Number:

357RM1

Version:

230306

System / product:

MIREL RM1 Registration Speedometer

Title:

Operating Manual

Further source and enclosed files:

	File	Description	Pages / Connection
1			
2			
3	;		

The document form is based on template 2738M:201210

List of document version:

Version	Description	Compiled by	Validated by	Approved by
080626	Document introduction	Ing. Csáder	Ing. Horváth	Ing. Horváth
130219	Document updated based on technical conditions	Ing. Csáder	Ing. Šajben	Ing. Šajben
180411	Update of Identification unit usage	Ing. Csáder	Ing. Michalec	Ing. Michalec
181112	Update of Fault codes list	Ing. Csáder	Ing. Csáder	Ing. Michalec
190405	Update of Fault codes list	Ing. Michalec	Ing. Michalec	Ing. Michalec
230306	Addition of modification in BOXKOG structural design	Ing. Žilinec	Ing. Michalec	Ing. Michalec

Contents

1 Purpose of the document

Document specifies operating method and conditions concerning MIREL RM1 registration speedometer.

Document is intended for:

- Producer´s personnel trained and authorized to carry out diagnostics and service of MIREL RM1 registration speedometer
- Operator´s personnel trained and authorized to carry out operation or diagnostics and maintenance of MIREL RM1 registration speedometer and authorized by a responsible Operator´s representative for said activity
- Third Parties´ staff competent for DRV manufacturing and reconstruction trained for operation or diagnostics and maintenance of MIREL RM1 registration speedometer and authorized by a superior person for said activity

Document follows-up and refers to documentation below:

Related Documentation

No.		Version	Title
[A1]	297RM1	221011	MIREL RM1– Technical Conditions
[A2]	547MAP	221123	KAM User Manual

Follow-Up Documentation

No.		Version	Title
[B1]	278RM1	230306	MIREL RM1 Maintenance Manual, Diagnostics

Cited and Related Standards

No.		Version	Title and additional information
[C1]	EN 50155	2021	Railway Applications. Rolling stock. Electronic Equipment

2 Specification of Document Changes

Version 080626

Document rollout

Version 130219

Document update based on technical conditions in version 120806.

Addition of modification RM1.1.

Version 180411

Identification unit operation method update.

Version 181112

Error code list update.

Version 190405

Error code list update.

Version 230306

Document update based on actual template.

Addition of modification RM1.2 in BOXKOG structural design.

3 Applied Designations and Terminology

RM	Speedometer of driving rail vehicle, a device with primary function of speed measurement and its indication at locomotive cab
ZJ, base unit	Unit which provides for speed measurement and evaluation, data registration and controls communication with remaining devices
ID, identification unit	Unit serving for entry of locomotive driver ID and train number by locomotive driver
IN, indication unit	unit displaying all 3 evaluated speeds (actual, maximum and preset)
USB interface	Data transfer in numeric form via USB-type communication line
self-diagnostics	Technological procedure by which device automatically and periodically checks principal performance functionality of all speedometer constituents
actual speed	Actual vehicle speed, indicated in $km.h^{-1}$
maximum allowed speed	Speed which shall not be surpassed in a given moment by actual speed, (intervention option of train protection)
preset speed	Speed set by staff in ARR (automatic speed regulation) or as required by drive control system
registration module	Module in which data are stored, considered by valid legal and operating regulations for mandatory recording
identification dialogue	Entry procedure for identification data to device comprising: login prompting notice, entry of locomotive driver statistical ID, train number entry
Log-off dialogue	Engine driver log-off procedure from equipment, comprising: notice to log-off, log-off proper
DRV	Driving rail vehicle
USB	Universal serial interface
BOXKOG	Structural modular system

4 General Characteristics

The MIREL RM1 speed recorder is equipment specifically designed for use on railway locomotives in all forms of tractive power. The RM1 secures three basic functions: measurement of instantaneous speed, indication of instantaneous speed and additional information, registration of instantaneous speed and other operating and technical data in relation to a time and route-independent scale.

The MIREL RM1 speed recorder is composed of a central processing unit, two indicator devices and two identification devices located at the engineer's stations. The interconnection of individual equipment is via a data line with serial data transmission. Alternatively, the RM1 can be operated with only one indicator device or without one. The same applies for the identification devices.

Power for the MIREL RM1 speed recorder is connected to the locomotive's battery source. Configuration of the MIREL RM1 is dependent upon the voltage of the battery source. Service of the speed recorder is performed exclusively from the engineer's station via the identification devices and control elements on the locomotive's control panel. Functionality of the identification instrument may be integrated into the control unit of a cooperating system. No entry into the locomotive's mechanical room or into the central processing unit of the equipment is required to operate the MIREL RM1 speed recorder.

The MIREL RM1 speed recorder is an electronic digital system designed on the basis of the latest electrical components where each instrument is controlled by a separate processor. The components used in the central processing unit meet demanding criteria for reliability and robustness. The central processing unit contains a processor module, power supply, registration module, module for measuring frequency inputs and a module for galvanically isolated digital inputs and outputs. The registration module is designed on the basis of large capacity semiconductor memory chips that ensure the storage of data even if disconnected from the locomotive's battery source for an extended period of time. The indication equipment contains the actual pseudo-analogue indication instrument and a digital indicator of instantaneous speed. The identification equipment comprises a 32-character alphanumeric display and a 12-button keyboard.

The MIREL RM1 speed recorder performs regular self-diagnostics and enables the performance of functional tests to re-test the correct functionality of all control system components and locomotive equipment that works with it. The equipment is maintenance free apart from performing functional tests.

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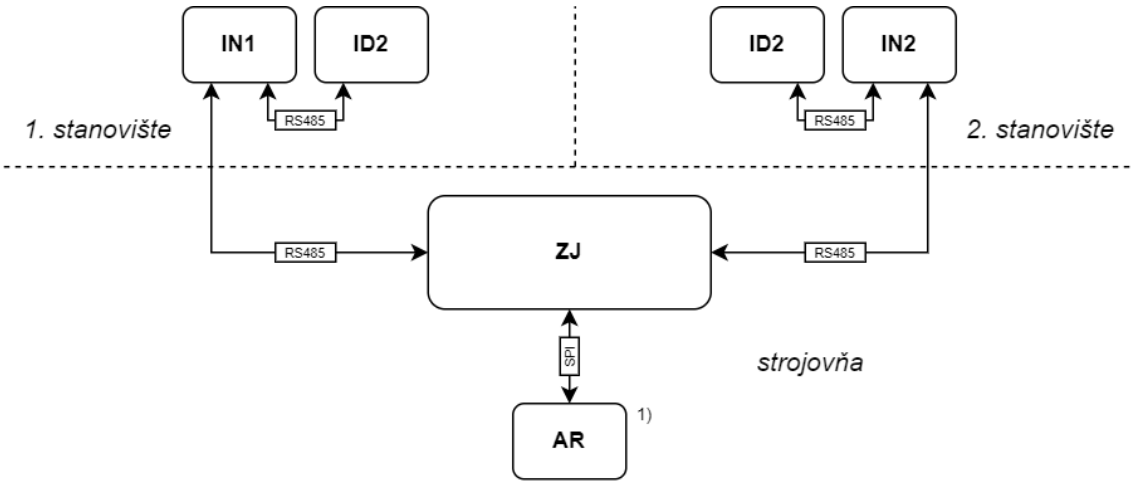
5 System Assembly

MIREL RM1 registration speedometer comprises, in a complete assembly, devices indicated below:

Device identifier	Description	Type	Count
ZJ	Base unit	RM1ZJ	1
AR [1)]	Archiving unit	RM1AR	max 1
IN – (IN1, IN2)	Indication unit	RM1IN	max 2
ID – (ID1, ID2)	Identification unit	RM1ID	max 2



1) In system version RM1.0 and RM1.1, archiving unit is part of RM1ZJ base unit. In system version RM1.2, the archiving unit represents a separate system component.

Minimum system configuration is comprised of RM1ZJ base unit.

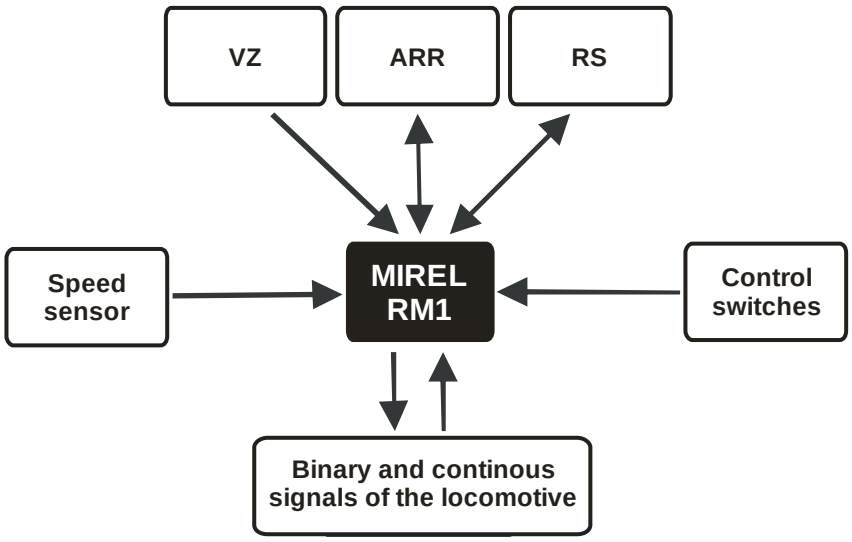
Mandatory interacting function units:

1) Incremental speed sensor 1x
2) control switches at driver cab 2x (alternatively 1x)
3) Train protection

Optional interacting function units:

1) ARR
2) control system

Block diagram of system wiring to driving rail vehicle:



6 Base Unit

The central processing unit secures all the operating functions of the MIREL RM1 speed recorder.

Namely:

1) Measurement and filtering of axle speed sensor
2) Calculating speed
3) Evaluating the distance travelled
4) Variables required for registration
5) Reading digital and analogue inputs
6) Controlling digital outputs
7) Communication with indication and identification units of engine driver cabs
8) Communication with connected interacting DRV devices
9) Self-diagnostics
10) Indication on the front panel

6.1 Base Unit Modifications

Base unit of MIREL RM1 registration speedometer is, in terms of the type of processor and registration module and the type of mechanical design, manufactured in following designs:

Device version	Mechanical design	Design description
RM1ZJ.0	BOX3U	Basic design
RM1ZJ.1	BOX3U	Design with extended processor- and registration module memory
RM1ZJ.2U	BOXKOG	Design with extended processor- and registration module memory

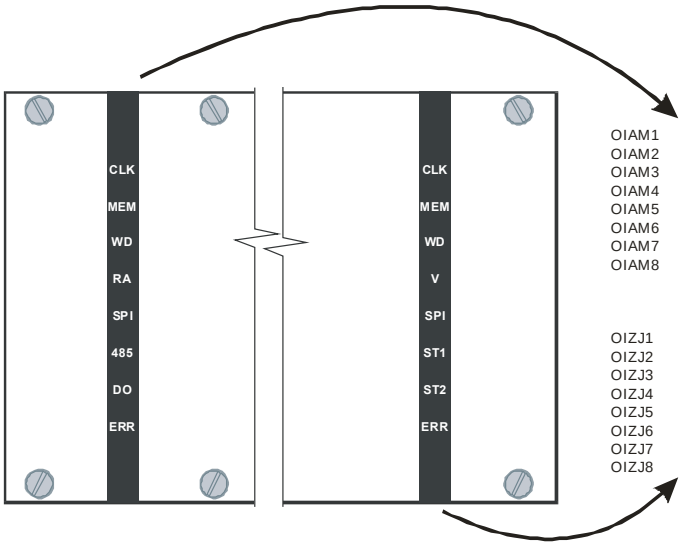
A more detailed description of various registration speedometer base unit designs can be found in Technical Conditions 297RM1.

On base unit´s front panel, eventually on front panels, there is a set of 16 indicating LEDs located. There aren´t any control elements on base unit and there aren´t required any operating staff actions on base unit. Base unit is powered from battery source of driving rail vehicle. The power supply is fused by the circuit breaker of the registration speedometer located within set of remaining DRV circuit breakers, or on a specific place depending on driving rail vehicle type. Remaining components of MIREL RM1 registration speedometer are powered via base unit.

Apart from indication elements, connector for reading out of registration module is located on front panel as well. Said connector differs depending on type of mechanical design of the base unit.

Device version	Mechanical design	Connector type
RM1ZJ.0 and RM1ZJ.1	BOX3U	15-pin DB-type connector
RM1ZJ.2U	BOXKOG	C3 connector (USB mini-A)

Indication elements located on base unit´s front panel:



OIAM1	CLK	Activity indicator of archive module
OIAM2	MEM	D1 self-diagnostics indicator of archive module
OIAM3	WD	D2 self-diagnostics indicator of archive module
OIAM4	RA	Activity indicator of juridical recorder unit
OIAM5	SPI	Indicator for SPI bus communication
OIAM6	485	Communication indicator on the line Rs485 of archive module
OIAM7	OD	Presence indicator of transmission module
OIAM8	ERR	Equipment fault of archive module

OIZJ1	CLK	Activity indicator of base unit
OIZJ2	MEM	D1 self-diagnostics indicator of base unit
OIZJ3	WD	D2 self-diagnostics indicator of base unit
OIZJ4	V	Indicator of non-zero speed measurments
OIZJ5	SPI	Indicator for SPI bus communication
OIZJ6	ST1	Indicator for communication with 1st cab
OIZJ7	ST2	Indicator for communication with 2st cab
OIZJ8	ERR	Equipment fault of system

6.2 Mechanical Design and Location

Structural design of base unit in BOX3U design is in width dimensions in accordance with EN 50155, i.e. principal width is 19”. Height dimension (in module U = 44,45 mm) is 3U. Base unit modules are embedded in an AL cabinet. There is a 72-pin DD-type industrial connector as well as a 25-pin DB type connector on rear panel.

Structural design of base unit in BOXKOG modular version has been designed to allow location of such devices in a standard subrack in accordance with standard EN 50155, i.e. identical one like base unit in BOX3U version.

The working position of the base unit is arbitrary. The location is inside driving rail vehicle, depending on its type. Under normal operating conditions and for servicing, it is necessary to provide access to the front panel of the base unit without dismantling it.

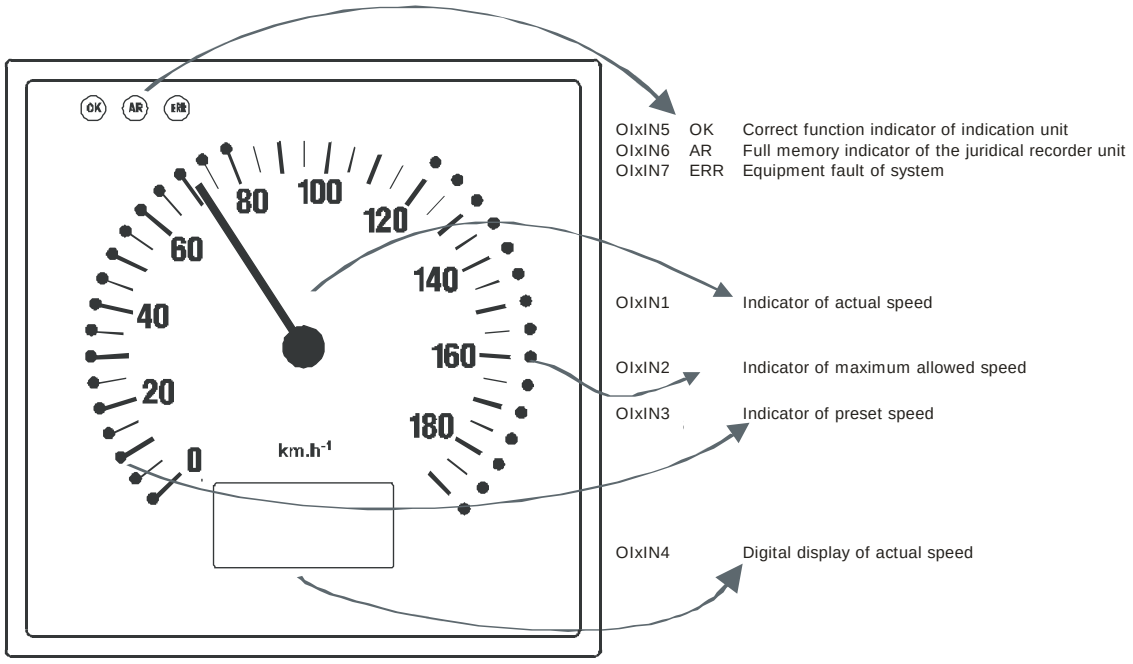
7 Indication Unit

Indication unit is a single-purpose, single-board computer, which indicates with help of a pseudo-analogue pointer indicator, digital numeric indicator, 2 light traces (red and green) and 3 indication LEDs at engine driver cab, items listed below:

1) Actual speed – pseudo-analogue pointer indicator, digital numerical indicator
2) Maximum allowed speed – red light trace
3) Pre-set speed – green light trace
4) Proper device performance – indication LED
5) Registration module full – indication LED
6) Device fault – indication LED

Indication unit display elements have permanent background illumination. Background brightness intensity is regulated with help of fitted illumination intensity sensor.

Wiring to base unit of MIREL RM1 registration speedometer occurs with help of quadruple-conductor cabling, which serves for communication between base- and indication unit.



7.1 Mechanical Design and Location

Structural design of indication unit is in a plastic cabined intended for fitting into a desk. Indication elements are located at front panel, a 7-pole terminal board on rear panel.

The working position of indication device is arbitrary, depending on driving rail vehicle design, taking into account the visibility of the indicating elements.

Digital indicator of driving rail vehicle speed indicated actual speed with a maximum preciseness of registration speedometer. The function of pseudo-analogue pointer indicator is to provide fast staff orientation when reading out actual speed.

8 Identification Unit

Identification unit RM1ID is a single-purpose, single-board computer, which serves for entry of engine driver, rolling stock and train identification data. Identification unit ensures a more detailed operating data indication with help of a 32-character alphanumeric display, which allows to display:

1) engine driver ID
2) train ID
3) train weight [1)]
4) operating mode [1)]
5) forwarder ID [1)]
6) actual speed
7) maximum allowed speed
8) preset speed
9) total distance covered
10) daily covered distance
11) percentual occupation of registration module
12) calendar date and time

Identification unit commands over a12-pushbutton keyboard allowing entry of data listed below:

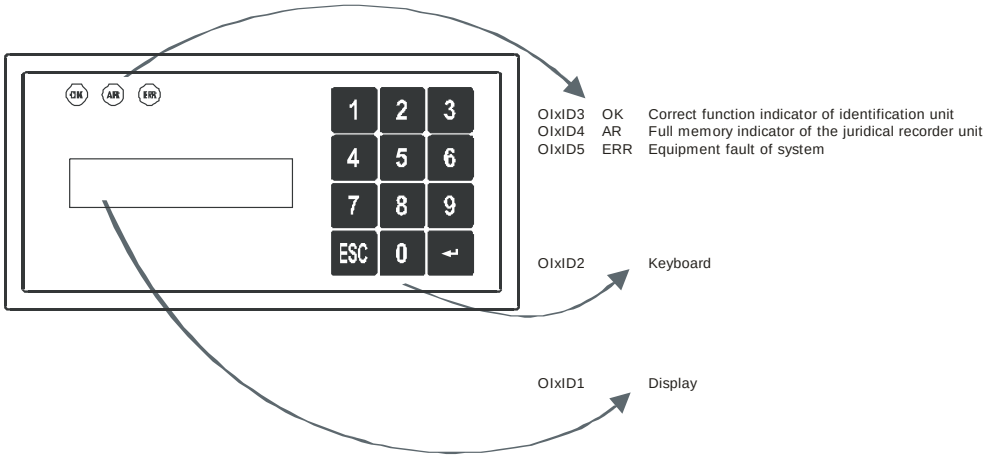
1) engine driver ID
2) train ID
3) train weight [1)]
4) forwarder ID [1)]
5) operation mode [1)]

Furthermore, identification unit indicates with help of 3 indication LEDs:

1) proper performance of indication unit
2) full status of registration module
3) device fault

[1)] in case of modifications with base unit version RM1ZJ.1 and RM1ZJ.2U

Identification unit display elements have permanent background illumination. Background brightness intensity is regulated with help of fitted illumination intensity sensor.



8.1 Mechanical Design and Location

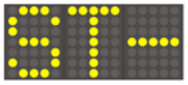
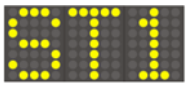
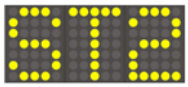
Structural design of identification unit is in a plastic cabined intended for fitting device into a desk. Indication elements and a keyboard are located on front panel. A 7-pole terminal board is located at rear side. The working position of indication device is arbitrary, depending on driving rail vehicle design, taking into account the visibility of the indicating elements and keyboard access.

9 Putting into Operation and Operation Termination

9.1 Putting into Operation

Registration speedometer MIREL RM1 is put into operation by switching on battery source of driving rail vehicle. There aren´t any other actions required to put unit into operation. Upon powering, registration speedometer accomplishes a one-time self-diagnostic test, during which the device is already operation-ready. Registration speedometer setting is enabled only from cab with active locomotive control.

Indication and identification unit indicated operation data at active locomotive cab. Active cab is indicated as shown below:

Control status	Active cab indication
control OFF at all cabs	
control on at cab No. 1	
control on at cab No.2	

Speed recorder functionality is signalled as follows once start up is complete:

1) The identification unit at the active station displays the operator login prompt
2) The numeric display on the indication unit at the active station displays the speed of the locomotive while the coloured signals indicate the maximum and pre-set speed
3) The dial indicator on the indication unit at the active station begins to indicate the instantaneous speed of the locomotive 10 seconds after being switched on
4) The identification unit at the inactive station displays "STx" where x stands for the number of the active station
5) Central processing unit indicator OIZJ1 flashes at a frequency of 1 Hz,
6) Central processing unit indicator OIZJ2 is lit constantly
7) Central processing unit indicator OIZJ3 is lit constantly,

The speed recorder is placed into undefined operator mode when switched on, which is indicated on the red signal with a maximum speed of 40 $km.h^{-1}$.

9.2 Termination of Operation

Upon termination of operation, switching off the device is achieved by switching off the battery source of driving rail vehicle. There aren´t any other actions required to terminate the device operation.

10 Identification Unit Keyboard Functions

10.1 Modifications with RM1ZJ.0

Keyboard pushbutton functions in „Identification“ mode:

Button	Function
0	entry of digit ‚0‘ when completing identification dialogue
1	entry of digit ‚1‘ when completing identification dialogue
2	entry of digit ‚2‘ when completing identification dialogue
3	entry of digit ‚3‘ when completing identification dialogue
4	entry of digit ‚4‘ when completing identification dialogue
5	entry of digit ‚5‘ when completing identification dialogue
6	entry of digit ‚6‘ when completing identification dialogue
7	entry of digit ‚7‘ when completing identification dialogue
8	entry of digit ‚7‘ when completing identification dialogue
9	entry of digit ‚9‘ when completing identification dialogue
↵	proceeding to the next step of identification dialogue
ESC	deleting of actually entered number

Keyboard pushbutton functions in „Operation“ mode:

Button	Function
0	display of date and time
1	display of rolling stock actual speed
2	display of preset rolling stock speed
3	display of maximum rolling stock speed
4	display of counter with covered distance in km
5	display of entered staff number
6	display of entered train number
7	memory full status of the registration module
8	unused
9	unused
↵	Cyclical switching of displayed data / confirmation of log-off dialogue
ESC	log-off dialogue triggering

10.3 Modifications with RM1ZJ.1 and RM1ZJ.2U

Keyboard pushbutton functions in „Identification“ mode:

Button	Function
0	entry of digit ‚0‘ when completing identification dialogue
1	entry of digit ‚1‘ when completing identification dialogue
2	entry of digit ‚2‘ when completing identification dialogue
3	entry of digit ‚3‘ when completing identification dialogue
4	entry of digit ‚4‘ when completing identification dialogue
5	entry of digit ‚5‘ when completing identification dialogue
6	entry of digit ‚6‘ when completing identification dialogue
7	entry of digit ‚7‘ when completing identification dialogue
8	entry of digit ‚7‘ when completing identification dialogue
9	entry of digit ‚9‘ when completing identification dialogue
↵	proceeding to the next step of identification dialogue
ESC	deleting of actually entered number

Keyboard pushbutton functions in „Operation“ mode:

Button	Function
0	display of date and time
1	display and adjustment of engine driver ID
2	display and adjustment of train ID
3	display and adjustment of train weight
4	display and adjustment of forwarder ID
5	display and adjustment of operation mode
6	unused
7	display of rolling stock actual speed display of preset rolling stock speed display of maximum rolling stock speed
8	display of counter with covered total distance display of counter with covered daily distance
9	memory full status of the registration module unused
↵	CONFIRM
ESC	log-off dialogue triggering

11 Operation Mode Setting

Registration speedometer MIREL RM1 can operate in two operation modes, namely:

1) **Identification** mode – staff logged off
2) **Operation** mode – staff logged in

Switching from “Identification” mode to “Operation” mode is achieved by locomotive driver by completing identification dialogue Switching from “Operation” mode to ”Identification” mode is achieved by locomotive driver by completing log-off dialogue in identification unit. Mode change is possible only with a motionless driving rail vehicle.

11.1 Operating Staff Login

Staff login takes place in „Identification“ operation mode and is carried out by completing login dialogue of MIREL RM1 registration speedometer identification unit.

Login dialogue control

Action	Button
Move to the next data entry	CONFIRM (↵)
Deleting of actually entered data	ESC

If staff during completion of login dialogue fails to operate any button within 10 seconds time, login dialogue closes and device remains in mode with staff logged-off.

11.1.1 Modifications with RM1ZJ.0

In case of modifications with RM1ZJ.0 base unit version, following data must be entered in order to complete login dialogue:

1) Locomotive driver ID (eight characters maximum)
2) Train number (eight characters maximum)

If staff during completion of login dialogue fails to operate any button within 10 seconds time, login dialogue closes and device remains in mode with staff logged-off.

Upon accomplished login dialogue completing, display of identification unit at active cab shows date and time, red trace on indication unit of active cab starts to indicate maximum speed based on train protection or DRV maximum design speed.

Further data are entered upon login into „OPERATION“ mode.

11.1.2 Modifications with RM1ZJ.1 and RM1ZJ.2U

In case of modifications with RM1ZJ.1 and RM1ZJ.2U base unit versions, following data must be entered in order to complete login dialogue:

1) Locomotive driver ID (ten characters maximum)

Upon accomplished login dialogue completing, display of identification unit at active cab shows date and time, red trace on indication unit of active cab starts to indicate maximum speed based on train protection or DRV maximum design speed.

Further data are entered upon login into „OPERATION“ mode.

11.2 Data Change in Operation Mode

Following data can be modified in „Operation“ mode:

1) train ID (maximum length depending on modification eight / ten characters)
2) train weight (four characters maximum)
3) forwarder ID (four characters maximum)
4) mode of operation (TRAIN, HELPER, PUSHING, SHUNTING, FAILURE, SERVICE)

Data change control in mode „Operation“

Action	Button
Switch between entered data	TL1 through TL5
Selection confirmation for data to be confirmed	CONFIRM (↵)
Data modification	Numeric buttons TL0 through TL9
Deleting of actually entered data	ESC
Saving of modified data	CONFIRM (↵)
Return to default date and time display	TL0

Procedure for data change in „Operation“ mode:

1) selection of data to be modified by staff
2) confirmation of selection
3) data modification
4) saving of modified data
5) return to default date and time display

11.3 Operating Staff Log-Off

Log-off is carried out by completing log-off dialogue.

Staff log-off procedure:

1) log-off dialogue triggering by ESC button
2) log-off confirmation by CONFIRM button

For modifications with RM1ZJ.0, if operating staff fails to confirm log-off dialogue within 10 seconds time, log-off dialogue shall close and device remains in mode „Operation“.

11.4 Change of Data Indicated by Identification Unit

11.4.1 Modifications with RM1ZJ.0

Display setting of other data (actual speed, maximum speed, date, time, etc.) in mode „Operation“ is enabled by gradual operating of CONFIRM button or by direct selection by means of buttons 0 through 7.

11.4.2 Modifications with RM1ZJ.1 and RM1ZJ.2U

Display setting of other data (actual speed, maximum speed, date, time, etc.) in mode „Operation“ is enabled by direct operating of buttons TL7, TL8, TL9 and TL0.

Daily covered distance can be zeroed by keeping button TL8 pressed for a time of at least 2s.

12 Overview of Operating Functions in the Individual Modes

Mode	Identification	Operation
Indication of instantaneous speed on the OIxIN1 gauge	Yes	Yes
Indication of instantaneous speed on the OIxIN4 numeric indicator	Yes	Yes
Indication of maximum permitted speed - red signal OIxIN2	permanent indication of 40 $km.h^{-1}$ maximum speed	Yes
Indication of pre-set speed – green signal OIxIN3	Yes	Yes
Indication of instantaneous speed on the OIxID1 display of the identification unit	no	Yes
Indication of maximum speed on the OIx-ID1 display of the identification unit	no	Yes
Indication of pre-set speed on the OIxID1 display of the identification unit	no	Yes
Indication of date and time on the OIxID1 display of the identification unit	no	Yes
Indication of distance travelled on the OIxID1 display of the identification unit	no	Yes
Indication of the engineer's identification number on the OIxID1 display of the identification unit	no	Yes
Indication of the train number on the OIx-ID1 display of the identification unit	no	Yes
Identification dialogue	Yes	no
Logout dialogue	no	Yes
Registration of recorded data	Full range	Full range

13 Registration Archive Memory Full Indication

Current status of operation archive memory occupation is displayed by identification unit in mode „Operation“ by pressing the button:

1) TL7 for modifications with RM1ZJ.0
2) TL9 for modifications with RM1ZJ.1 and RM1ZJ.2U

The value is presented in %. A value of 0 % means that the entire memory of the recording registration unit is full and is ready to record. A value of 100 % means that the recording registration unit is completely full. This value is set to 0 % after reading data from the speed recorder and unlocking the memory.

The IOxID4 indicator on the indication unit and IOxIN6 indicator on the identification unit flash when recording registration capacity is filled to a level of 75 % or higher in order to alert the operator of such condition. The equipment remains fully functional in this instance.

The IOxID4 indicator on the indication unit and IOxIN6 indicator on the identification unit are constantly on when recording registration capacity is filled to a level of around 98 % in order to alert the operator of such condition. The text "ArP" will flash on the digital indicators of the indication unit. The equipment in this instance is not functional and cannot be operated. Data is not stored in the recording registration unit. Instantaneous, pre-set and maximum speed indication on the indication unit remains functional. This value is set to 0 % after reading data from the speed recorder and unlocking the memory and the equipment is once again fully functional.

14 Data Transfer from Registration Speedometer

Data transfer from MIREL RM1 registration speedometer is carried out by means of:

System version	Transfer module
modifications with RM1ZJ.0	ATM.3 or ATM.4
modifications with RM1ZJ.1	ATM.5 cable
modifications with RM1ZJ.2U	USB A B5mini cable

For reasons of simplicity we shall thereinafter use a common designation – transfer module. Transfer module forms a part of MIREL ARKTUR evaluation and registration workplace.

For read-out it is necessary to connect transfer module to respective connector at front panel of registration speedometer base unit. Establishing communication is signalled as follows:

1) Indicator of IOAM7 registration module base unit lights – text „OD“
2) LINK indicator of ATM transfer module lights – text „LINK“ (neither cable ATM.5.A nor standard USB A on B5mini have indication)

Transfer module must be connected to speedometer within 15 s upon speedometer powering, when speedometer accepts its connection. Upon expiry of said time registration speedometer ignores the transfer module connection and speedometer remains in normal operation.

During data transfer from speedometer to evaluation computer, screen displays actual read-out progress. Successful transfer accomplishment is signalled by an audible signal and subsequent symbol  .

Upon data transfer accomplishment transfer module gets disconnected from connector at base unit front panel. Registration speedometer must be re-started in order to achieve normal operation. If the evaluation workplace has been configured for speedometer archive unlocking, speedometer registration archive memory is set free for further entry.

Depending on evaluation computer configuration, time and date are automatically set in registration speedometer via transfer module. Switch to summer and winter time is set as well.

In a case of emergency, when it is not possible to use a.m. data transfer method, or stored data must be secured with no delay (e.g. after an accident), registration module can be physically detached from registration speedometer and subsequently read-out into MIREL ARKTUR evaluation system outside of driving rail vehicle.

For modifications with RM1ZJ.0 and RM1ZJ.1 it is required to:

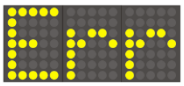
1) break the protective seal
2) loosen 4 M4 screws at registration module front panel

Furthermore, for all modifications it is necessary to:

3) pull out module and release its connector at registration module rear side

More detailed information concerning data transfer procedure from MIREL RM1 registration speedometer to MIREL ARKTUR evaluation workplace and their evaluation and registration method are available in operating manual of evaluation workplace.

15 Fault Signalling



Speed recorder faults are divided into two groups. Specifically these groups are faults that prevent subsequent use of the speed recorder and faults that restrict subsequent use of the speed recorder.

In the case of a **fault that prevents subsequent use of the speed recorder,** the equipment on the front panel on the indication unit and on the identification unit indicates a fault (ERR). In the case of any such fault, the operator should first switch off the breaker for the speed recorder for at least 1 second and then switch the breaker back on in order to re-initialize the speed recorder. A serious fault will not be cleared in this manner and the error message will be displayed again.

A numbered code indicating the fault in the equipment is displayed on the identification unit in order to more clearly define the exact reason for the fault in the equipment.

Faults that prevent subsequent use of the speed recorder:

E00	Permanent loss of communication between the central processing unit and the indication unit or identification unit
E01	Watchdog failure
E02	Program integrity failure (FLASH and EEPROM memory integrity)
E04	Communication error between central processing unit and indication unit at the 1st station
E05	Communication error between central processing unit and indication unit at the 1st station
E06	Communication error between central processing unit and identification unit at the 1st station
E07	Communication error between central processing unit and identification unit at the 1st station
E08	General failure of active indication unit ■ Watchdog failure ■ Program integrity fault (FLASH and EEPROM memory integrity) ■ Indication unit communication fault ■ Fault in integrity of configuration parameters
E09	General failure of active identification unit ■ Watchdog failure ■ Program integrity failure (FLASH and EEPROM memory integrity) ■ Identification unit communication fault
E10	Combined module error in BBC at position A ■ Start-up error of watchdog circuits ■ Program integrity error (FLASH and EEPROM memory integrity) ■ Integrity error of configuration parameters ■ Communication error between module and central unit Error of communication with control system on CAN bus
E11	Combined module error in BBC at position B ■ Start-up error of watchdog circuits ■ Program integrity error (FLASH and EEPROM memory integrity) ■ Integrity error of configuration parameters ■ Communication error between module and central unit Error of communication with control system on CAN bus
E12	Communication error between central unit and BBC-A gateway
E13	Communication error between central unit and BBC-B gateway
E20	Speed measurement fault
E21	Fault in assessment of actual direction of travel
E22	Power fault in incremental rotation sensor

E23	Power fault in analogue input
E24	Sensor fault, analogue input 1
E25	Sensor fault, analogue input 2
E33	Fault in integrity of configuration parameters
E34	Communication fault in SPI link
E40	Incorrect date fault in registration module
E41	Combined module error in EXIO / BBC cooperating device at position A ■ Start-up error of watchdog circuits ■ Program integrity error (FLASH and EEPROM memory integrity) ■ Integrity error of configuration parameters ■ Error of communication with control system on CAN bus Error of communication with diesel oil consumption system
E42	Combined module error in EXIO cooperating device at position B ■ Start-up error of watchdog circuits ■ Program integrity error (FLASH and EEPROM memory integrity) ■ Integrity error of configuration parameters Error of module communication with module on EXIO-A position
E43	Combined module error in EXIO cooperating device at position C ■ Start-up error of watchdog circuits ■ Program integrity error (FLASH and EEPROM memory integrity) ■ Integrity error of configuration parameters Error of module communication with module on EXIO-A position
E44	Combined module error in EXIO cooperating device at position D ■ Start-up error of watchdog circuits ■ Program integrity error (FLASH and EEPROM memory integrity) ■ Integrity error of configuration parameters Error of module communication with module on EXIO-A position
E45	Error of communication between registration module with cooperating device
E50	Watchdog fault in the registration module
E51	Communication parameters integrity error of registration module
E52	Error of initialization or entry on SD-card of the registration module
E53	Real-time circuit error of the registration module

In the case of a **fault that restricts subsequent use of the speed recorder** there is no indication on the front panel of the central processing unit or on the indication and identification units at the active station. Such faults involve the indication and identification units at the inactive station. These faults restrict the activity of the speed recorder at the station at which the indication and identification units are operating correctly.

Faults restricting the subsequent use of the speed recorder are indicated on the indication or identification units of the inactive station:

E00	General fault in the indication or identification unit ■ Watchdog fault in the indication or identification unit ■ Memory fault in the indication or identification unit ■ Permanent loss of communication between the central processing unit and the indication unit or identification unit ■ Communication fault involving the indication or identification unit

16 Notes