- Cabinet can contain up to 16 VIO9 object controllers
- The maximum information capacity of the cabinet is 128 DC input signals and 128 DC output signals.

LET’S TALK!

TMH SMART SYSTEMS

ADDRESS

Moscow, 3rd Rybinskaya str. 18 bld.22

Business center «Burevestnik»

PHONE NUMBER

+7 (495) 899 0195

E-MAIL

info@tmhsmart.ru

- discover more about TMH Smart Systems