

Ingeteam

INGESYS™ RCM Data Logger

Product Overview



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Introduction

1 Introduction

INGESYS™ RCM is a remote condition monitoring solution that allows you to capture and log operational data on the various elements of a train for subsequent analysis in a remote, Cloud-based control centre using advanced monitoring and analysis tools.

It is designed to improve the preventive maintenance of assets on a train with the aim of increasing their availability and reducing operational costs.

Advantages include:

- A wide range of communication protocols for data acquisition and transmission using wired or wireless interfaces
- Collect physically connected signals
- Powerful monitoring and analysis tool based on latest technologies
- System adapted to the requirements of the railway sector
- Optimum cost solution

INGESYS™ RCM Data Logger is an electronic device that records data over time or in relation to location from physical input signals or from communication buses in the train

Easy integration in control networks is possible thanks to its wide range of communication interfaces, for integration in LAN networks via ETHERNET with protocols as MODBUS TCP/IP, ETHERNET IP/CIP, TRDP, in fieldbuses like CAN, MVB, RS485 and 3G, 4G , WIFI Networks.

INGESYS™ RCM Data Logger is compliant with the standard EN50155 for rolling stock systems in the railway sector.

Data Logger Functionality

2 Data Logger Functionality

INGESYS™ RCM Data Logger is a modular recorder system that can be adapted to each application thanks to its modular hardware structure.

Data and event recording from different data sources of information is allowed:

- Digital and analogue variables
- Temperature sensors (PT100, NTC)
- Counters for speed measurement
- Accelerometers
- Positioning (GPS)
- RS232 / RS485 serial interfaces
- Ethernet networks with TCP/IP/UDP, MODBUS TCP/IP protocols
- Field Buses: MVB, CAN, Modbus RTU, Ethernet IP

INGESYS™ RCM Data Logger is a programmable system allowing the user to optimize system behavior regarding signal processing and data traffic.

Registered information can be uploaded to central processing centers through GSM (3G/4G) and Wi-Fi communication links using standards FTP (Client /Server) or sFTP (Client) protocols.

2.1 Main functionalities

2.1.1 Data Logger

Two simultaneous record sessions (each session can have different signals or the same) are available. A recorder session can be continuous (every sample is recorded) or Trigger based (the data is captured with a configurable pre and post history around the trigger condition).

Main characteristics:

- Number of simultaneous record sessions: 2
- Amount of global signals per record: 512
- Up to 7 Environment Categories
- Number of signals per Environment Category: up to 512 (each environment variable counts as a signal inside the register)
- Recording of the pre and post history: Possible in each record (triggered session)
- Triggering of the recording: Event-driven (each event can be programmable by the user or it can be a signal of the equipment)
- Max number of recordable variables: 2048
- Recording of the data: 10MB per session (ring buffer)
- Recording of files memory: Up to 4GB (once the memory is full, the older recorder is deleted)

2.1.2 Event Logger

Up to 255 events can be recorded in a persistent memory with information of variables associated to the event:

- Description
- Number of times an event occurred
- Current status
- Event history
- Last time an event was activated
- Last time an event was deactivated

2.1.3 Programmability

The **INGESYS™ RCM Data Logger** is programmable by the user, based on this programmability the user can generate new variables (for recording) based on real variables, transform variables, design the logic related to events, etc.

Available programming tools:

- IEC 61131-3 with Codesys Tool
- “C/C++” language

2.1.4 Configuration / Visualization

INGESYS™ RCM Data Logger provides a Web Interface for configuration and visualization tasks. This web interface allows:

- Service optimization enabling a remote access
- System configuration and operation
- Data visualization and analysis

Hardware Description

3 Hardware Description

Main components of **INGESYS™ RCM Data Logger** are described in following sections.

3.1 Power Supply

Main characteristics:

Power Supply	
Electrical	
Power Supply Voltage	24Vdc (-30%/+25%) Class S1 (EN50155:2007)
Maximum Power Supply Consumption	24V@300mA
Typical Power Supply Consumption	24V@150mA
Dissipated Power	8W (max.)
Connector type	6-pin male (Connector: X10)

Tbl 1. Power Supply. 24Vdc Technical Data.

Connector pinout is as follows:

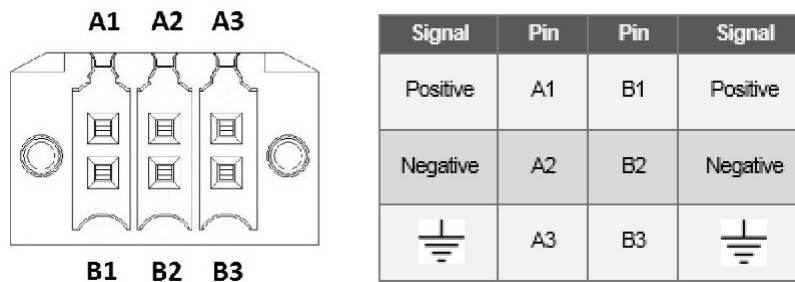


Fig 1. Power supply connector.

Note:

(A1-B1), (A2- B2), (A3- B3) internally tied.

3.2 Processor module

Main characteristics:

Technical Data	
Functional	
Main Processor	32bit processor 400MHz
Communication ports	2 x 10/100-Base-TX (Internal Switch) ETHERNET ports
Communication ports connectors	M12 connector
USB interface	1USB 2.0 Type A
Positioning	GPS
Storage Memory	
Internal	32Mbyte Optional: 1, 2, 4 Gbyte

Tbl 2. Processor module technical data.

Status leds:

LED	INDICATION	LED COLOUR
Power	Controller powered	Red
	Controller no powered	OFF
ON	Controller ON	Green
	Controller without FW	Green Blinking (T=3')
OK	Controller OK	Green
	No User Application	OFF
OKIO	Inputs / Outputs OK	Green
	Inputs / Outputs Error	OFF
RUN	Controller Running	Green Blinking
	Controller Stopped	OFF
BUSY	Controller Busy (Firmware Updating)	Blue

Tbl 3. Processor module status leds.

3.3 Communication interfaces

INGESYS™ RCM Data Logger offers a wide range of communication interfaces and protocols. Following interface modules can be integrated in an **INGESYS™ RCM Data Logger** for its integration in the train:

Type	Interface Module
Fieldbuses	CAN, MVB
Ethernet	10/100 Mbit/s. Protocols: MODBUS TCP/IP, ETHERNET IP/CIP, TRDP
Serial	RS232/485. Protocols: MODBUS RTU, Transparent protocol
Wireless	GSM, WLAN

Tbl 4. INGESYS™ RCM Data Logger interface modules.

3.3.1 Fieldbuses interfaces

INGESYS™ RCM Data Logger can be integrated in CAN and MVB fieldbuses.

3.3.1.1 CAN interface module

Enables the **INGESYS™ RCM Data Logger** to behave as a CAN Sniffer capable of reading data traffic on the CAN bus.

Main characteristics:

Communications	
Communication Protocol	CANopen
Number of channels	1
Connection type	9-pin D-sub male
Physical medium	Copper
Maximum Transmission speed	Up to 1Mbit/s (Cable length dependent)
Functionality	Sniffer

Tbl 5. CAN cable interface module characteristics.

Connectors pinout is as follows:

	CAN
1	
2	CANL
3	GND
4	
5	⏏
6	
7	CANH
8	
9	

Fig 2. CAN cable interface connector pinout.

3.3.1.2 MVB interface module

Enables the **INGESYS™ RCM Data Logger** to behave as a MVB Sniffer capable of reading up to 4096 ports on the MVB bus.

Main characteristics:

Communications	
Communication Protocol	MVB
Number of channels	2
Connection type	1 x 9-pin D-sub Female (Connector X20) 1 x 9-pin D-sub Male (Connector X22)
Physical medium	EMD
Maximum Transmission speed	1,5Mbit/s
Functionality	Sniffer

Tbl 6. MVB EMD SNFR interface module characteristics.

Connectors pinout is as follows:

Pin	Signal
1	A.Data_P
2	A.Data_N
3	-
4	B.Data_P
5	B.Data_N
6	A.Term_P
7	A.Term_N
8	B.Term_P
9	B.Term_N

Fig 3. MVB EMD interface module connector pinout.

3.3.2 SERIAL interfaces

INGESYS™ RCM Data Logger can be integrated in RS232/RS485 communications links, collecting and filtering communication data.

Main characteristics:

Communications	
Protocols	MODBUS RTU, Transparent protocol
Number of ports	1
Connection type	9-pin D-sub Female
Physical medium	Copper
Maximum Transmission speed	RS232 Up to 64Kbit/s cable length dependent RS485 Up to 500Kbit/s cable length dependent
Signals/Diagnosis	Yes

Tbl 7. RS232/RS485 characteristics.

Connectors pinout is as follows:

	RS232	RS485 Full Duplex	RS485 Half Duplex
1		Tx+	Tx+ / Rx+
2	RXD		
3	TXD		
4		Rx+	
5	GND	GND	GND
6		Tx-	Tx- / Rx-
7			R_Term*
8		Rx-	
9			R_Term*

Fig 4. RS232/485 connector pinout.

Note:

(*) indicates pins for bus end resistor

3.3.3 ETHERNET interfaces

INGESYS™ RCM Data Logger can be integrated in ETHERNET communications links, collecting and filtering communication data.

Main characteristics:

Communications	
Functional	
Communication Protocol	MODBUS TCP/IP, ETHERNET IP/CIP, TRDP
Number of ports	2 x 10/100-Base-TX (Internal Switch) ETHERNET ports
Connection type	M12, 4 pin D-code (Connector X12 , X13)
Physical medium	Copper
Maximum Transmission speed	100 Mbit/s

Tbl 8. ETHERNET characteristics.

Connectors pinout is as follows:

	M12
1	Tx+
2	Rx+
3	Tx-
4	Rx-

Fig 5. ETHERNET Connector.

Status LEDs.

LED	INDICATION	LED COLOUR
Link status	Inactive Link	Green
	No Link	OFF
	Active Link	Green Blinking
Link Speed	100Mbits/s speed	Orange
	10Mbits/s speed	OFF

Tbl 9. ETHERNET status LEDs.

3.3.4 WIRELESS interfaces

INGESYS™ RCM Data Logger can be integrated in WLAN and GSM fieldbuses.

3.3.4.1 GSM interface module

INGESYS™ RCM Data Logger can be integrated via GSM communications links to centralized Analysis and Monitoring systems.

Main characteristics:

Communications	
Functional	
Standards	UMTS/HSPA+ (3G) GSM/EDGE (2G)
Frequencies	UMTS: 800/ 850/ 900/ 1900/ 2100MHz GSM/EDGE: 850/ 900/1800/ 1900MHz
Sensitivity	UMTS: -110dBm GSM850/EGSM900: -108.5dBm DCS1800/PCS1900: -108dBm
Antenna connector	SMA female (Connector: X21)
SIM Card format	MicroSIM

Tbl 10. GSM characteristics.

3.3.4.2 WLAN interface module

INGESYS™ RCM Data Logger can be integrated via WLAN communications links to centralized Analysis and Monitoring systems.

Main characteristics:

Communications	
Functional	
Standards	Dual-band Wi-Fi (802.11 a/b/g/n)
Working mode	Client mode AP mode
Frequency Band	2.412 - 2.484 GHz (20Mhz channels) 5.180 - 5.845 GHz (20 and 40Mhz channels)
Supported Data Rates	802.11abg data rates up to 54 Mbps 802.11n data rates up to MCS7
Modulation	OFDM with BPSK, QPSK, 16-QAM, 64-QAM IEEE 801.11b with CCK and DSSS
802.11 MAC Features	WEP, WPA, WPA2, WMM, WMM-PS (UAPSD), WMM-SA, AES, TKIP, CKIP
Antenna connector	SMA female (Connector: X23)

Tbl 11. WLAN characteristics.

3.4 Input /Output's modules

Following Input/Outputs modules can be integrated in an **INGESYS™ RCM Data Logger**:

Signal Type	I/O Module
Digital Modules	16 x 24Vdc digital inputs module
	8 x 24Vdc digital inputs + 8 x 24Vdc digital outputs module
Analog Modules	8 x V/I analog inputs module
	4 x IEPE inputs + 4 x fast analog inputs module
	6 x IEPE inputs + 2 x fast analog inputs module
	4 x IEPE inputs + 1 x encoder input + 2 analog inputs module
	Temperature inputs modules Options: PT100 (2-wires), PT100 (3-wires) ,NTC, TC

Tbl 12. INGESYS™ RCM Data Logger modules.

3.4.1 Digital modules

3.4.1.1 16 Digital Input module

Digital input module with 16 x 24Vdc inputs with common reference.

Main characteristics:

Digital Inputs	
Functional	
Number of inputs	16
Connection mode	One common return
Input polarity	Positive (type PNP)
Input delay time	0.5ms (max.)
Electrical	
Input to system isolation	2500Vdc, 60s
Isolation between inputs	No
Nominal voltage	24Vdc
Low level	0V to 11V
High level	16,8V to 30V
Input current	3mA (typ.) @ 24V

Tbl 13. Digital Inputs. Technical Data.

Connector and pinout is as follows:

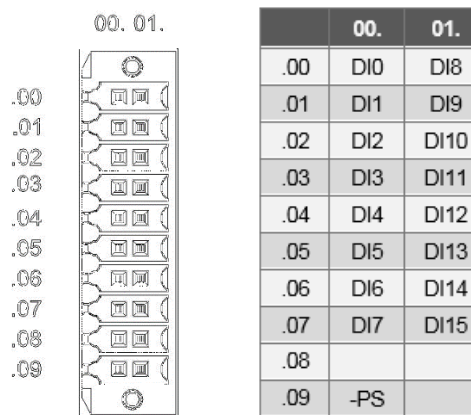


Fig 6. Digital Input connector and pinout.

Indication LEDs:

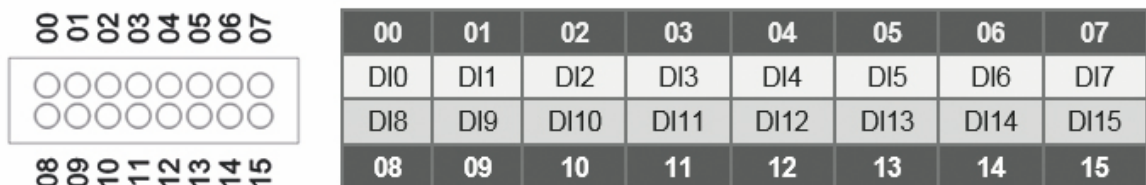


Fig 7. Module indication LEDs.

3.4.1.2 8 Digital Input + 8 Digital Output mixed module

Mix digital inputs / outputs module with 8 x 24Vdc inputs with common reference and 8 x 24Vdc outputs with common reference.

Main characteristics:

Digital Inputs	
Functional	
Number of inputs	8
Connection mode	One common return
Input polarity	Positive
Input delay time	0.5ms (max.)
Electrical	
Input to system isolation	2500Vdc, 60s
Isolation between inputs	No
Nominal voltage	24Vdc
Low level	0V to 11V
High level	16,8V to 30V
Input current	3mA (typ.) @ 24V

Tbl 14. Digital Inputs. Technical Data.

Digital Outputs	
Functional	
Number of outputs	8
Connection mode	Common high side drive
Output delay time	0.5ms (max.) (resistive load)
Operating rate	1Khz (max.) (resistive load)
Electrical	
Output technology	Solid state relay (SSR)
Isolation output to system	2500Vdc, 60s
Isolation between outputs	No
Aux. supply voltage	24Vdc (rated) 16,8Vdc (min.), 30Vdc (max.)
Aux. supply current	Sum of all output currents plus 15mA
Max. current per output	500mA
Max. short circuit current per output	1.7A, limited by SSR protection

Tbl 15. Digital Outputs. Technical Data.

Connector and pinout is as follows:

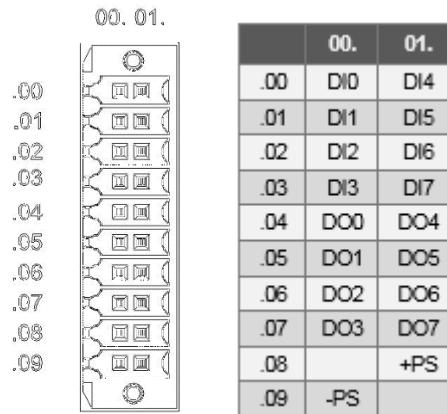


Fig 8. Digital Inputs / Outputs connector and pinout.

Indication LEDs:

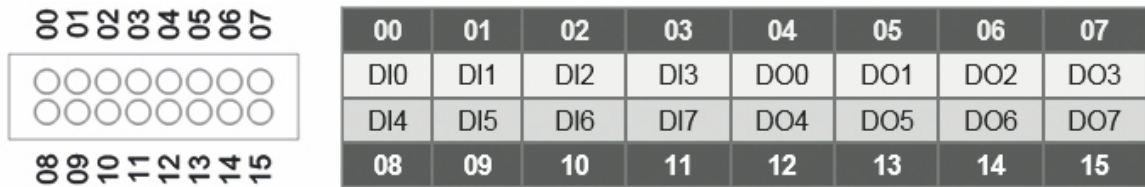


Fig 9. Module indication LEDs.

3.4.2 Analog modules

3.4.2.1 8 Analog Input module

Analog input module with 8 V/I analog inputs.

Main characteristics:

Analog Inputs	
Functional	
Number of inputs	8
Connection mode	Common GND reference
Input signal	Voltage / Current
Measurement ranges	+/- 10V, +/- 5V, +/- 1V, 0 to 10V, 0 to 5V +/- 20mA, 0 to 20mA, + 4mA to 20mA
Refresh time	0,56ms
A/D converter	13 bits
Electrical	
Break down current in current mode	+/- 35mA
Break down voltage	+/- 15V
Isolation input to system	1500Vac, 60s
Isolation between inputs	No
Input impedance, voltage mode	>33Kohm
Input impedance, current mode	440ohm (min.), 460ohm (max.)

Tbl 16. Analog Inputs. Technical Data.

Connector and pinout is as follows:

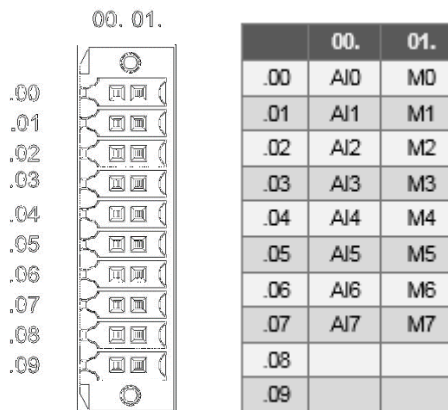


Fig 10. Analog Input connector and pinout.

3.4.2.2 4IEPE + 4 Fast Analog Input module

Mix analog input module with 4 IEPE accelerometer input signals and 4 high speed V/I analog inputs with common reference.

Main characteristics:

IEPE Inputs	
Functional	
Number of inputs	4
IEPE sensor	+/-5V , +/-1V
Input connection	Single ended
Sampling rate	Up to 100Ks/sec
Input resolution	Up to 16bits
Electrical	
Isolation	
Front connector to system connector	1500Vdc 1min
Front connector to earth	1500Vdc 1min
Max Input voltage	+/- 15V from any AI(+/-) input to M point
Input Impedance	
Voltage mode	>500Kohm
Current mode	440ohm (typ.)
Aux. supply voltage	24Vdc +/- 10%
Aux. supply current	130mA (max.) / 80mA (typ.) @ 24Vdc

Tbl 17. IEPE Inputs. Technical Data.

Analog Inputs	
Functional	
Number of inputs	4
Connection mode	Common GND reference
Input signal	Voltage / Current
Measurement ranges	+/- 10V, +/- 5V, +/- 1V, 0 to 10V, 0 to 5V +/- 20mA, 0 to 20mA, + 4mA to 20mA
Sampling rate	Up to 100Ks/sec
A/D converter	16 bits
Electrical	
Break down current in current mode	+/- 35mA
Break down voltage	+/- 15V
Isolation input to system	1500Vac, 60s
Isolation between inputs	No
Input impedance, voltage mode	>500Kohm
Input impedance, current mode	440ohm (min.), 460ohm (max.)

Tbl 18. Analog Inputs. Technical Data.

Connector and pinout is as follows:

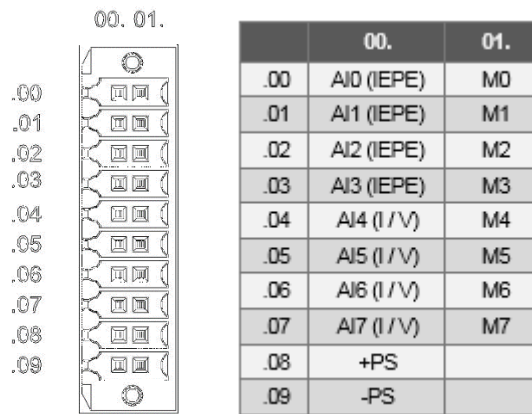


Fig 11. Module connector and pinout.

3.4.2.3 6IEPE + 2 Fast Analog Input module

Mix analog input module with 6 IEPE accelerometer input signals and 2 high speed V/I analog inputs with common reference.

Main characteristics:

IEPE Inputs	
Functional	
Number of inputs	6
IEPE sensor	+/-5V , +/-1V
Input connection	Single ended
Sampling rate	Up to 100Ks/sec
Input resolution	Up to 16bits
Electrical	
Isolation	
Front connector to system connector	1500Vdc 1min
Front connector to earth	1500Vdc 1min
Max Input voltage	+/- 15V from any AI _n (+/-) input to M point
Input Impedance	
Voltage mode	>500Kohm
Current mode	440ohm (typ.)

Tbl 19. IEPE Inputs. Technical Data.

Analog Inputs	
Functional	
Number of inputs	2
Connection mode	Common GND reference
Input signal	Voltage / Current
Measurement ranges	+/- 10V, +/- 5V, +/- 1V, 0 to 10V, 0 to 5V +/- 20mA, 0 to 20mA, + 4mA to 20mA
Sampling rate	Up to 100Ks/sec
A/D converter	16 bits
Electrical	
Break down current in current mode	+/- 35mA
Break down voltage	+/- 15V
Isolation input to system	1500Vac, 60s
Isolation between inputs	No
Input impedance, voltage mode	>500Kohm
Input impedance, current mode	440ohm (min.), 460ohm (max.)

Tbl 20. Analog Inputs. Technical Data.

Auxiliary Power Supply	
Electrical	
Aux. supply voltage	24Vdc +/- 10%
Aux. supply current	130mA (max.) / 80mA (typ.) @ 24Vdc

Tbl 21. Auxiliary Power Supply. Technical Data.

Connector and pinout is as follows:

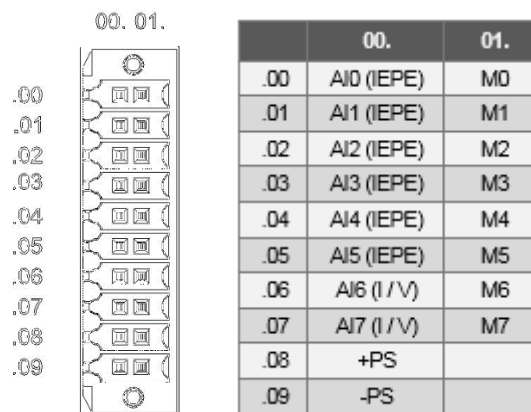


Fig 12. Module connector and pinout.

3.4.2.4 2 Analog Input + 4IEPE + 1 Encoder Input module

Main characteristics:

Analog Inputs	
Functional	
Number of inputs	2
Connection mode	Common GND reference
Input signal	Current
Measurement ranges	+/- 20mA, 0 to 20mA, + 4mA to 20mA
Refresh time	0,56ms
Input resolution	16bits
Error full scale at 25°	+/- 0,1%
Electrical	
Break down current in current mode	+/- 35mA
Break down voltage	+/- 15V
Isolation input to system	1500Vac, 60s
Isolation between inputs	No
Input impedance, voltage mode	>33Kohm
Input impedance, current mode	440ohm (min.), 460ohm (max.)

Tbl 22. Analog Inputs. Technical Data.

IEPE Inputs	
Functional	
Number of inputs	4
Signal input range	+/- 5V
Input connection	Single ended
Sampling rate	48Ks/sec
Dynamic range	96dB
Useful band	0.1Hz to 20kHz
Input resolution	18bits
Error full scale at 25°	+/- 0,1%
Diagnostic	
Number	1 measurement per IEPE input
Diagnostic Type	Bias Output Voltage measurement (0 to 24V)
Input resolution	16bits
Error full scale at 25°	+/- 1%
Electrical	
Isolation	
Front connector to system	1500Vdc 1min
Front connector to earth	1500Vdc 1min

Tbl 23. IEPE Inputs. Technical Data.

Encoder Input	
Functional	
Input supported	Incremental Encoder (A, B signals) or 3 individual Digital Inputs for speed measurement
Count speed	50.000count/sec
Input resolution	32bits
Error full scale at 25°	+/- 0,01%
Electrical	
Counter signals standard	HTL or PNP/NPN @24Vdc

Tbl 24. Encoder Input. Technical Data.

Auxiliary Power Supply	
Electrical	
Aux. supply voltage	24Vdc +/- 10%
Aux. supply current	130mA (max.) / 80mA (typ.) @ 24Vdc

Tbl 25. Auxiliary Power Supply. Technical Data.

Connector and pinout is as follows:

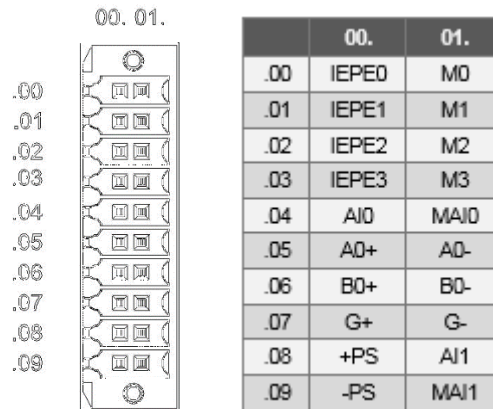


Fig 13. Module connector and pinout.

Signals:

- | | |
|---------------|----------------|
| A10, A11: | Analog Inputs |
| IEPE0..IEPE3: | IEPE Inputs |
| A0+, A0-: | Encoder Inputs |
| B0+, B0-: | Encoder Inputs |
| G+, G-: | Encoder Inputs |
| +PS, -PS: | Power Supply |

3.4.2.5 10 Temperature Input module

Module for the acquisition of temperature signals from different temperature sensors types (PT100 2/3wires, NTC, Thermocouple).

Main characteristics:

Temperature Inputs	
Functional	
Number of inputs	Up to 10 temperature inputs depending on the sensor type and connection
Connection mode	2 wires, 3 wires
Input signal	PT100 sensor (2-3wires), NTC, TC
Measurement ranges	
NTC	4.7 .. 470 Kohm
PT100	-50 .. +200 °C
TermoCouple J	-40 .. +750 °C
TermoCouple K	-200 ..+1350 °C
TermoCouple T	-200 .. +350 °C
Refresh time	48ms (max.)
A/D converter	16bits
Electrical	
Open circuit voltage	3,4V (max.)
PT100 current	1,6mA (max.)
Isolation input to system	1500Vac, 60s
Isolation between inputs	No

Tbl 26. Temperature module. Technical Data.

Connector and pinout is as follows:

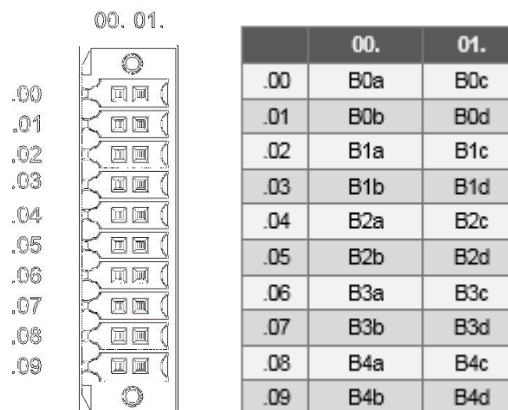


Fig 14. Temperature module connector and pinout.

3.4.2.5.1 Sensor Connection Possibilities

Internally the module is divided in 5 signal blocks (each block has 4 terminals). Each block contains two possible input channels (TX-TY):

- B0 → T0-T1
- B1 → T2-T3
- B2 → T4-T5
- B3 → T6-T7
- B4 → T8-T9

In following figures, the connection diagram for the different types of sensors is represented:

a) NTC + NTC / PT100 + PT100.

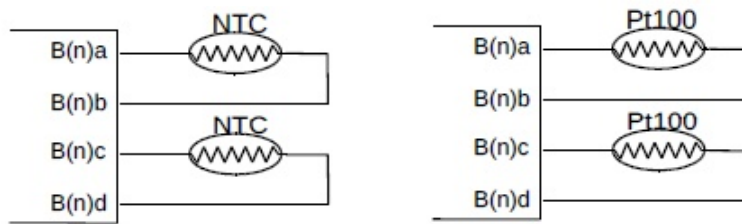


Fig 15. NTC + NTC // PT100 + PT100 (2-wires) connection diagram.

b) NTC + PT100 (2-wires) / PT100 (2-wires) + NTC. Both sensors share a common electrical point formed by B(n)b y B(n)d.

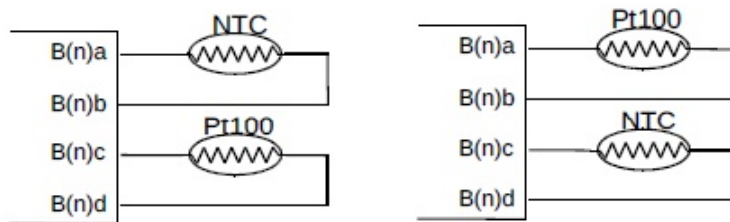


Fig 16. NTC + PT100 (2-wires) // PT100 (2-wires) + NTC connection diagram.

c) NTC + Empty sensor / PT100 (2-wires) + Empty

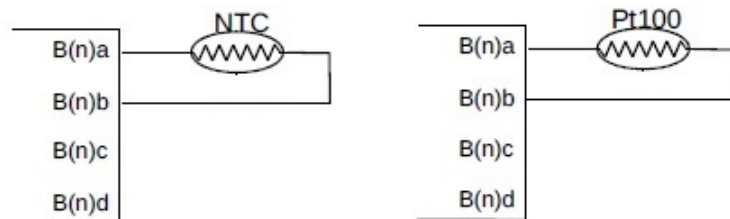


Fig 17. NTC + Empty // PT100 + Empty connection diagram.

d) PT100 (3-wires) or Differential thermocouple

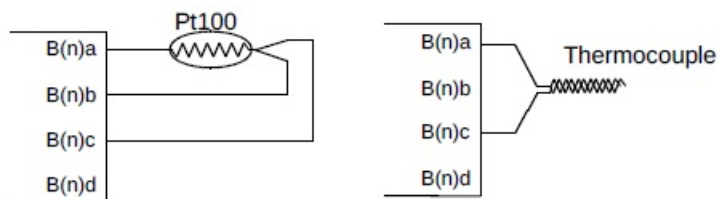


Fig 18. Pt100 (3-wire) // ThermoCouple connection diagram.

Note:

In all cases both sensors share a common electrical point formed by B(n)b y B(n)d.

Mechanical Solution

4 Mechanical Solution

4.1 System Configuration

INGESYS™ RCM Data Logger presents an internal modular and expandable design that enables its customization to application’s I/Os and communication requirements.

INGESYS™ RCM Data Logger is formed by the integration of user defined processor, communication and I/O modules, that are assembled in a compact mechanical solution. Up to 4 fieldbuses and 10 I/O modules can be selected and integrated in a compact mechanical enclosure.

In the following figure, a view of how this assembly is performed is shown:

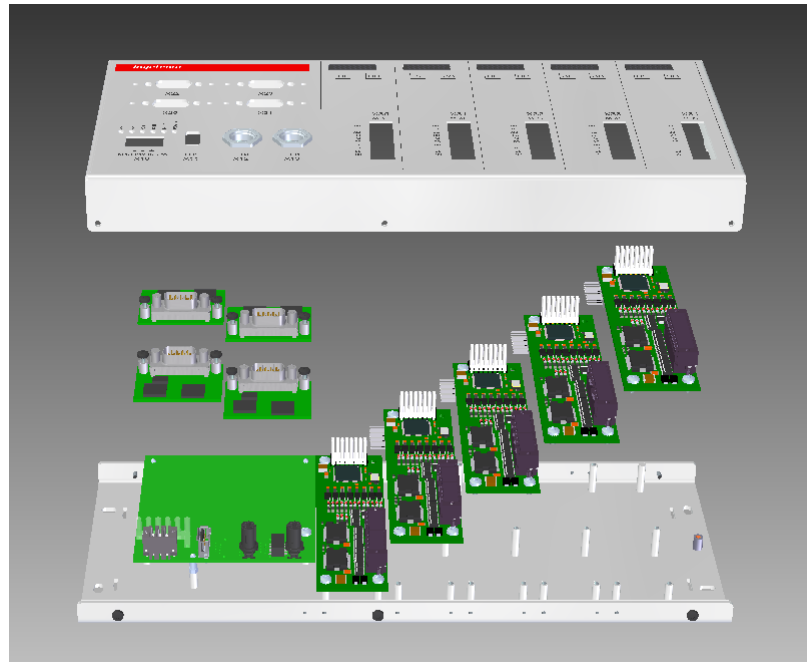


Fig 19. Mechanical solution.

Once the modules are selected, a customized mechanical enclosure to contain the whole set is designed and a unique reference code is assigned to the set. This reference is used to define precisely the new customized system for further manufacturing and commercial purposes.

In the following figure, an example of a customized final system is shown:

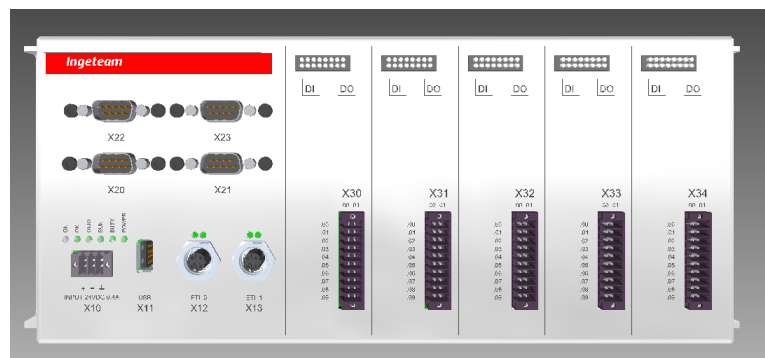


Fig 20. Customized final system.

INGESYS™ RCM Data Logger is manufactured by using pre-assembled off-the-shelf electronic modules allowing very fast delivery. All available modules have been already certified, assuring system’s quality and standards’ compliance.

4.2 Mechanical Data

The dimension of **INGESYS™ RCM Data Logger** depends on the number of I/O modules selected.

The processor module is always requested and have a width of 149mm. Each additional I/O module increase the width in 37,5mm. (Max.: 10 x I/O modules)

The position of the fixing holes is detailed in the following figure:

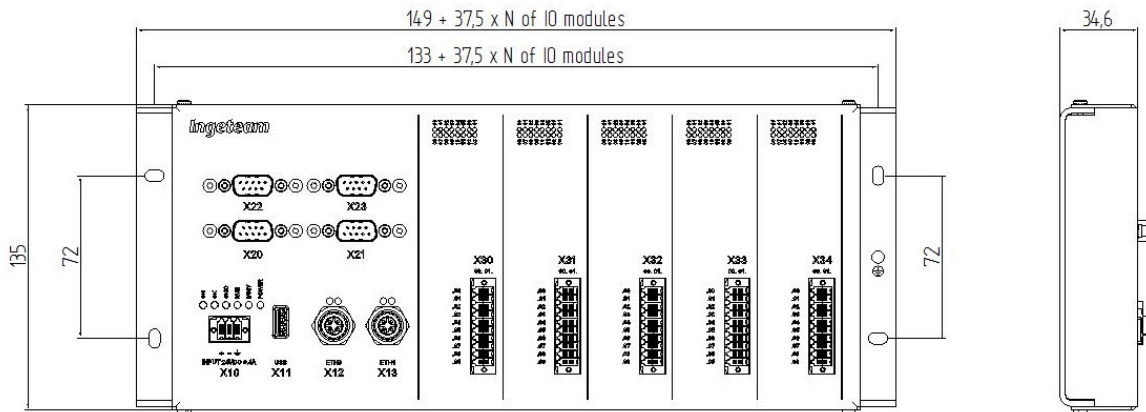


Fig 21. **INGESYS™ RCM Data Logger** Dimensions.

Maximum I/Os modules	Max. 10 x I/O modules
Processor module dimensions	149mm x 135mm x 34,6mm
I/O modules dimensions	37,5mm x 135mm x 34,6mm
Mounting	Panel
Case material	Aluminium
Weight	475 - 1500g

Tbl 27. Mechanical data.

Certifications

5 Certifications

5.1 Electromagnetic Compatibility

INGESYS™ RCM Data Logger system complies with European directive 2004/108/CE on electromagnetic compatibility (EMC) as well as the EN50155 Railway Standard. The following table shows the approved standards tests and the levels applied:

Test	Standard Applied	Test Level
Power Supply Compliance Tests	EN 50155:2007	Class S1
Electric Shock Immunity Tests	EN 61000-4-2 EN 50121-3-2:2007	Shock on contact: ±6kV Shock in the air: ±8Kv
Radio-frequency, radiated, electromagnetic field immunity tests	EN 61000-4-3 EN 50121-3-2:2007	20V/m / 80Mhz – 1Ghz 10V/m / 1,4GHz – 2,1GHz 5V/m / 2,1GHz – 2,5GHz
Rapid transient bursts immunity tests	EN 61000-4-4 EN 50121-3-2:2007	±2kV (signal) ±2kV (DC power supply)
Shock wave immunity tests	EN 61000-4-5 EN 50121-3-2:2007	±2kV line to earth ±1kV line to line
Immunity against conducted disturbances induced by radio-frequency fields	EN 61000-4-6 EN 50121-3-2:2007	10Vrms
Radiated emission measurement	CISPR 16-2-3 EN 50121-3-2:2007	50dB (µV/m) between 30MHz and 230MHz, 57dB (µV/m) between 230MHz and 1000MHz
Conducted emission measurement	CISPR 16-2-3 EN 50121-3-2:2007	99dB (µV/m) between 0,15MHz and 0,5MHz, 93dB (µV/m) between 0,5MHz and 30MHz
Insulation Test	EN 50155:2007	Insulation resistance: 500Vdc Dielectric Strength: 500Vac / 710Vdc

Tbl 28. Summary of EMC tests.

5.2 Climatic Conditions

INGESYS™ RCM Data Logger system environmental limits:

Climatic Conditions	
Temperature Range	-40°C to +70°C (EN50155:2007 TX)
Relative Humidity Range	30% to 95% (EN50155:2007 Damp Heat Cyclic Test)

Tbl 29. Climatic Environment Conditions.

5.3 Vibration and Shock Tests

INGESYS™ RCM Data Logger system has passed the following vibration and shock tests according to EN50155, certifying its reliability.

Vibrations Test		
Constant frequency	Frequency Severity Duration	15Hz 28,9m/s ² 4,5hours on each axis (x,y,z)
Frequency scan	Range Severity Duration	From 3Hz to 100Hz See Frequency Scan Test 4,5hours on each axis (x,y,z)

Tbl 30. Vibrations Test.

Shocks Test	
Shock type	1/2 sinusoidal wave cycle
Acceleration peak/pulse duration	15g / 11ms
Number of pulses	3 successive pulses in each direction (+ & -) and per axis (x,y,z) = 3x2x3 = 18pulses

Tbl 31. Shocks Test.

Frequency Scan Test									
Frequency (Hz)	5	11	18	20	30	32	50	60	100
Ax, Ay, Az (m/s ²)	2	11	11	20	20	14	14	10	10

Tbl 32. Frequency Scan Test.

INGESYS™ RCM Data Logger system has also been designed to conform to the following vibration tests as stated in EN50155 (IEC 61373:2010):

Vibrations Test		
Random vibration tests	Frequency Duration Severity: ASD Level ((m/s ²)/Hz) RMS Value (m/s ²)	5 to 150Hz 10min on each axis (x,y,z) Vertical :0,0301;Transversal 0,0144;Longitudinal 0,0144 Vertical: 1,01; Transversal: 1,01; Longitudinal: 1,01
Simulated long-life testing	Frequency Duration Severity: ASD Level ((m/s ²)/Hz) RMS Value (m/s ²)	5 to 150Hz 5h on each axis (x,y,z) Vertical: 0,964;Transversal: 0,461;Longitudinal: 0,461 Vertical: 5,72;Transversal: 5,72; Longitudinal: 5,72
Shock tests	Waveform Number of pulses Severity: Peak Accel (m/s ²) Duration (ms)	Half-sine pulses 3 positive and 3 negative successive pulses in each axis 50 30

Tbl 33. Vibrations Test as stated in EN50155 (IEC 61373:2010).

5.4 Fire Protection

INGESYS™ RCM Data Logger system fulfills the fire protection requirements defined in the standard EN455-45-2.

Test	Standard Applied	Test Level
Fire Protection on Railway Equipment	EN 45545-2:2013+A1:2015	HL2

Tbl 34. Summary of Fire Protection (EN45545-2) tests.

5.5 Storage and Transport Conditions

The “Storage and Transport Conditions” table below details the terms for storing and transporting **INGESYS™ RCM Data Logger** system in their original packaging:

Storage and Transport Conditions	
Vibrations	Check Vibration and Shock Tests
Shocks	Check Vibration and Shock Tests
Temperature Range	-40°C to +90°C
Relative Humidity Range	10% to 95%

Tbl 35. Storage and Transport Conditions.

INGESYS™ RCM Selection Table

6 INGESYS™ RCM Selection Table

INGESYS™ RCM can be configured based on particular needs. Up to 4 fieldbuses and up to 10 I/O modules can be selected. Specific commercial reference is obtained using the following selection table:

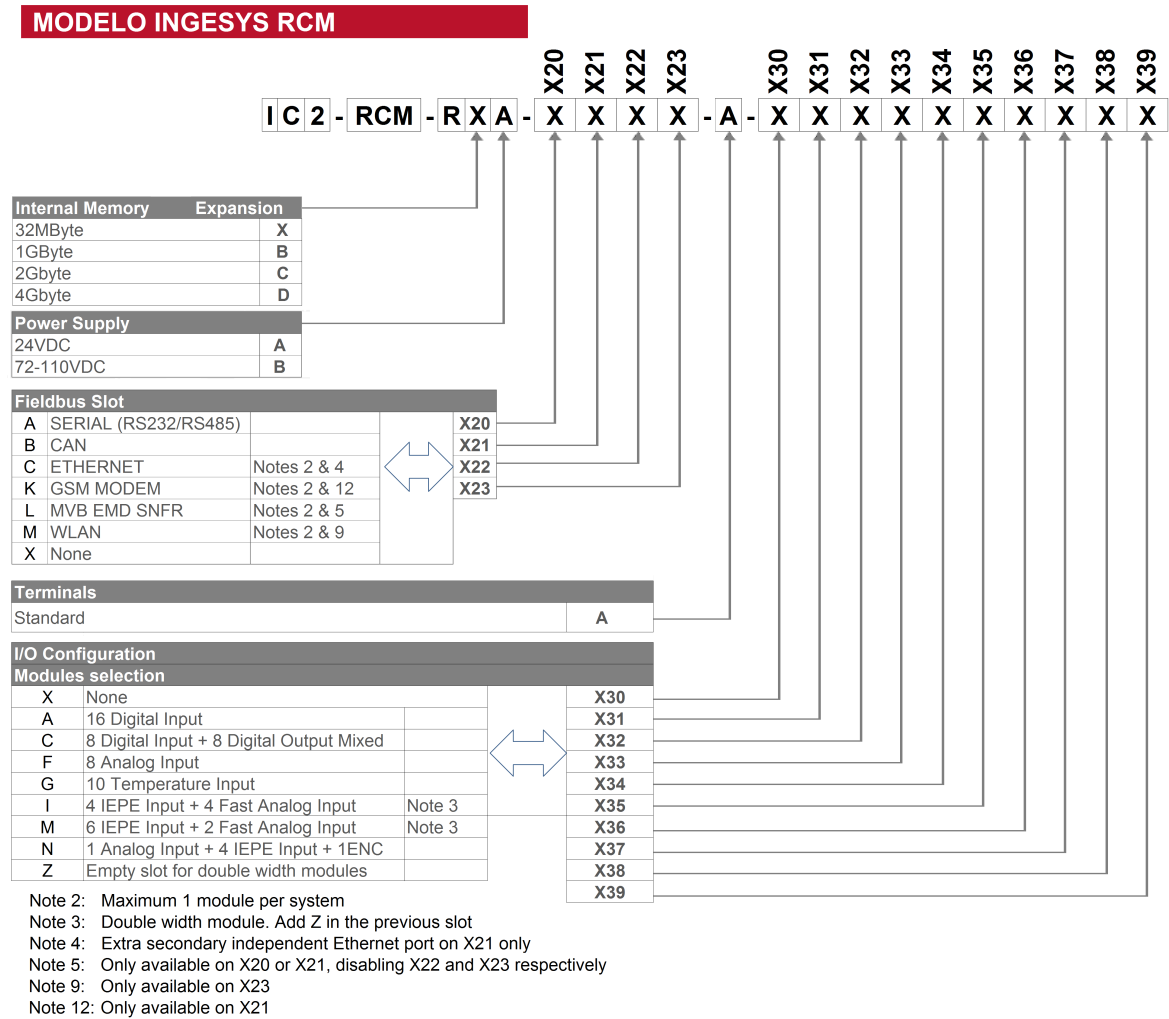


Fig 22. Selection Table.

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