LOS ANGELES COUNTY

METROPOLITAN TRANSPORTATION AUTHORITY

LIGHT RAIL VEHICLE

P2550

RUNNING MAINTENANCE AND SERVICE MANUAL

SECTION 19 EVENT RECORDER

Metro

AnsaldoBreda

SECTION 19

EVENT RECORDER

PART I

THEORY OF OPERATION

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SECTION 19

EVENT RECORDER

19-I-01 INTRODUCTION

This Section of the Running Maintenance and Service Manual is divided into three Parts:

- Part I: Theory of Operation
- Part II: Troubleshooting
- Part III: Maintenance

Each Paragraph is numbered accordingly, to avoid that paragraphs of the same Section, pertaining to a different Part, have the same number.

Part I – Theory of Operation

Part I gives a thorough overlook of the System structure and operation, by means of descriptions, figures, photos, schematics, block diagrams and flow charts, together with references to other documents or Sections when needed.

Part II – Troubleshooting

It gives the Maintenance Technicians a path to troubleshoot the System in every condition by means of the available tools:

- The PTU, equipped with the specific SW program
- The IDU
- The Fault Isolation Table

The Part III – Maintenance consists of:

- Preventive Maintenance
- Corrective Maintenance
- Consumable Materials
- Test Equipment, Tools & Special Tools

19-I-01.a LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

The Abbreviations, Acronyms and Symbols commonly used throughout this manual are given below with their related meaning.

Abbreviation	Meaning
ADU	Automatic Display Unit
AI	Analogue Input
ALM	Power Supply
DI	Digital Input
ECU	Electronic Control Unit (Brake)
ER	Event Recorder
FIDI	Fully Isolated Digital Input
FIFO	First In First Out
GTW	Gateway
IDU	Integrated Diagnostic Unit
LED	Light Emitted Diode
LRV	Light Rail Vehicle
MB	Mega Bytes
MTA	Metropolitan Transportation Authority
MVB	Multifunction Vehicle Bus
PC	Personal Computer
PTU	Portable Test Unit
SAM	Software for Analysis Maintenance
TCU	Traction Control Unit
TOM	Train On board Memory
UC	Unit Control
USB	Universal Serial Bus

19-I-01.b LIST OF DEFINITIONS

The Definitions commonly used throughout this manual are given below with their related meaning.

Definition	Meaning
'A' body section	The section of an articulated vehicle containing the pantograph
'B' body section	The section of an articulated vehicle not containing the pantograph
AW0	Empty car operating weight
AW1	Full seated load plus AW0
AW2	Standees at 4 persons per square meter plus AW1
AW3	Standees at 6 persons per square meter plus AW1
AW4	Standees at 8 persons per square meter plus AW1
Front door	The door close to the Operator's Cab
Rear door	The door close to the Articulation Section

19-I-01.c LIST OF MEASUREMENT UNITS AND SYMBOLS

The Measurement Units commonly used throughout this manual are given below with their related meaning.

Definition	Meaning
Ω	Ohm
°C	Celsius degree
°F	Fahrenheit degree
A	Ampere
ft	Foot
g	Gram
gal	Gallon
in	Inch
kg	Kilogram – approx 2.205 pounds
lb	Pound
m	Meter – approx 3.28 feet
mm	Millimeter – approx 0.0394 inches
N	Newton
rms	Root Mean Square Voltage
s	Second
V	Voltage
Vd	Differential Voltage
Vdc	Direct Current Voltage
Vin	Input Voltage
Vm	Common Voltage
W	Watt

19-I-02 THEORY OF OPERATION

19-I-02.01 General Description of the System

The P2550 LRV TOM (Train On-board Memory) Event Recorder is a piece of Data Recording and Processing equipment designed to:

- Acquire data from the vehicle systems;
- Record the collected data in a crashworthiness memory;
- Make recorded data available for downloading;
- Process the vehicle speed;
- Play-back recorded data for analysis;
- Help diagnosing faults;
- Report faults and give hints for repair;

By means of its SAM (Software for Analysis and Maintenance) software, the recorded data can be used for:

- Juridical investigation;
- Driver supervision;
- Advanced maintenance.

Figure 19-I-02.1 The TOM Rack

The TOM Event Recorder can acquire:

- 64 Digital Inputs;
- 8 Analog Inputs;
- 2 Frequency Inputs.

The TOM is connected to the vehicle battery, to get the power supply (37.5Vdc), and to the MVB network, to collect data from the vehicle systems.

The TOM can also be connected to an external Laptop (PTU) for downloading and analyzing the recorded data.

A PCMCIA port is provided to collect the recorded data on a PCMCIA card.

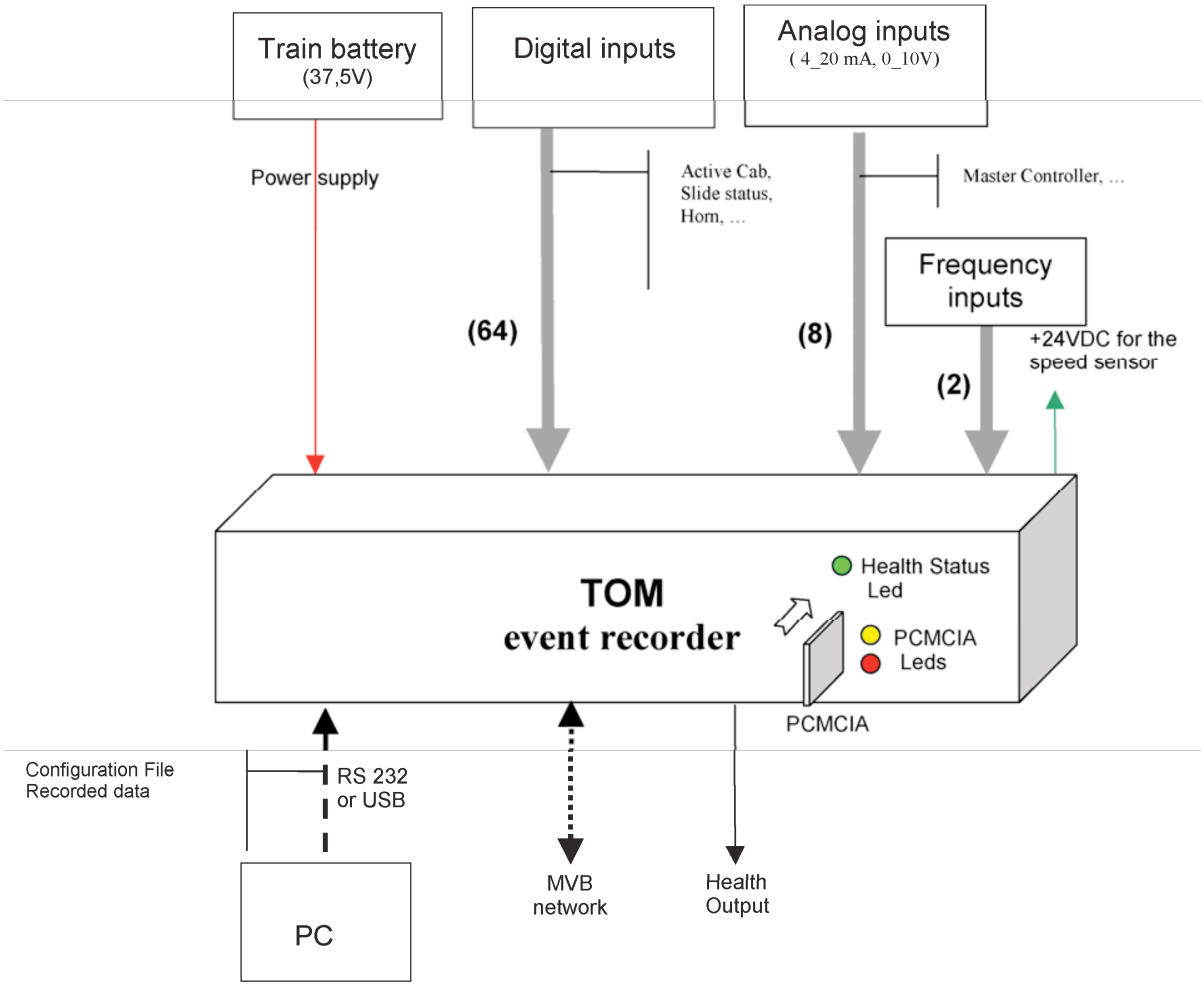


Figure 19-I-02.2 TOM Architecture

The TOM Event Reorder is equipped with two memories (refer to Figure 19-I-02.3):

- Secure Memory (6 MB), the Black Box, based on a flash memory. It stores the journey data that are required in case of juridical investigations. The data is protected against loss and corruption in the event of an accident;
- User Long Memory (8 MB), based on a flash memory. It stores the same data as the secure memory, but allows faster downloading.

i. System – Vehicle Relationship

The TOM Event Recorder is connected to most of the Systems of the vehicle/train consist.

It gets the input signals (Digital, Analog and from the MVB) to be recorded and sends signals related to its status to the IDU through the GTW and the MVB (refer to Section 18).

Figure 19-I-02.4 System-Vehicle Relationship

ii. System – Component Relationship

The TOM Event Recorder is made up of a rack containing the following components refer to Figure 19-I-02.10,

Figure 19-I-02.11 and Figure 19-I-02.12):

- 1 Power Supply Board, with connector;
- 1 Unit Control (UC) Board, with 1 PCMCIA port and LED an USB port;
- 1 IFT Board, with connector;
- 4 MEL Boards, with connectors;
- 1 MVB Module Board, with connectors for MVB Link, MVB Maintenance, RJ45;
- 1 Secure Memory (orange) with the Earth Stud;
- 1 connector for Coding Plug;
- 1 Connector for Maintenance (for connecting the PTU).

The Power Supply Board is supplied by the vehicle battery and supplies all TOM Boards.

The UC Board contains the slot for the PCMCIA Board and the three LEDs that tells the operator what is going on with the card.

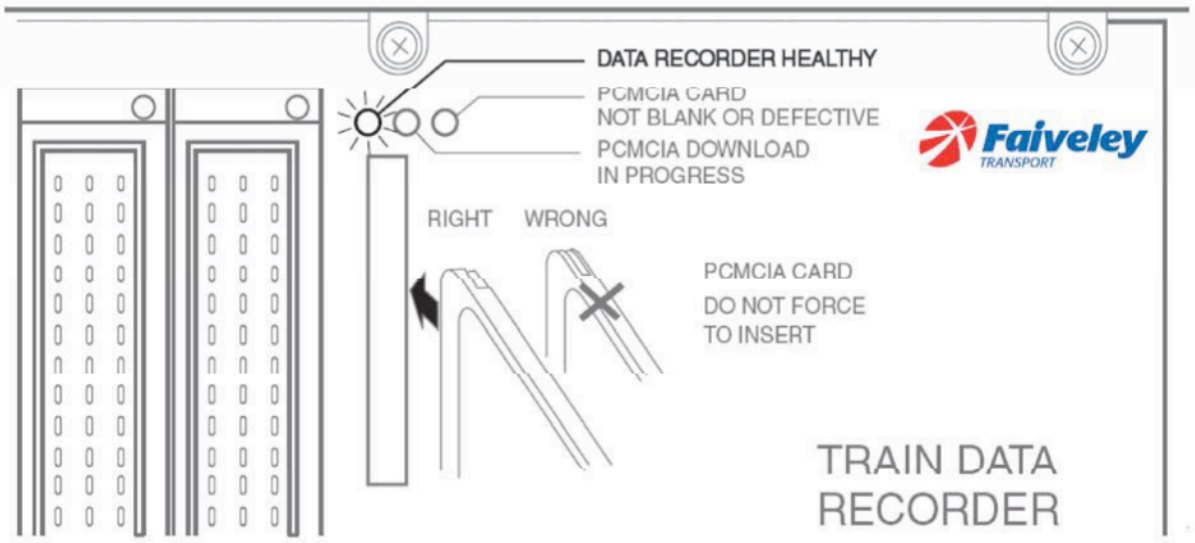


Figure 19-I-02.5 TOM Health Indicator

The 1FT and the MEL Boards receive and manage the Analog and Digital signals respectively.

The MVB Module Board manages the link with the MVB bus and the two LEOs tell the operator about MVB Link activity and MVB health.

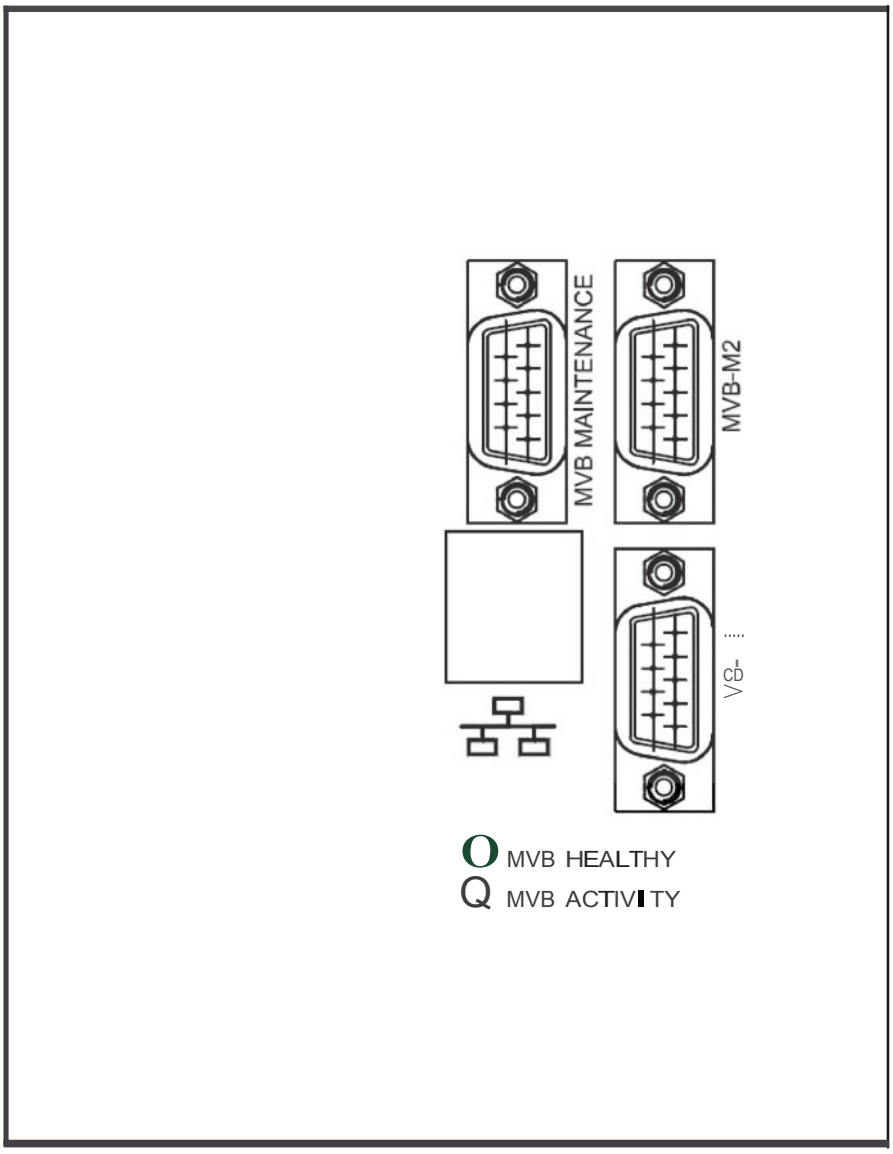


Figure 19-1-02.6 MVB Health and Link Status Indicator

iii. System Performances and Characteristics

a) Technical Data

Dimensions:	483 x 305 x 133 (in mm)
Weight:	≤15 kg
Rack:	3U84TE
Water and dust tightness:	IP20
Connectors:	metallic DIN 41612 type E plugs on front face
	SUBD9 male and USB connectors for maintenance
	SUBD9 male and female connectors for MVB
Mechanical ground:	Earth stud
Operating conditions:	EN50155 standard (11/1995)
Supply voltage:	37.5 Vdc (from 25 Vdc to 47 Vdc)
Power consumption (in max configuration):	40 W maximum (20 W typical)
Vibration and shock:	according to EN50155 standard (11/ 1995)
Electromagnetic compatibility:	EN50155 (11/1995), EN50121-3-2 (09/2000)

b) Mechanical interfaces

Enclosure:	3U 19" rack
Water & Dust tightness :	IP20
Color:	Pastel orange RAL 2003 on front face only.
Dimensions:	About 130mm (high) x 440mm (wide) x 290mm (depth)
Typical weight:	10 kg without option
Fixing:	Four fixing screws M6
Mating connectors:	Metallic type E DIN 41612 plugs on the front face
Mechanical ground :	Earth stud

c) Power Supply:

Nominal Power Supply	37.5Vdc
Operating Range	24-47Vdc
Electrical Insulation	1,500 Vdc
Power Consumption	20W (max 40W)
Protection against polarity inversion	Yes
Protection against surges	1.8 kV – 5/50 µs – 100 Ω

The Power Supply board provides protection against surges and transients in order to comply with the standards DR2: EN50121 Railway applications – Electromagnetic compatibility - Part 3-2: Rolling stock – Apparatus, and DR1: EN50155 Railway applications - Electronic equipment used on rolling stocks.

d) Standards

General standard:	EN 50155, IEC 60571: class T3 (-25°C to +70°C operating)
Specific Standard	GMRT 2472 Issue One (British Standard for On Train Recorders)
Electromagnetic compatibility	EN 50121-3-2

e) TOM Digital Inputs

Total number of inputs:	64
Nominal voltage:	37,5 Vdc
Number of Fully Isolated Battery Inputs:	8
Number of Group Isolated Battery Inputs:	56
Minimum pulse detection:	Programmable from 10 ms to 2.5s per input.

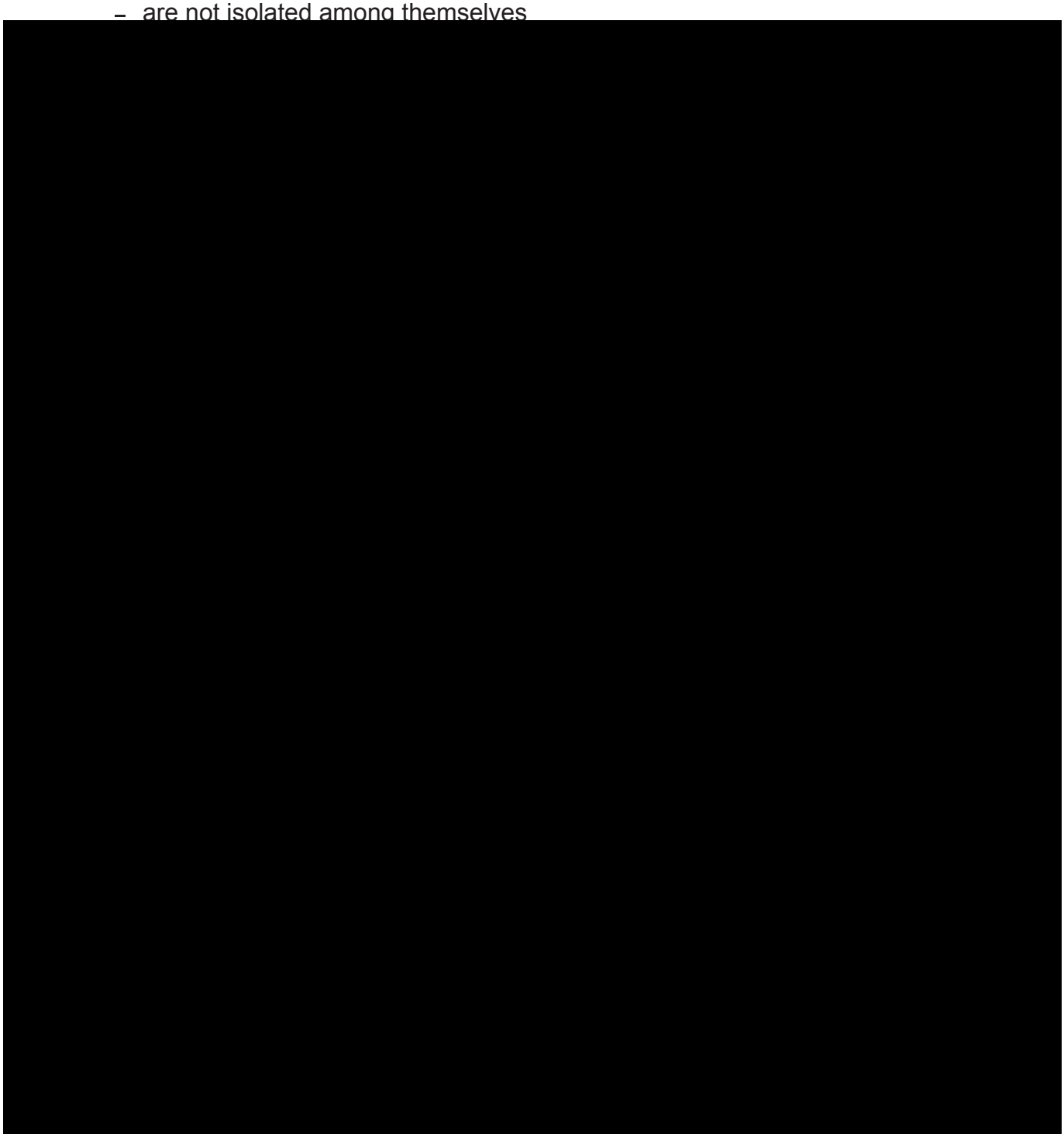
Each Fully Isolated Battery Digital Input:

- is isolated from the other Digital Inputs,
- is a differential input,
- cannot fail to a short-circuit due to its design,
- cannot inject a current back to the monitored equipment.

Electrical insulation	1500 Vdc
Low level differential voltage detection	< 6 V
High level differential voltage detection	> 22 V
Maximum permanent voltage	47 V
Current consumption per input	> 5 mA at 26 V
Maximum current consumption per input when it is failed	15 mA at 47 V
Protection against polarity inversion	yes

The Group Isolated Battery Digital Inputs are divided into groups of 14 inputs.
The inputs of each group:

- have one common reference,
- are isolated from the other Inputs of the group,
- are not isolated among themselves



f) TOM Analogue Inputs

Four types of analogue inputs can be processed by the system:

- Standard 4-20mA current loop inputs (to be connected to analogue outputs of a
- powered device)
- 4-20mA 2-wire sensor inputs (to be connected to a pressure sensor, for example)
- High impedance 4-20mA current loop inputs (to be connected to analogue outputs of a powered device)
- 0-10V voltage inputs (to be connected to analogue outputs of a powered device)

Twisted shielded cables are required to connect all the analogue inputs in order to improve their immunity against train interferences.

The shield of the cable must not be connected to a pin of the connector but to the connector body itself by using the appropriate cable seal (refer to Figure 19-I-02.7).

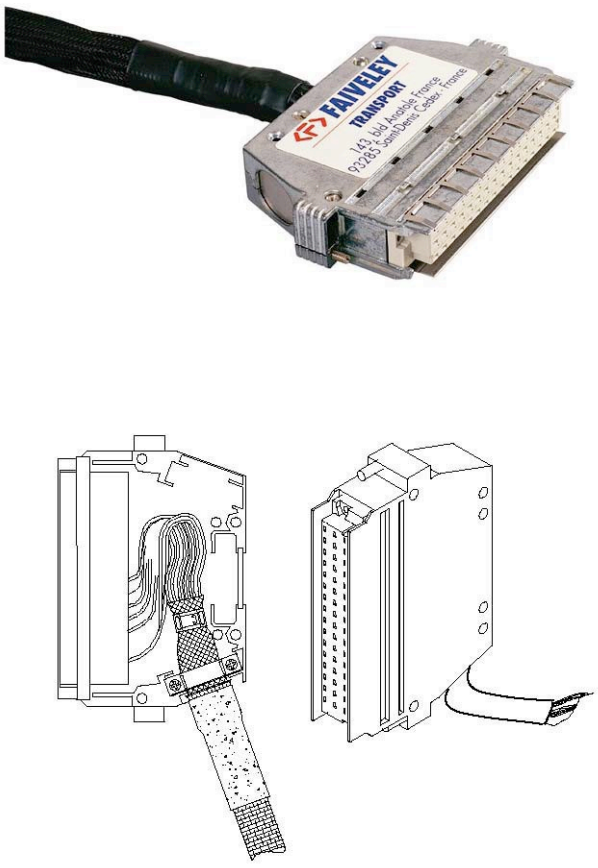
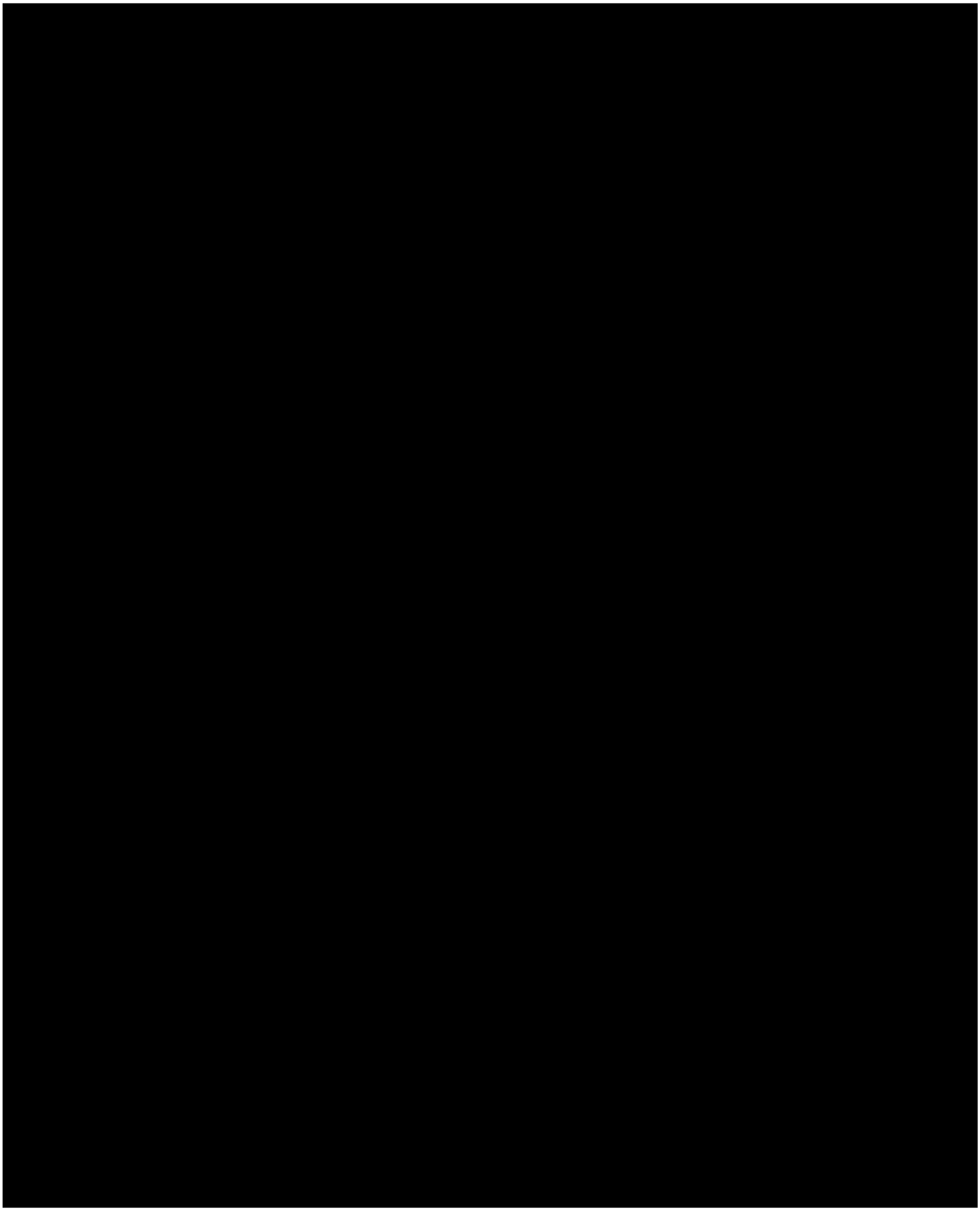
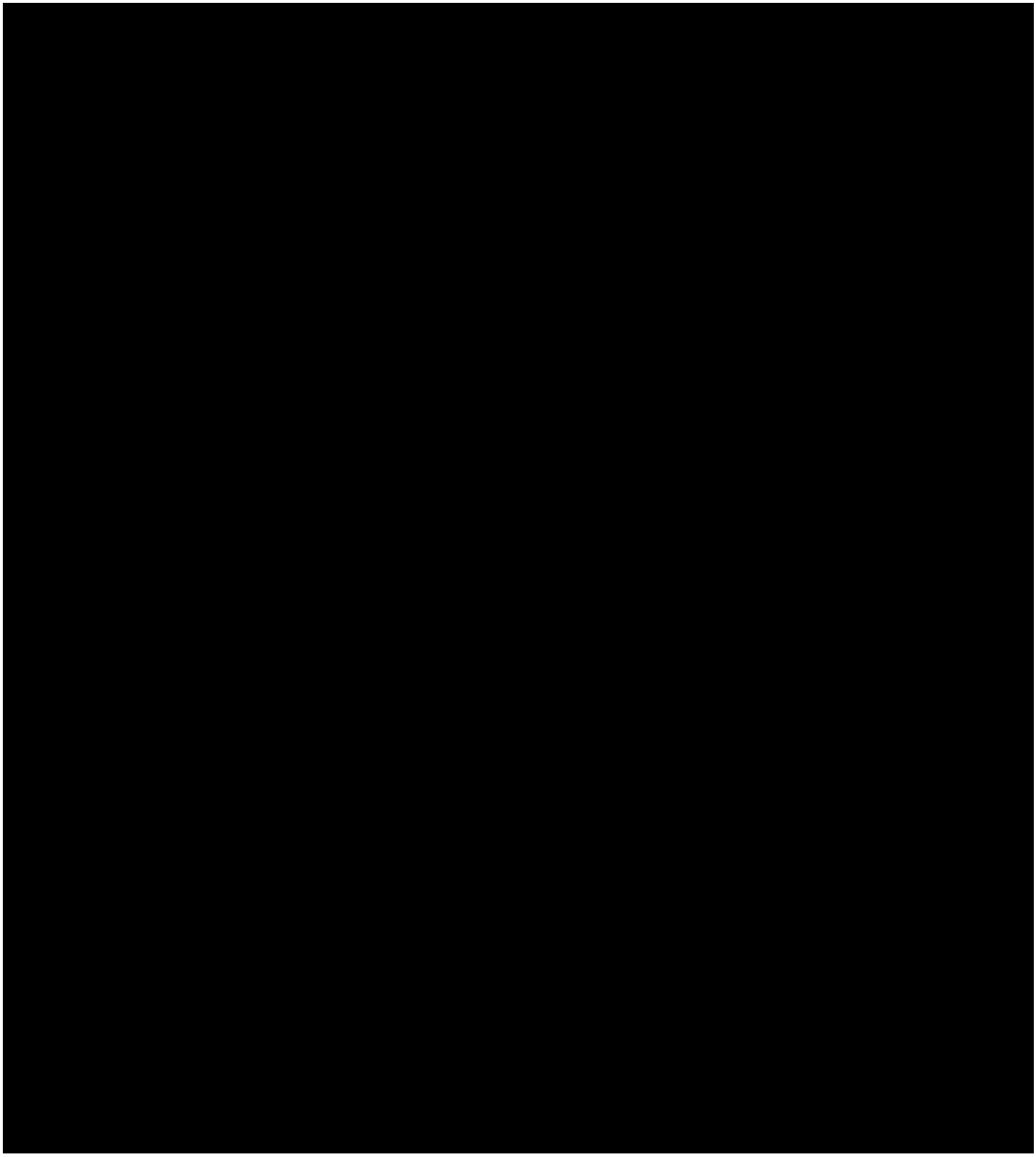
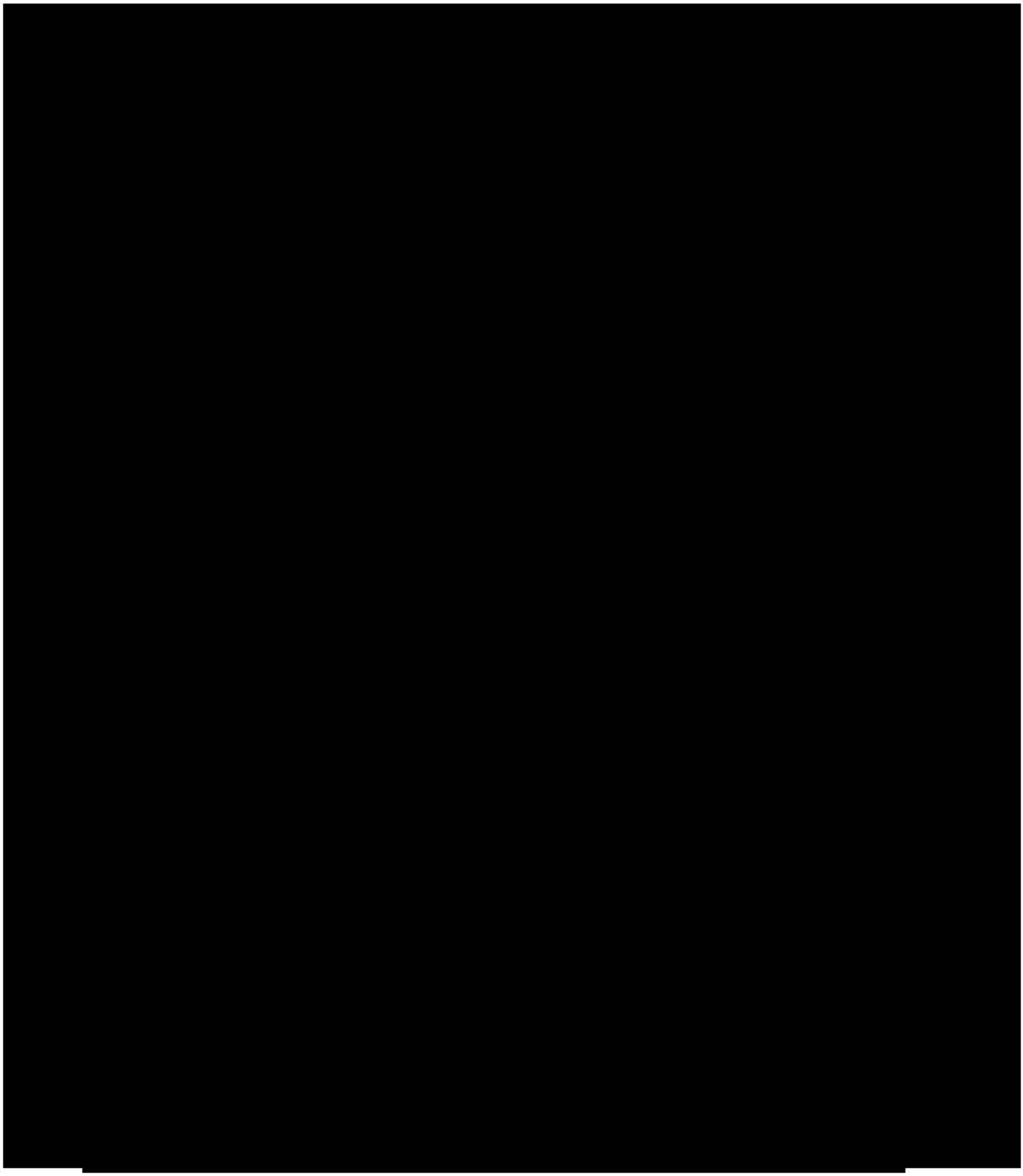


Figure 19-I-02.7 DIN 41612 Connector





High Impedance 4-20mA Current Loop Input



g) TOM Frequency Inputs

The Event Recorder has 2 frequency inputs. They can be connected to various types of speed sensors (passive or active). It is possible to supply one speed sensor with a 24V supply voltage coming from the TOM.

The frequency inputs:

- Are not isolated,
- Have a ground reference,
- Are differential inputs.

0-10V Inputs	Features
Electrical Insulation	No
Low Level Voltage Detection	<5V
High Level Voltage Detection	>14.4V
Maximum Differential Voltage	24V
Common Mode Voltage Range (Vm)	-100V to 1020V
Common Mode Input Impedance	200 kΩ
Input Impedance	4.64 kΩ
Current Consumption per Input	2.8mA at 13V
Maximum Frequency	3500 Hz
Accuracy	<0.5% at 25°C < 2%

h) TOM Communication Ports

Communication ports	
1 MVB network port	Used for the connection to the other devices present on the MVB bus (TCU, IDU, ECU, …)
Serial port 1: One isolated RS485	Not used

TOM Memories

User Long Memory	
Memory size	8 MBytes
Typical data capacity	Refer to
Memory management	A new recorded data erases the oldest one (FIFO mode)

Secure Memory	
Memory size	6 MBytes
Resistance features:	Temperature of 700°C for 5 minutes
	Chock of 100g, 10ms, ½ sine wave
	Crushing force of 20kN
	Magnetic fields by current of 64kA with 107 A/s rise
	Resistant to most of common fluids (IP 66).
Color:	Pastel orange RAL 2003
Data retention:	10 years without battery.
Memory management	A new recorded data erases the oldest one (FIFO mode)
Possible option	12 Mbytes model

i) TOM Other Ports

LED front face	
Functions:	A green LED is available on the front face of the recorder to signal that the equipment is working properly. The label of the LED is "Data Recorder Healthy".

RS232 and USB maintenance port	
Functions:	The TOM sends a copy of its recorded data to the laptop. SAM provides a maintenance data management through this serial link.
Typical download time :	
- Secure memory (6 MB model)	40 min
- User long memory	20 min
Connected equipment:	Laptop with SAM software.
RS232 Port type :	A non-isolated RS232 port
RS232 Connector on the recorder:	SubD 9 female
USB port type:	USB device
USB connector on the recorder:	Series B receptacles

PCMCIA Port	
Function:	When a PCMCIA card is inserted, the recorder copies its files on the PCMCIA card.
Typical user long memory download time:	3 min
PCMCIA card type:	5V PC card ATA type II or I.
Minimum Card size:	16 MB
Maximum addressable space by TOM:	2 GB
Location:	On the front face.
Max. number of insertions:	5000

The PCMCIA card is an off-the-shelf item. This card is only used by the depot staff to download data.

j) Wiring

The following table describes the characteristics of the wires to be used with the Event Recorder:

Equipment	Wire
Power Supply Board (ALM) + earth cable	1 DIN 41612 (female connector only with contacts)
MEL Boards	4 DIN 41612 (female connector only with contacts)
IFT Board	1 DIN 41612 (female connector only with contacts)
MVB Module Board	1 SUBD9 (female connector only with contacts) 1 SUBD9 (male connector only with contacts)

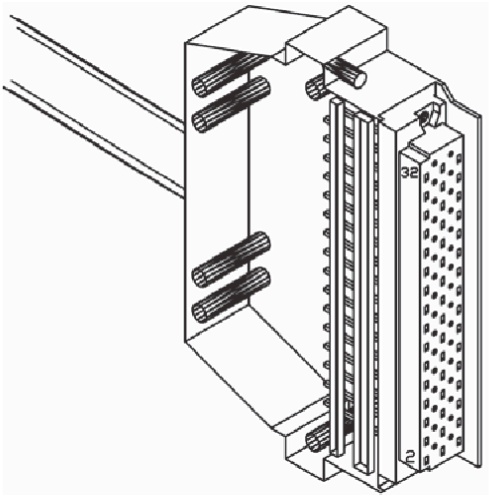


Figure 19-I-02.8 DIN41612 Connector

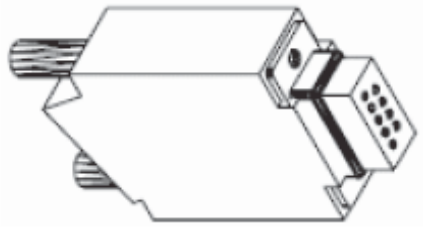
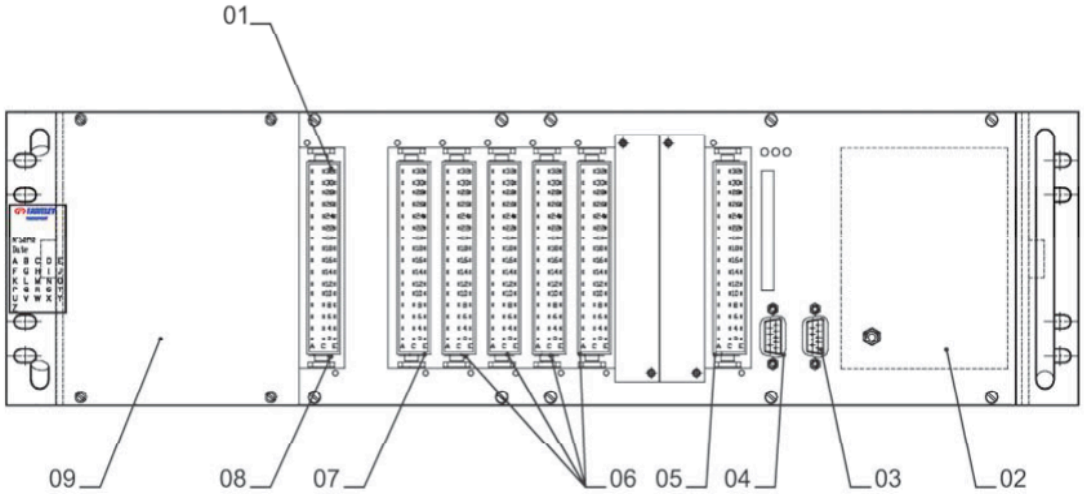


Figure 19-I-02.9 SUBD9 Connector

19-I-02.02 Main System Components

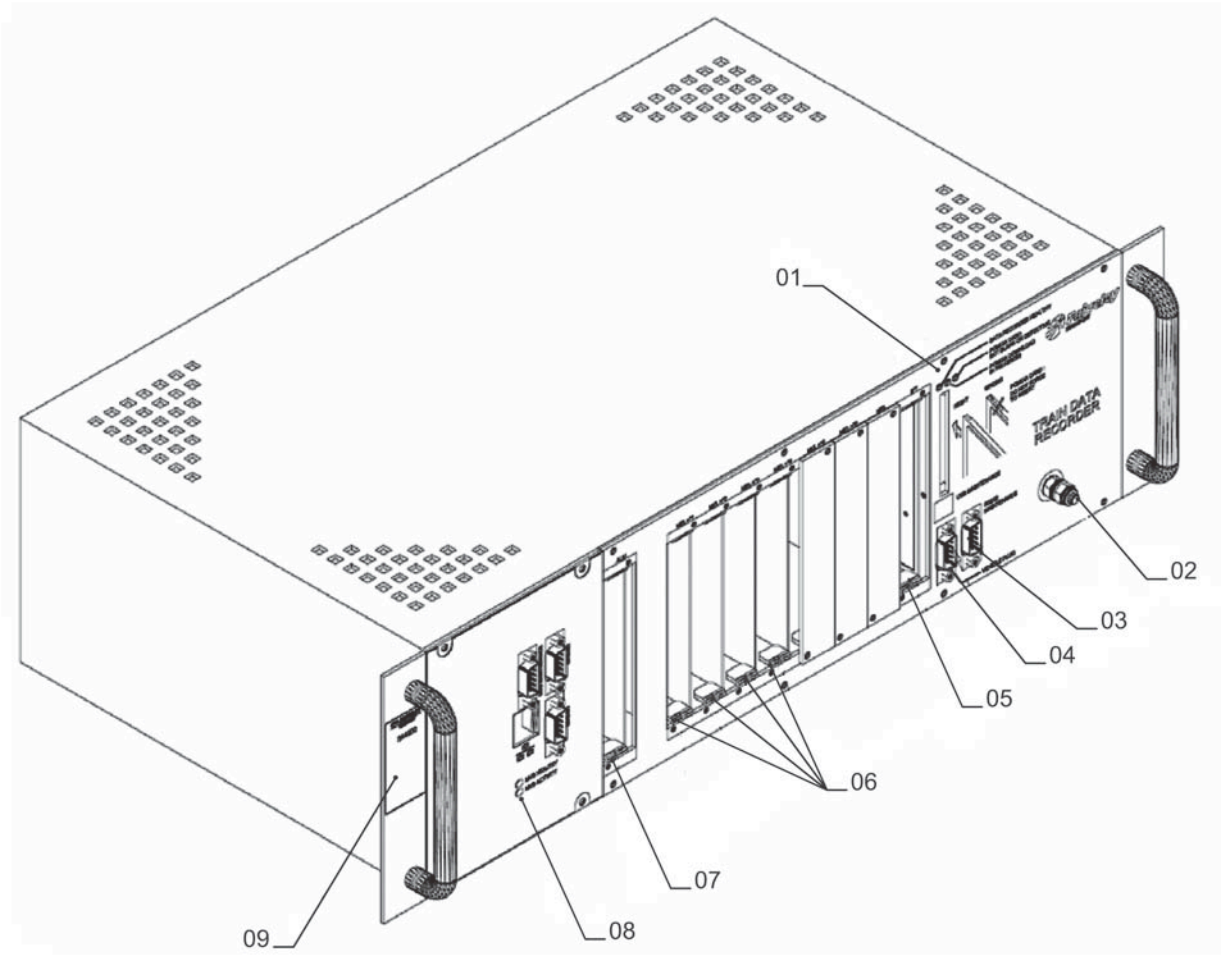
All data are stored in the TOM Event Recorder.
The recorder consists of a rack made of stainless steel containing the following items:

- 1 power supply board (ALM board)
- 1 unit control (UC) board with an USB interface port
- 1 IFT board
- 4 MEL boards
- 1 MVB Module board
- 1 Secure Memory (orange painted)



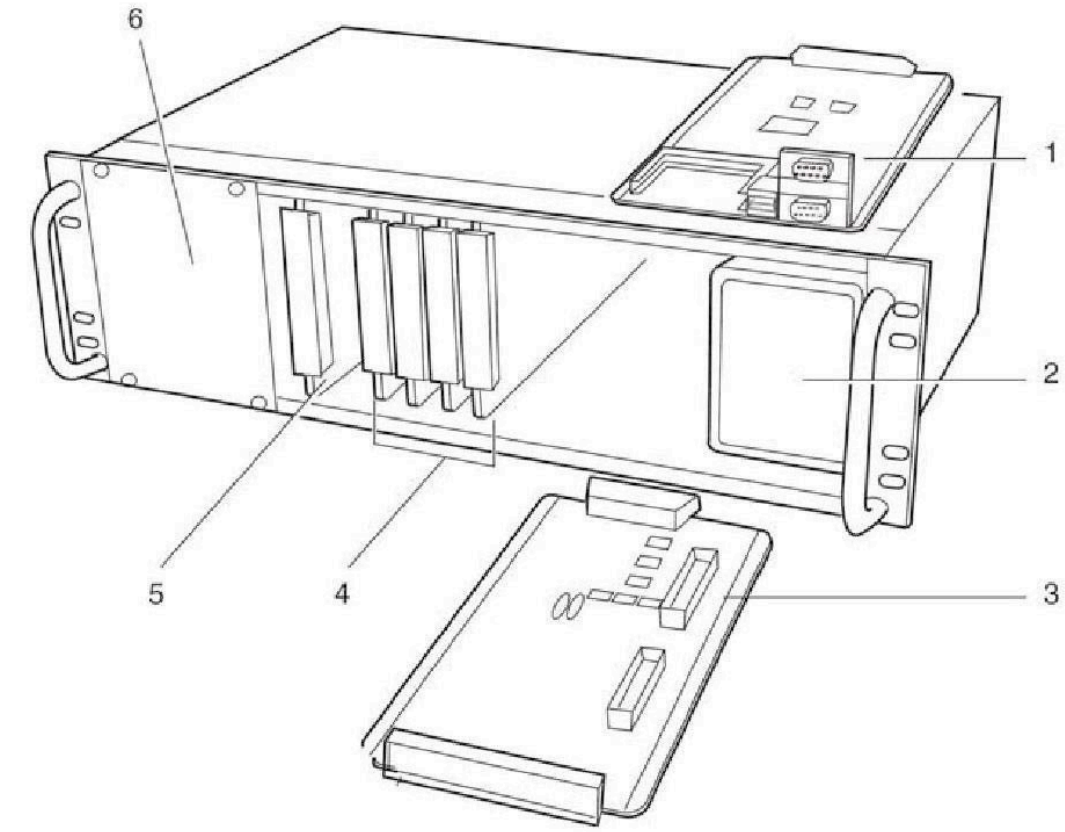
01. DIN41612-E48 CONNECTOR
02. SECURE MEMORY
03. SUBD 9PTS FEMALE MAINTENANCE
04. SUBD 9PTS CODING PLUG
05. IFT BOARD
06. MEL BOARD
07. MEL/AWS BOARD
08. ALM BOARD
09. LOCATION OF THE MVB INTERFACE

Figure 19-I-02.10 TOM Front Panel Lay-out



01. PCMCIA PORT AND LED
02. GROUND STUD
03. CONNECTOR FOR MAINTENANCE
04. CONNECTOR FOR CODING PLUG
05. CONNECTOR FOR IFT BOARD
06. CONNECTORS FOR MEL
07. CONNECTOR FOR POWER SUPPLY
08. CONNECTOR FOR MVB LINK AND MVB MAINTENANCE, RJ45
09. LABEL

Figure 19-I-02.11 TOM Event Recorder – Front Panel



01. UNIT CONTROL BOARD (SHOWN EXTRACTED FROM TOM)
02. SECURE MEMORY MODULE
03. IFT BOARD (SHOWN EXTRACTED FROM TOM)
04. MEL BOARDS
05. POWER SUPPLY BOARD
06. MVB MODULE BOARD

Figure 19-I-02.12 TOM Event Recorder – Boards

The Front Panel of the Event Recorder is equipped with:

- 6 DIN41612 type E male connectors for Power supply board, IFT board, MEL boards
- 1 USB male connector for maintenance
- 1 SUBD9 female connector for maintenance
- 3 LEDs to provide indication on the recorder status
- 1 earth stud
- 1 SUBD9 female connector and 1 SUBD9 male connector for MVB Link
- 1 SUBD9 female connector for maintenance
- 1 RJ45 female connector (Ethernet unused)

19-I-02.02.01 The Power Supply Board

TBS

19-I-02.02.02 The Unit Control Board

The Unit Control Board with the PCMCIA interface is the supervisor of the Data recorder's functions. It contains:

- 1 Microprocessor
- 2 Flash Memories
- 1 EPROM for the storage of parameters
- 2 RAM for the Software variables
- 1 EPL matrix for the address decoding
- 1 Real Alarm Clock
- 1 Watch Dog
- 1 Interface USB for connecting the PTU
- 1 Interface RS232 for connecting the PTU

19-I-02.02.03 The IFT Board

The IFT board provides 8 channels for analogue inputs and interfaces with the following elements:

- The MEL and MVB Module internal boards (isolated LONWORKS interface with transformer)
- The internal secure memory module (LONWORKS interface without isolation),
- 2 frequency inputs for speed acquisition

19-I-02.02.04 The MEL Boards

The MEL boards collect and process the following digital inputs:

- 2 fully isolated battery digital inputs (separate references)
- 14 group isolated battery digital inputs (common reference: -BATT)

19-I-02.02.05 The MVB Module Board

TBS

19-I-02.02.06 The Secure Memory Module

The Secure Memory Module is a memory where the events are stored with a high degree of protection.

The Secure Memory Module operates in FIFO mode: when the memory is full, new data erase the oldest ones.

The data recorded must be read with SAM software.

The data stored in the TOM Secure Memory are protected against the effects of collision.

Data are stored in flash memories, which guarantee 10 years of storage without any loss of information. These data are protected against critical conditions such as:

- Fire
- Crushing force
- Fluids like battery acids, diesel oil, engine oil...
- Fire fighting foams
- Huge magnetic fields due to catenary falls

19-I-02.02.07 Operation

19-I-02.02.07.01 Data Acquisition

TOM receives a wide range of information coming from different modules:

- Digital inputs from MEL
- Analogue inputs from IFT
- MVB Link

The main features of the data acquisition are:

- Different sampling methods are available for each input. For instance, the speed signal can be sampled against time, distance or steps of speed
- TOM has its own internal clock and calculates the acceleration and the distance traveled from the speed
- Some inputs are fully isolated to allow a direct wiring of safety critical signals
- Each digital input has its own filter which can be adjusted to record either a short pulse on a push button or to reject noise on relays

Figure 19-I-02.17 shows the Internal Architecture of the TOM Event Recorder.

The signals acquired are listed in the following tables, divided by source.

a) MEL Board Digital Inputs

The TOM Event Recorder is equipped with four MEL Boards (refer to Figure 19-I-02.12), each one of which is connected to the TOM through 4 connectors J2-J5 (MEL with J2, MEL 2 with J3, MEL 3 with J4 and MEL4 with J5).

The following Tables show the input numbers and the related card pins with the related data (Description, Voltage, type).

Table 19-I-02.1 MEL 1 (J2) Digital Inputs

Card	Input #	Card Pins		Name of Signal displayed with SAM	Input Voltage	Value displayed with SAM	Type of Signal	Graphic display in SAM
		+	-					
MEL1	1	E12	E10	Logical Input 1	0	0	Vital	Y
					37.5 Vdc	1		
	2	C12	E6	Logical Input 2	0	0	Vital	Y
					37.5 Vdc	10		
	3	E14	C30 E30	Horn & Gong #1	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	4	C14		Logical Input 4	0	0	Non Vital	Y
					37.5 Vdc	1		
	5	E16		Horn & Gong #2	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	6	C16		Logical Input 6	0	0	Non Vital	Y
					37.5 Vdc	1		
	7	E18		Horn & Gong #3	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	8	C18		Logical Input 8	0	0	Non Vital	Y
					37.5 Vdc	1		
	9	E20		Horn & Gong #4	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	10	C20		Logical Input 10	0	0	Non Vital	Y
					37.5 Vdc	1		
	11	E22		Right door CL. M.O	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	12	C22		EMI recorder tripped	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	13	E24		Left door CL. M.O	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	14	C24		Brake appl. Bypass - Car B	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	15	E26		Right door CL. S.O	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	16	C26		No motion bypass - Car B	0	OFF	Non Vital	Y
					37.5 Vdc	ON		

Table 19-I-02.2 MEL 2 (J3) Digital Inputs

Card	Input #	Card Pins		Name of Signal displayed with SAM	Input Voltage	Value displayed with SAM	Type of Signal	Graphic display in SAM
		+	-					
MEL2	17	E12	E10	Logical Input 17	0	0	Vital	Y
					37.5 Vdc	1		
	18	C12	E6	Logical Input 18	0	0	Vital	Y
					37.5 Vdc	OFF		
	19	E14	C30 E30	FWD	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	20	C14		Right door bypass - Car B	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	21	E16		REV	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	22	C16		Left door bypass - Car B	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	23	E18		Cab A Act.	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	24	C18		Propulsion cut out - Car B	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	25	E20		Cab B Act.	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	26	C20		TCU2 fault	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	27	E22		Logical Input 27	0	0	Non Vital	Y
					37.5 Vdc	1		
	28	C22		Logical Input 28	0	0	Non Vital	Y
					37.5 Vdc	1		
	29	E24		F.B fault	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	30	C24		Logical Input 30	0	0	Non Vital	Y
					37.5 Vdc	1		
	31	E26		FSB	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	32	C26		ECUb cut out	0	OFF	Non Vital	Y
					37.5 Vdc	ON		

Table 19-I-02.3 MEL 3 (J4) Digital Inputs

Card	Input #	Card Pins		Name of Signal displayed with SAM	Input Voltage	Value displayed with SAM	Type of Signal	Graphic display in SAM
		+	-					
MEL3	33	E12	E10	EB trainline	0	OFF	Vital	Y
					37.5 Vdc	ON		
	34	C12	E6	SCEB trainline	0	OFF	Vital	Y
					37.5 Vdc	ON		
	35	E14	C30 E30	Coast	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	36	C14		Logical Input 36	0	0	Non Vital	Y
					37.5 Vdc	1		
	37	E16		Motoring	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	38	C16		TCU1 fault A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	39	E18		Left door CL. S.O.	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	40	C18		Dead man tripped	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	41	E20		No motion	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	42	C20		Logical Input 42	0	0	Non Vital	Y
					37.5 Vdc	1		
	43	E22		Sanding on	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	44	C22		No motion bypass - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	45	E24		track brakes app.	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	46	C24		Brake appl. Bypass - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	47	E26		35 Mph	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	48	C26		Left door bypass - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		

Table 19-I-02.4 MEL4 (J5) Digital Inputs

Card	Input #	Card Pins		Name of Signal displayed with SAM	Input Voltage	Value displayed with SAM	Type of Signal	Graphic display in SAM
		+	-					
MEL4	49	E12	E10	Logical Input 49	0	0	Vital	Y
					37.5 Vdc	1		
	50	C12	E6	Logical Input 50	0	0	Vital	Y
					37.5 Vdc	1		
	51	E14	C30 E30	Right door release	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	52	C14		TWC by-pass	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	53	E16		EMI bypass	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	54	C16		Left door release	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	55	E18		Left door open	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	56	C18		Propulsion cut out - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	57	E20		Right door open	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	58	C20		ECUa cut out	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	59	E22		Left door close	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	60	C22		ECUc cut out	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	61	E24		Right door close	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	62	C24		EB Loop power supply bypass	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	63	E26		ATP bypass	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	64	C26		Right door bypass - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		

IFT Board Analog Inputs

The IFT Board collects all Analog Input Signals (refer to Figure 19-I-02.13).

Card	Input #	Card Pins		Name of Signal Displayed with SAM	Input Signal	Value Displayed with SAM	Scale	Unit Displayed with SAM	Recording Step	Graphic Display in SAM
IFT	1	A28	A30	Master Controller Position - Car A	[4 mA,20 mA] (High Z)	[-100%,+100%]	1 bit = 1%	%	10%	Y
	2	C28	E28	Master Controller Position - Car B	[4 mA,20 mA] (High Z)	[-100%,+100%]	1 bit = 1%	%	10%	Y
	3	C16	E14	Analogue input 3	[0V,10V]	[0mV-10000mV]	1 bit = 1mV	mV	100 mV	N
	4	E18	A14	Analogue input 4	[0V,10V]	[0mV-10000mV]	1 bit = 1mV	mV	100 mV	N
	5	C24	A20	Analogue input 5	[4 mA,20 mA]	[0mA-20mA]	1 bit = 1mV	mA	5 mA	N
	6	A22	E20	Analogue input 6	[4 mA,20 mA]	[0mA-20mA]	1 bit = 1mV	mA	5 mA	N
	7	C22	E22	Analogue input 7	[4 mA,20 mA]	[0mA-20mA]	1 bit = 1mV	mA	5 mA	N
	8	A26	C20	Analogue input 8	[4 mA,20 mA]	[0mA-20mA]	1 bit = 1mV	mA	5 mA	N
	9	C2	A24 E26	Speed	[0Hz,3500Hz]	[0Mph-70Mph]	1 bit = 0,5 Mph	mph	from 0-25 mph: 1 mph from 26-70 mph: 2 mph	Y
	10	C30	E30	spare						N

Figure 19-I-02.13 IFT Board Analog Inputs

The frequency signals coming from the B Motor Truck speed sensor (15801) are also sent to the TOM Event Recorder (refer to).

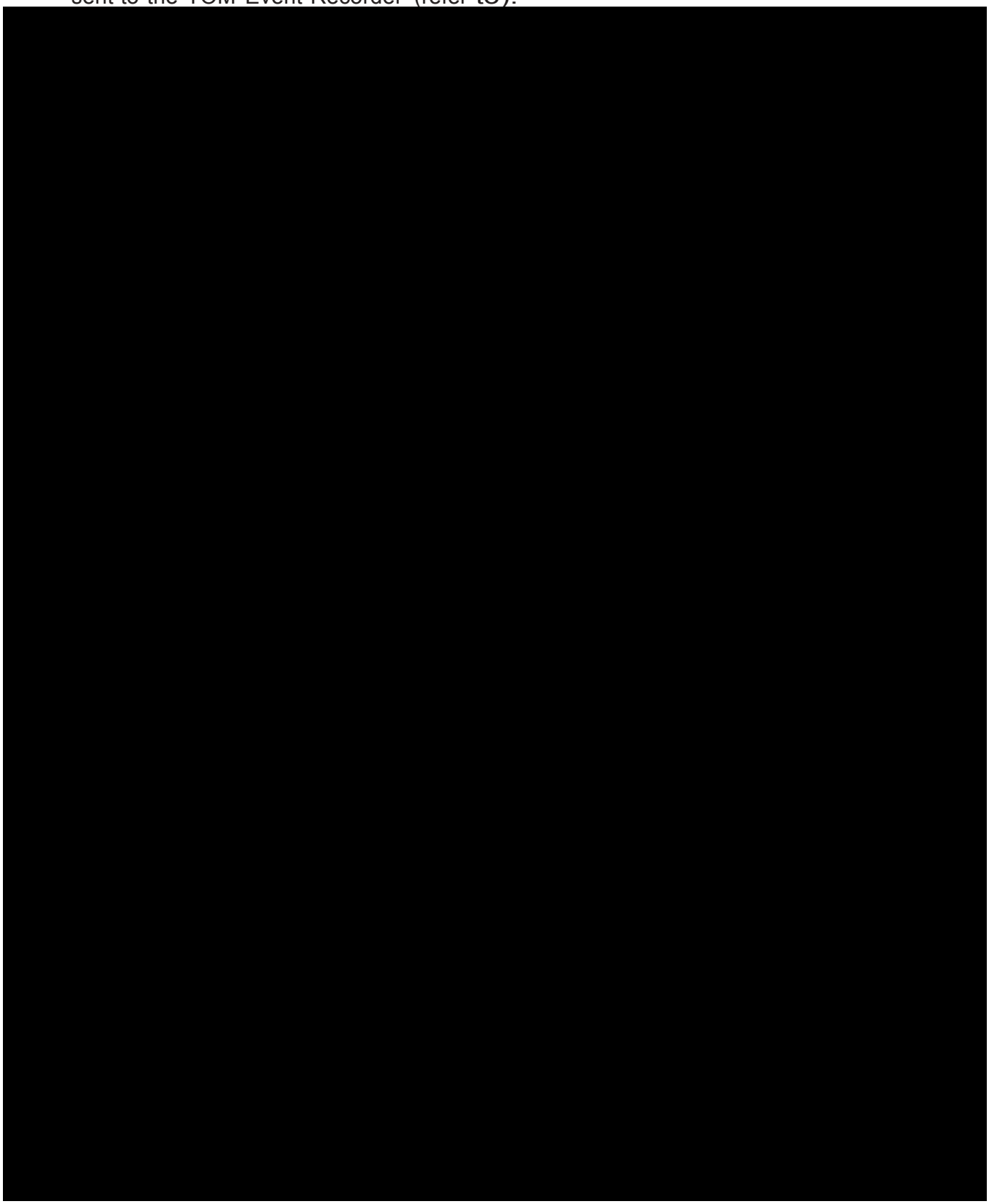
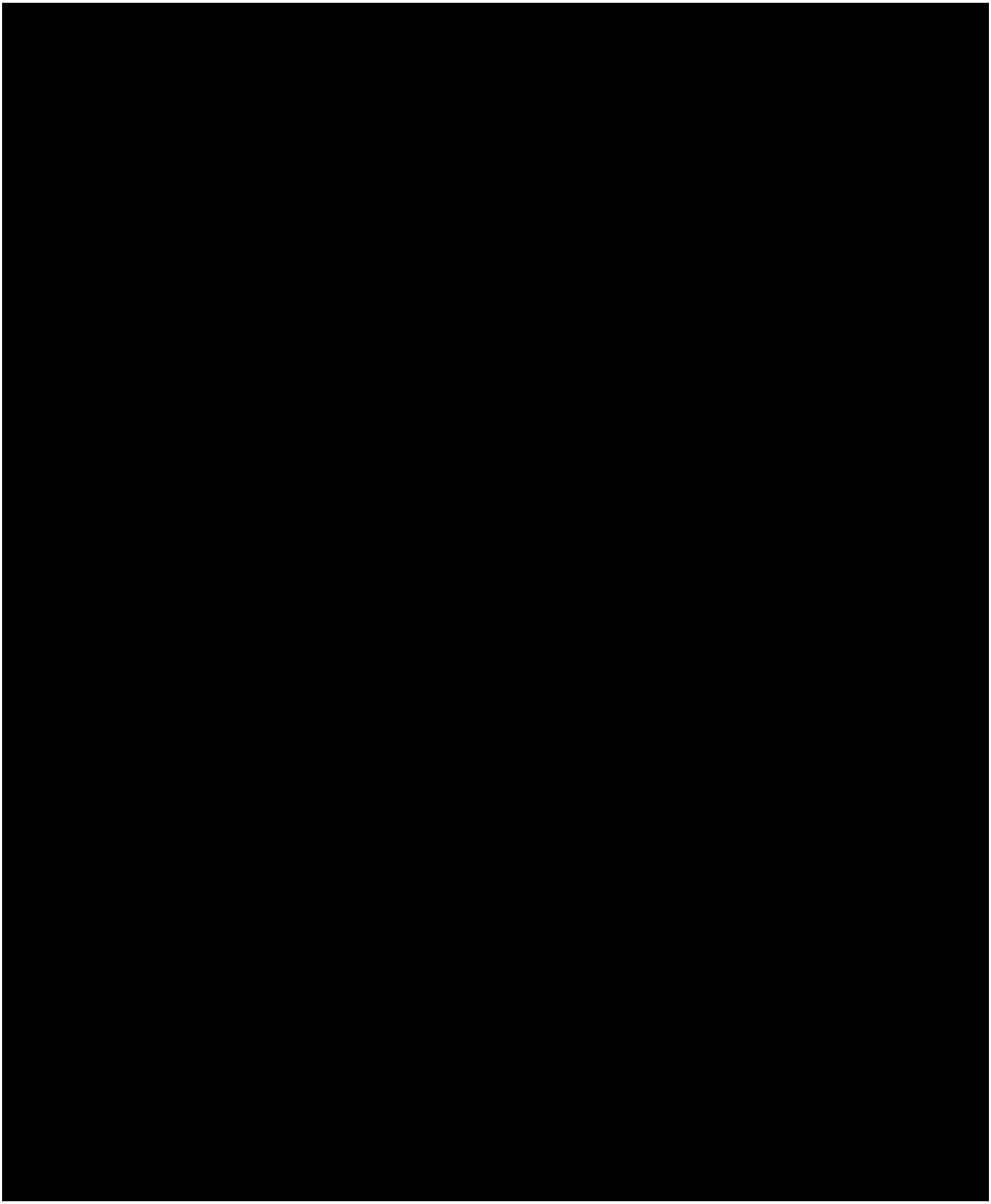
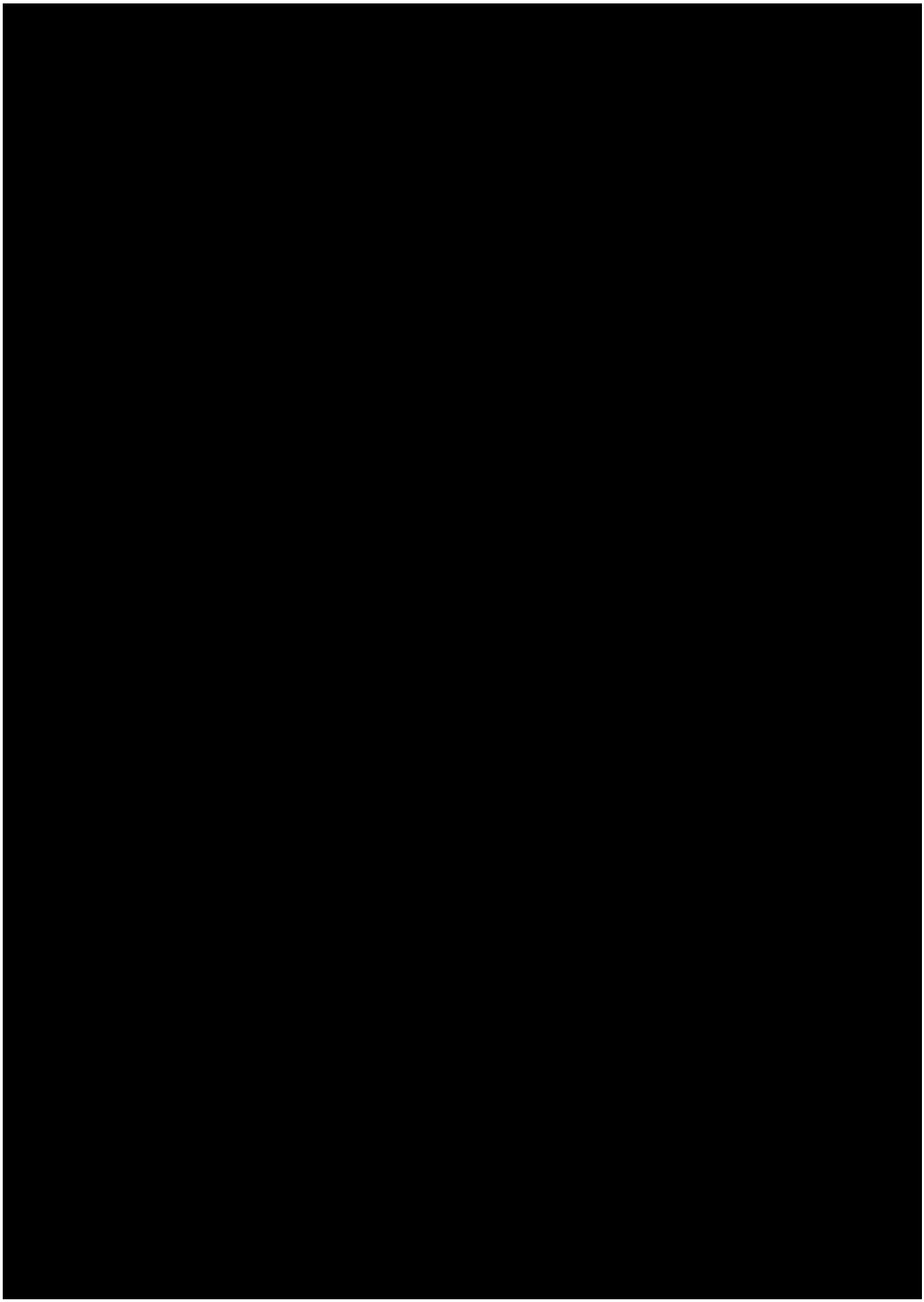


Figure 19-1-02.14 Signals to the Event Recorder (1 of 2)





19-I-02.02.07.02 Signal Monitoring – Sampling Rate

The Digital Signals are sampled by the Event Recorder every 10 ms.

The Analogue Signals are sampled by the Event Recorder every 20 ms.

For the MVB signals, the sampling rate is equal to the cycle time of each MVB port (refer to the “Cycle” column of).

19-I-02.02.07.03 Speed Processing

The speed can be calculated by the Event Recorder through one or two frequency inputs.

The Event Recorder frequency input(s) can be connected to a speed sensor. The electrical characteristics of the signal must be compatible with the TOM frequency input(s).

The Frequency Inputs must:

- Be Not isolated
- Have a ground reference
- Be Differential Inputs

Table 19-I-02.5 Frequency Inputs

Electrical Insulation	No
Low Level Voltage Detection	<5V
High Level Voltage Detection	>14.4V
Maximum Differential Voltage	24V
Common Mode Voltage Range (Vm)	-100V to 100V
Common Mode Input Impedance	200kΩ
Input Impedance	4.64kΩ
Current Consumption per Input	2.8mA at 13v
Maximum Frequency	3500 Hz
Accuracy	<2% (<5% at 25°C)

a) Speed Sensor Interface

One speed sensor will be connected to one frequency input of the Event Recorder according to the diagram below:

Figure 19-I-02.18 Speed Sensor Connection Schematic

A 3 wires twisted shielded cable is recommended between the speed sensor and the Event Recorder.

The speed calculated by the Event Recorder from the speed probe is compared to the speed which is present on the MVB bus.

Should the speed probe provide no pulses whereas a speed is detected on the MVB bus, a fault is recorded in the maintenance memory of the recorder.

From the speed probe, the Event Recorder also calculates the acceleration of the vehicle being recorded.

b) Wheel Diameter Adjustment

The standard method to adjust the wheel diameter is with SAM software (programmable parameter).

As an option, the diameter of the wheel on which the Event Recorder speed sensor is mounted can be deducted from the reference wheel diameter and from axle 1 speed of TCU_A which are present in the MVB data.

The adjustment is to be performed at stabilized speed.

19-I-02.02.07.04 Data Recording

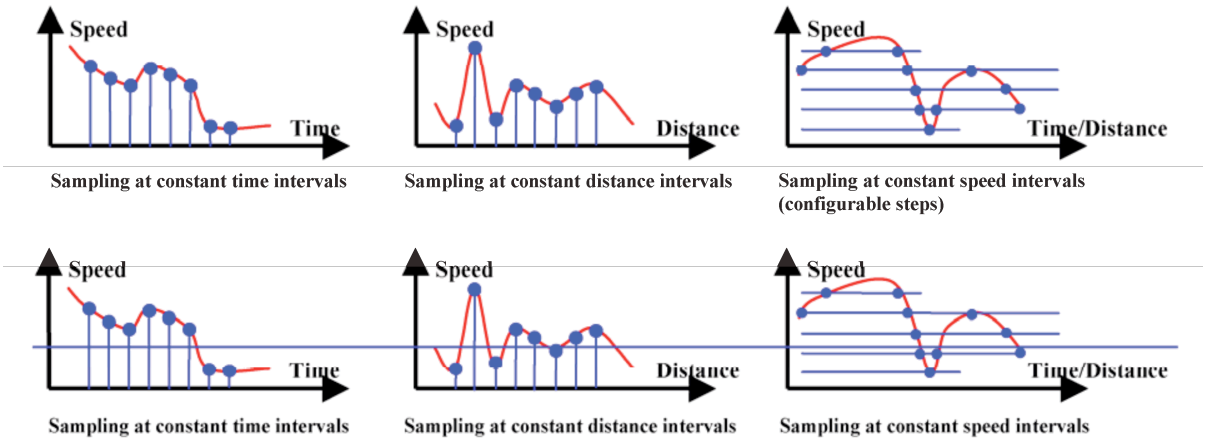
The TOM recorder stores data in different memories:

The Secure Memory stores the journey data that are required in case of juridical investigations.

The data is protected against loss and corruption in the event of an accident.

The User Long Memory stores the same data as the secure memory. It allows quicker downloading than the secure memory.

Different recording methods can be considered. For instance, the speed signal can be recorded against time, distance or steps of speed:



For a more efficient use of the memory space, in the proposed system, the recording is triggered as explained below:

- Digital inputs and discrete data (i.e., Overspeed Indicator – MVB port 810): each time there is a modification of status (i.e. all the modifications are recorded provided that they are compatible with the sampling rate)
- Analogue inputs: when it crosses a configurable step
- MVB analogue signals: when it crosses a pre-defined step

The specification as well as our experience lead us to propose the following configuration:

Table 19-I-02.6 Data Recording Configuration

Type of Data	Criteria of Recording
Events related to the modification of input signals:	
Digital Inputs	Each time there is a modification of status.
Analogue inputs	When the signal crosses a configurable step.
Speeds	The speed calculated by the ER from its speed probe and the MVB_ATP_ADU_Speed are recorded as defined below: - From 0 to 25 Mph : steps of 1 Mph - Above 25 Mph : steps of 2 Mph Note : these values can be modified in the ER configuration file (same configuration for both signals).
MVB data	The rules below are applied : - Discrete data : every changes are recorded - Analogue signals : pre-defined steps - GPS coordinates : stored as a context to the speed event
The recorder also records the following events:	
Power up	Time and distance are recorded at each power up of the recorder.
Start and stop of the vehicle	Time and distance are recorded at each start and stop of the vehicle.
Time counter (resolution : 100 ms)	The counter is reset every 1 minute.
Distance counter (resolution : 1/1000 mile)	The counter is reset every 1 mile.
Acceleration (resolution : 1 mg)	The value is recorded every 10 mg (about 0,1 ms-2).
Time change of the Event Recorder	Each time change received through MVB is recorded.
Snapshot of all the variables.	Every 500 events

All the recorded events are time stamped with a resolution of 100ms.

The recorder's clock can be updated by using SAM software and a laptop or can be synchronized with an onboard equipment.

When the recorder is powered off, the time is saved thanks to an internal lithium cell battery. It is advised to change the cell every 6 years.

The commutation between summer-time and winter-time is managed automatically by the recorder.

When it is not synchronized with another device, the drift of the clock is lower than 5 minutes per year.

The Signals to be recorded are listed in the Annex (refer to paragraph 19-I-03.01).

In addition to this list, MVB spare signals can be managed by the recorder. A dedicated MVB port has been dedicated to this purpose.

To add new signals, proceed as follows:

	Update of SAM Software (new XML file)	New configuration file to be uploaded to each recorder	Software modification of each recorder
New digital input amongst the spare inputs	x		
New digital input board		x	
New analogue input amongst the spare inputs		x	
New MVB signals amongst the spare signals	x		
New MVB signals beyond the spare signals			x

The same events are recorded in real time in the various storage units of the system:

- Secure Memory of the TOM Event Recorder (6 MB)
- User Long Memory of the TOM Event Recorder (8 MB)

Figure 19-I-02.19 TOM Event Recorder Memory Organization

The analysis of the recorded data and the configuration of the recording can be done by using SAM software.

This software implements efficient search criteria which enable to easily find an "incident" in a large amount of data.

19-I-02.02.07.05 Recording Time

The recording time depends on the operational data of the vehicle.

The following parameters have been taken to estimate the recording time :

Length of the line	43,75 miles
Number of stations (i.e. number of start/ stops per trip)	14
Number of trips per day	8
Average speed	25 Mph
Mileage covered per day	350miles input signals
Operating time	20 hours
Number of changes per day of the Input Signals	Refer to the Annex, paragraph 19-I-03.01 “List of Recorded Data” – column “Changes per day”

With the above mentioned assumptions, as well as the capacity of the Secure Memory and the proposed configuration, the duration of recording can be estimated in approximately 73 hours (1,825 miles).

For the User Long Memory, it can be estimated in approximately 96 hours.

19-I-02.02.07.06 Clock Synchronization

The clock synchronization of the event recorder will be performed thanks to the MVB network available in the vehicle (time information included in the data coming from the MVB network).

The TOM Event Recorder has the capability of saving the clock information after the power down.

So, just the first synchronization is needed to set up the system.

A loss of MVB communication (complete or limited to the time information) could be signaled through the fault output of the recorder (refer to Section 19, Part II).

19-I-02.02.07.07 Data download

The Data Download is possible through:

- Serial link or USB
- PCMCIA card

NOTE: RS232 and USB cannot be used simultaneously.

Figure 19-I-02.20 Access to TOM Files and Parameters with SAM

19-I-02.02.07.08 Data Downloading from the Recorder

The data recorded into TOM can be downloaded by different ways.

The following table lists the memories that can be read by the different means.

	Secure memory	User long memory	Maintenance file
Serial/USB link	☑	☑	☑
PCMCIA		☑	☑

a) Serial/USB Link

A laptop computer with SAM (Software for Analysis and Maintenance) must be connected to the RS232 or USB port of the TOM recorder with a serial/USB cable.

The Software for Analysis and Maintenance allows the user to choose the type of data to be downloaded (journey files, maintenance file...).

Refer to the SAM "Installation and utilization manual" (document ZA 531 486.800) for complete procedure.

b) PCMCIA Board

A PCMCIA card (5V PC card ATA type I or II) must be inserted in the TOM PCMCIA port.

Then a copy of the recorded data is downloaded into the card.

Different indicators on the TOM front panel give information on the data downloading: a yellow LED indicates if the TOM is able to access to the PCMCIA card.

This LED flashes during data downloading and is switched off when the copy is finished.

A red LED indicates if the card is full or coming from another type of data recorder (LED flashing), or if the copy has failed (LED continuously ON).

If the card is full or not formatted (yellow LED ON but red LED flashing), the TOM can clear the card or format it if the user removes the card and inserts it again within two seconds.

The user long memory (journey files), the alarm memory and the maintenance file can be downloaded into the PCMCIA card.

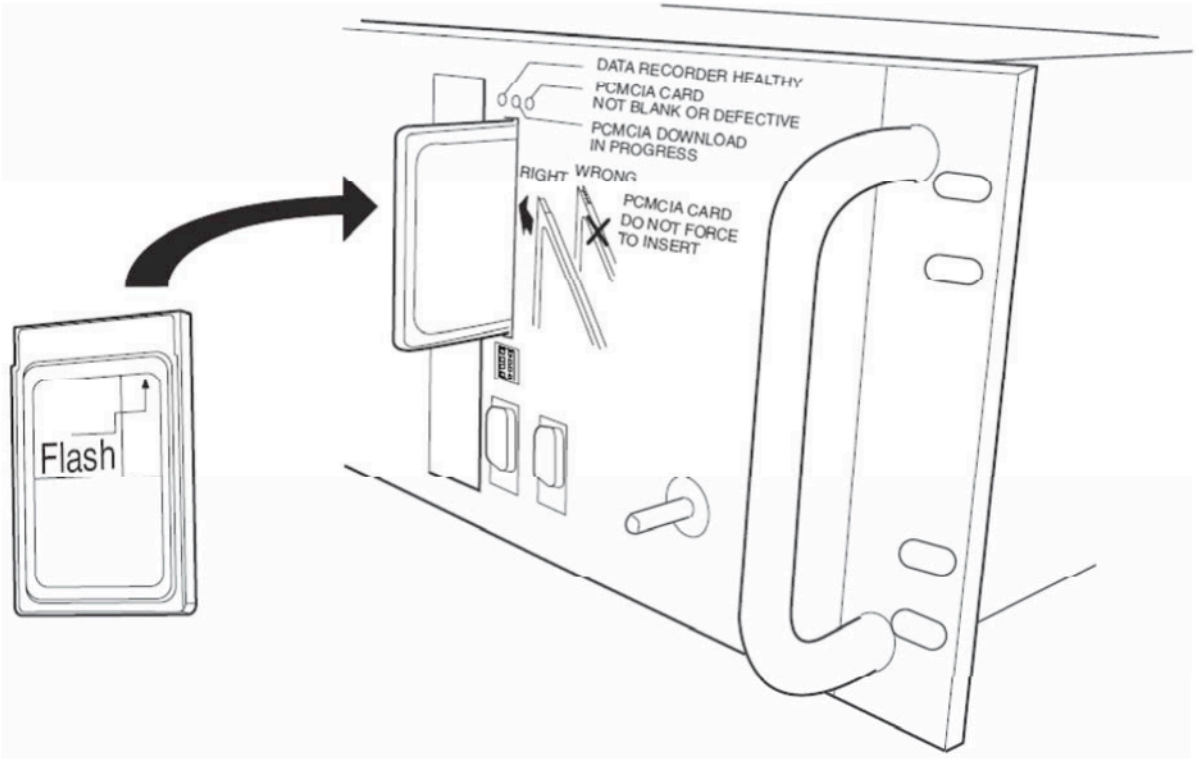


Figure 19-I-02.22 PCMCIA Card Slot

19-I-02.02.07.09 Transfer of Recorded data to the Analysis Station

a) Presentation of the PCMCIA reader

The data transferred on the PCMCIA card can be read by a PCMCIA reader.

PC software is provided in order to read the data stored on a PCMCIA card. This software is compatible with Windows 98 (OSR2), Windows 2000 and Windows XP Pro operating systems.

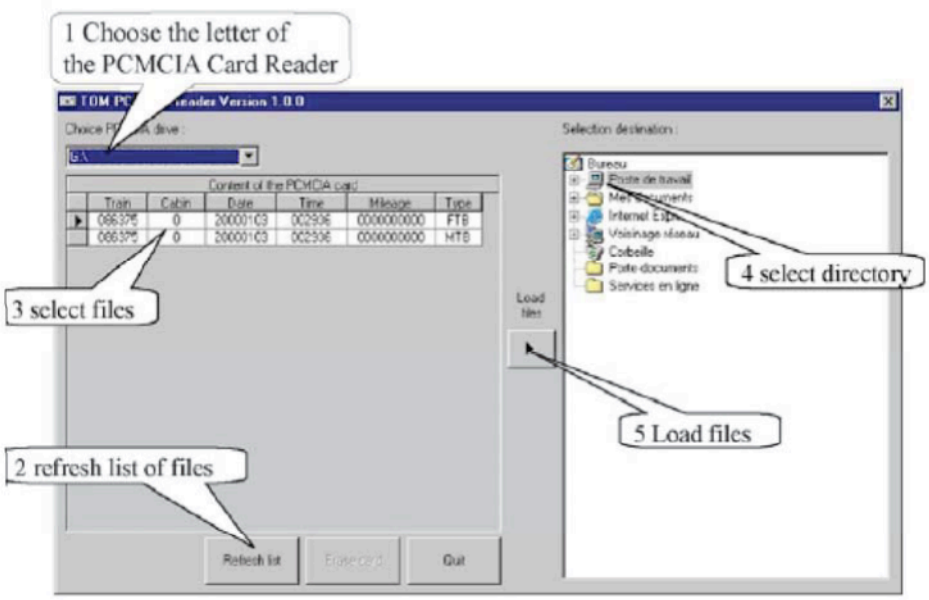
The loaded data are stored on the hard disk of the PC.

b) Data transfer procedure

1. Start the application in the menu

Start → Programs → TOM → PCMCIA READER → PCMCIA Reader.

2. When the software is running, select the letter corresponding to the PCMCIA reader in the pop-up list.
3. Click on "REFRESH LIST" to refresh the list of files stored in the PCMCIA card.
4. Select the requested files (FTB files are journey files and MTB files are TOM maintenance files).
5. Choose a folder in the window "selection destination" or create a new folder by clicking in this window with the right button of your mouse.
6. Load the selected files by clicking on the button with an arrow called "LOAD FILES".



Note: The button ERASE CARD will format a card. If you click on it, the card will be initialized with a correct boot and the login of the INI file.

Refer to the "User Manual for TOM PCMCIA Reader" (ZA534198.820) for details.

19-I-02.02.07.10 Data Analysis

The SAM software provides various functions for analyzing the data, such as:

- Visualize recorded data with multiple display modes
- Create new digital signals for display by combining existing signals search for recorded events using complex criteria
- Write annotations on specific points of the journey, convert journey data files in a standard format

Refer to the SAM "Installation and utilization manual" (document ZA531486.800) for details.

The minimum configuration required for installing and using the SAM software is the following:

- Pentium III 800 MHz minimum (Pentium IV recommended for journey files analysis),
- RAM memory 256 Mbytes (512 Mbytes recommended for journey filesanalysis)
- Hard disk space: 5 Gbytes
- RS232 port
- USB port
- Windows 98, Windows Millenium, Windows 2000 or Windows XP Operating System (Windows 2000 recommended for protected access)

19-I-02.02.07.11 Diagnostic Information

The health status of the recorder is provided by means of the MVB bus :

1. System OK (neither Major nor Minor faults)
2. Major faults
3. Minor faults

The following diagnostic information is also available:

- Failure of a digital input board
- Failure of the secure memory
- Failure of the CPU board memory
- Failure of the CPU real time clock
- Failure or short-circuit of the speed sensor power supply (24V)
- Failure or short-circuit of the analogue sensor power supply (15V)

19-I-03 ANNEX

19-I-03.01 List of Recorded Data

This paragraph contains the Lists of all Recorded Data.

Table 19-I-03.1 Digital Inputs Assignment List

Input #	Conn	Pin #	Signal Name	Digital Direct	Signal Level	Size of Data (bits)	Range	Graphic Display in SAM	Changes per day
DL1	J2	E12-E10		x	FIDI:37.5Vdc		0-1	Yes	200
DL2	J2	C12-E6		x	FIDI:37.5Vdc		0-1	Yes	200
DL3	J2	E14	Horn & Gong #1	x	DI:37.5Vdc		0-1	Yes	200
DL4	J2	C14		x	DI:37.5Vdc		0-1	Yes	200
DL5	J2	E16	Horn & Gong #2	x	DI:37.5Vdc		0-1	Yes	200
DL6	J2	C16		x	DI:37.5Vdc		0-1	Yes	200
DL7	J2	E18	Horn & Gong #3	x	DI:37.5Vdc		0-1	Yes	200
DL8	J2	C18		x	DI:37.5Vdc		0-1	Yes	200
DL9	J2	E20	Horn & Gong #4	x	DI:37.5Vdc		0-1	Yes	200
DL10	J2	C20		x	DI:37.5Vdc		0-1	Yes	200
DL11	J2	E22	Right Door CL M.O.	x	DI:37.5Vdc		0-1	Yes	200
DL12	J2	C22	EMI recorder tripped	x	DI:37.5Vdc		0-1	Yes	200
DL13	J2	E24	Left Door CL M.O.	x	DI:37.5Vdc		0-1	Yes	200
DL14	J2	C24	Brake applied By-pass – Car B	x	DI:37.5Vdc		0-1	Yes	200
DL15	J2	E26	Right Door CL S.O.	x	DI:37.5Vdc		0-1	Yes	200
DL16	J2	C26	No Motion By-pass – Car B	x	DI:37.5Vdc		0-1	Yes	200
DL17	J3	E12-E10		x	FIDI:37.5Vdc		0-1	Yes	200
DL18	J3	C12-E6		x	FIDI:37.5Vdc		0-1	Yes	200
DL19	J3	E14	FWD	x	DI:37.5Vdc		0-1	Yes	200
DL20	J3	C14	Right door bypass - Car B	x	DI:37.5Vdc		0-1	Yes	200
DL21	J3	E16	REV	x	DI:37.5Vdc		0-1	Yes	200
DL22	J3	C16	Left door bypass - Car B	x	DI:37.5Vdc		0-1	Yes	200
DL23	J3	E18	Cab A Act.	x	DI:37.5Vdc		0-1	Yes	200
DL24	J3	C18	Propulsion cut out - Car B	x	DI:37.5Vdc		0-1	Yes	200
DL25	J3	E20	Cab B Act.	x	DI:37.5Vdc		0-1	Yes	200
DL26	J3	C20	TCU2 fault	x	DI:37.5Vdc		0-1	Yes	200
DL27	J3	E22		x	DI:37.5Vdc		0-1	Yes	200
DL28	J3	C22		x	DI:37.5Vdc		0-1	Yes	200
DL29	J3	E24	F.B. fault	x	DI:37.5Vdc		0-1	Yes	200
DL30	J3	C24		x	DI:37.5Vdc		0-1	Yes	200
DL31	J3	E26	FSB	x	DI:37.5Vdc		0-1	Yes	200
DL32	J3	C26	ECUb cut out	x	DI:37.5Vdc		0-1	Yes	200

Table 19-I-03.1 Digital Inputs Assignment List

Input #	Conn	Pin #	Signal Name	Digital Direct	Signal Level	Size of Data (bits)	Range	Graphic Display in SAM	Changes per day
DL33	J4	E12-E10	EB trainline	x	FIDI:37.5Vdc		0-1	Yes	200
DL34	J4	C12-E6	SCEB trainline	x	FIDI:37.5Vdc		0-1	Yes	200
DL35	J4	E14	Coast	x	DI:37.5Vdc		0-1	Yes	200
DL36	J4	C14		x	DI:37.5Vdc		0-1	Yes	200
DL37	J4	E16	Motoring	x	DI:37.5Vdc		0-1	Yes	200
DL38	J4	C16	TCU1 fault A	x	DI:37.5Vdc		0-1	Yes	200
DL39	J4	E18	Left Door CL S.O.	x	DI:37.5Vdc		0-1	Yes	200
DL40	J4	C18	Dead man tripped	x	DI:37.5Vdc		0-1	Yes	200
DL41	J4	E20	No Mo ion	x	DI:37.5Vdc		0-1	Yes	200
DL42	J4	C20		x	DI:37.5Vdc		0-1	Yes	200
DL43	J4	E22	Sanding On	x	DI:37.5Vdc		0-1	Yes	200
DL44	J4	C22	No Mo ion By-pass – Car A	x	DI:37.5Vdc		0-1	Yes	200
DL45	J4	E24	Track Brake applied	x	DI:37.5Vdc		0-1	Yes	200
DL46	J4	C24	Brake applied By-pass – Car A	x	DI:37.5Vdc		0-1	Yes	200
DL47	J4	E26	35 mph	x	DI:37.5Vdc		0-1	Yes	200
DL48	J4	C26	Left Door By-pass – Car A	x	FIDI:37.5Vdc		0-1	Yes	200
DL49	J5	E12-E10		x	FIDI:37.5Vdc		0-1	Yes	200
DL50	J5	C12-E6		x	DI:37.5Vdc		0-1	Yes	200
DL51	J5	E14	Right Door Release	x	DI:37.5Vdc		0-1	Yes	200
DL52	J5	C14	TWC By-pass	x	DI:37.5Vdc		0-1	Yes	200
DL53	J5	E16	EMI By-pass	x	DI:37.5Vdc		0-1	Yes	200
DL54	J5	C16	Left Door Release	x	DI:37.5Vdc		0-1	Yes	200
DL55	J5	E18	Left Door Open	x	DI:37.5Vdc		0-1	Yes	200
DL56	J5	C18	Propulsion Cut-out – Car A	x	DI:37.5Vdc		0-1	Yes	200
DL57	J5	E20	Right Door Open	x	DI:37.5Vdc		0-1	Yes	200
DL58	J5	C20	ECUA Cut-out	x	DI:37.5Vdc		0-1	Yes	200
DL59	J5	E22	Left Door Close	x	DI:37.5Vdc		0-1	Yes	200
DL60	J5	C22	ECUc Cut-out	x	DI:37.5Vdc		0-1	Yes	200
DL61	J5	E24	Right Door Close	x	DI:37.5Vdc		0-1	Yes	200
DL62	J5	C24	Power Supply By-pass	x	DI:37.5Vdc		0-1	Yes	200
DL63	J5	E26	ATP By-pass	x	DI:37.5Vdc		0-1	Yes	200
DL64	J5	C26	Right Door By-pass – Car A	x	DI:37.5Vdc		0-1	Yes	200
			TOTAL	64					
			Spare	15					
			Used	49					

Table 19-I-03.2 Analog Inputs Assignment List

Input #	PIN #	Signal Name	Analog Direct (AI)	Signal Level	Size of Data (bits)	Range	Unit	Graphic Display in SAM	Changes per day	Recording Step
AI1	A28-A30	Master Controller Position – Car A	x	AI:4-20mA High Z	16	-100; +100	%	Yes	2240	10%
AI2	C28-C30	Master Controller Position – Car B	x	AI:4-20mA High Z	16	-100; +100	%	Yes	2240	10%
AI3	C16-E14	spare	x	AI:0-10V	16					
AI4	E18-A14	spare	x	AI:0-10V	16					
AI5	C24-A20	spare	x	AI:4-20mA Ext PS	16					
AI6	A22-E20	spare	x	AI:4-20mA OTMR PS	16					
AI7	C22-E22	spare	x	AI:4-20mA OTMR PS	16					
AI8	A26-C20	spare	x	AI:4-20mA OTMR PS	16					
FI1	C2-A24-E26	spare	x	AI: frequency	16	0-70	mph	Yes	10080	From 0 to 25mph: 1mph Above 25mph: 2mph
FI2	C30-E30	spare	x	AI: frequency						
		TOTAL	10							

Table 19-I-03.3 MVB Data

#	Description	From MVB	MVB port #	Data Type	Byte off set	Bit Off set	Cycle (ms)	Graphics Display in SAM	Changes per day	Recording Step	Comments
	TCU A is MoV	x	105	B1	2	0	64	Y	10	NA	
	TCU B is MoV	x	106	B1	2	0	64	Y	10	NA	
	Vehicle Count	x	100	U8	3	0	64	N	1	NA	
MVB_6	Propulsion/Brake Effort Cmd	x	105 or 106	18	3	0	64	Y	650	10%	The choice of the port number depends on which TCU is master and is made according to the bit MoV in port 105 and port 106. Note : same signal as Analog Inputs 1 and 2.
MVB_1	Time and Date	x	510 or 610	TD48	0	0	256	N	1	NA	This parameter is used to synchronize the Event Recorder internal clock. The choice of the port number to be used (510 or 610) is made according to the bit MoV in port 105 and port 106.
MVB_12#1	Propulsion A Sliding Status	x	401	B1	26	0	32	Y	200	NA	
MVB_12#2	Propulsion B Sliding Status	x	411	B1	26	0	32	Y	200	NA	
MVB_12#3	ECU A Sliding Status	x	210	B1	0	4	32	Y	200	NA	
MVB_12#4	ECU B Sliding Status	x	220	B1	0	4	32	Y	200	NA	
MVB_12#5	ECU C Sliding Status	x	230	B1	0	4	32	Y	200	NA	
MVB_7	ATP_ADU Speed	x	810 or 820	B8	4	0	256	Y	10080	Same as the speed from the speed sensor FI_1	
MVB_2#1	Overspeed Indicator	x	810 or 820	A2	0	0	256	N	1	NA	The choice of the port number depends on which TCU is master and is made according to the bit MoV in port 105 and port106.
MVB_2#2	ATP Failure Indicator	x	810 or 820	A2	0	2	256	N	1	NA	
MVB_2#3	Street Running Indicator	x	810 or 820	A2	0	4	256	N	200	NA	
MVB_2#4	Stop&Proceed Indicator	x	810 or 820	A2	0	6	256	N	200	NA	
MVB_2#5	Alarm Indicator	x	810 or 820	A2	1	0	256	N	1	NA	
MVB_2#6	Overspeed Penalty	x	810 or 820	B1	1	2	256	Y	1	NA	
MVB_2#7	ATP_ADU Communication	x	810 or	B1	1	3	256	Y	1	NA	

Table 19-I-03.3 MVB Data

#	Description	From MVB	MVB port #	Data Type	Byte off set	Bit Off set	Cycle (ms)	Graphics Display in SAM	Changes per day	Recording Step	Comments
	Failure		820								
MVB_13#1	ECU A EB Ac ivated	x	108	B1	13	0	64	Y	10	NA	
MVB_13#2	ECU A WSP Valve detected	x	108	B1	13	1	64	Y	200	NA	
MVB_13#3	ECU B EB Ac ivated	x	108	B1	13	2	64	Y	10	NA	
MVB_13#4	ECU B WSP Valve detected	x	108	B1	13	3	64	Y	200	NA	
MVB_13#5	ECU B EB Ac ivated	x	108	B1	13	4	64	Y	10	NA	
MVB_13#6	ECU C WSP Valve detected	x	108	B1	13	5	64	Y	200	NA	
MVB_14#1	PICA0 Connection Status	x	108	B1	14	0	64	Y	1	NA	
MVB_14#2	PICA1 Connection Status	x	108	B1	14	1	64	Y	1	NA	
MVB_14#3	PICB0 Connection Status	x	108	B1	14	2	64	Y	1	NA	
MVB_14#4	PICB1 Connection Status	x	108	B1	14	3	64	Y	1	NA	
MVB_14#5	PICA0 Communication Status	x	108	A2	14	4	64	N	1	NA	
MVB_14#6	PICA1 Communication Status	x	108	A2	14	6	64	N	1	NA	
MVB_14#7	PICB0 Communication Status	x	108	A2	15	0	64	N	1	NA	
MVB_14#8	PICB1 Communication Status	x	108	A2	15	2	64	N	1	NA	
MVB_3#1	Vehicle ID1	x	108	B16	3	0	64	N	1	NA	The bit valid of the port is to be used also
MVB_3#2	Vehicle ID2	x	151	B16	3	0	64	N	1	NA	The bit valid of the port is to be used also
MVB_3#3	Vehicle ID3	x	152	B16	3	0	64	N	1	NA	The bit valid of the port is to be used also
MVB_3#4	Vehicle ID4	x	153	B16	3	0	64	N	1	NA	The bit valid of the port is to be used also
MVB_4#1	GPS Position: X coordinate	x	710	B32	16	0	256	N			Recorded as a context with the speed event (FI_1)
MVB_4#2	GPS Position: Y coordinate	x	710	B32	20	0	256	N			Recorded as a context with the speed event (FI_1)
MVB_4#3	GPS Position: Z coordinate	x	710	B32	24	0	256	N			Recorded as a context with the speed event (FI_1)

Table 19-I-03.3 MVB Data

#	Description	From MVB	MVB port #	Data Type	Byte off set	Bit Off set	Cycle (ms)	Graphics Display in SAM	Changes per day	Recording Step	Comments
MVB_5	Reference Wheel Diameter	x	520	U8	10	0	256	N	1	NA	This is not the diameter of the wheel on which is mounted the speed sensor of the Event Recorder.
MVB_9#1	TCUA Delivered Effort	x	401	116	18	0	32	Y	16800	TBD	
MVB_9#2	TCUB Delivered Effort	x	411	116	18	0	32	Y	16800	TBD	
MVB_10	LON Life Signal	x	520	B16	20	0	256	N	1	NA	
MVB_11	MVB Life Signal	x	520	B16	22	0	256	N	1	NA	
MVB_16	ATP Penalty Brake Activation	x	810 or 820	B1	1	4	256	Y	1	NA	The choice of the port number depends on which TCU is master and is made according to the bit MOv in port 105 and port 106.
MVB_18#1	TCUA Dynamic Inverter	x	431	B1	12	2	256	Y	1	NA	
MVB_18#2	TCUB Dynamic Inverter	x	432	B1	12	2	256	Y	1	NA	
MVB_17#1	TCUA Inverter Fault	x	421	B1	10	1	256	Y	1	NA	
MVB_17#2	TCUB Inverter Fault	x	402	B1	10	1	256	Y	1	NA	
MVB_8#1	ECUA Brake Cylinder Pressure	x	210	U8	3	0	32	Y	16800	100mBar	
MVB_8#2	ECUB Brake Cylinder Pressure	x	220	U8	3	0	32	Y	16800	100mBar	
MVB_8#3	ECUC Brake Cylinder Pressure	x	230	U8	3	0	32	Y	16800	100mBar	
MVB_19	Emergency Door Activation Status	x	421 or 402	B1	0	2	256	Y	1	NA	
	TOTAL	53									

NOTE: Meaning of the abbreviations used in the Table above (Column Signal Level).

DESCRIPTION		Power Supply provided by OTMR (OTMR PS)	External Power Supply (Ext PS)	No Power Supply required	For the details of the electrical interface refer to the documents indicated below
DI: 37.5Vdc	Digital Input with common reference (37.5V)		X		"ZA544186 - TOM Los AngelesTechnical Description (issue E).pdf" section 8.2.2 (Group Isolated Battery Digital Inputs)
FIDI: 37.5Vdc	Fully Isolated Digital Input (37,5V)		X		"ZA544186 - TOM Los AngelesTechnical Description (issue E).pdf" section 8.2.1 (Fully Isolated Battery Digital Inputs)
AI: 10V	Analogue Input 0 to 10 V		X		"ZA544186 - TOM Los AngelesTechnical Description (issue E).pdf" section 8.3.4 (0-10V inputs)
AI: 4-20mA Ext PS	Analogue Input 4 to 20 mA		X		"ZA544186 - TOM Los AngelesTechnical Description (issue E).pdf" section 8.3.1 (4-20mA current loop inputs)
AI: 4-20mA OTMR PS	Analogue Input 4 to 20 mA	x			"ZA544186 - TOM Los AngelesTechnical Description (issue E).pdf" section 8.3.2 (4-20mA 2-wire sensor inputs)
AI: 4-20mA High Z	Analogue Input 4 to 20 mA		x		"ZA544186 - TOM Los AngelesTechnical Description (issue E).pdf" section 8.3.3 (High impedance 4-20mA current loop input)
AI: Frequency	Frequency Input	x			"ZA544186 - TOM Los AngelesTechnical Description (issue E).pdf" section 8.4 (Frequency inputs)
MVB	MVB bus			x	"ZA544186 - TOM Los AngelesTechnical Description (issue E).pdf" section 8.6

19-I-03.02 Ingress Protection Ratings (IP Codes)

Table 19-I-03.4 Ingress Protection Ratings (IP Codes)

Ingress Protection Classification			
First Digit		**Second Digit**	
IP	**Protection Provided**	**IP**	**Protection Provided**
0	No Protection	0	No Protection
1	Protected against solid objects up to 50mm e.g. accidental touch by hands	1	Protected against vertically falling drops of water e.g. condensation
2	Protected against solid objects up to 12mm e.g. fingers	2	Protected against direct sprays of water up to 15 deg from the vertical
3	Protected against solid objects over 2.5mm e.g. tools	3	Protected against direct sprays of water up to 60 deg from the vertical
4	Protected against solid objects over 1mm e.g. wires	4	Protected against water sprayed from all directions - limited ingress permitted
5	Protected against dust - limited ingress (no harmful deposit)	5	Protected against low pressure jets of water from all directions - limited ingress permitted
6	Totally protected against dust	6	Protected against strong jets of water e.g. for use on shipdecks - limited ingress permitted
		7	Protected against the effects of immersion between 15cm and 1m
		8	Protected against long periods of immersion under pressure

SECTION 19

EVENT RECORDER

PART II

TROUBLESHOOTING

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SECTION 19

EVENT RECORDER

19-II-01 INTRODUCTION

This Section of the Running Maintenance and Service Manual is divided into three Parts:

- Part I: Theory of Operation
- Part II: Troubleshooting
- Part III: Maintenance

The content in this section is numbered so that paragraphs about different parts always have different numbers.

Part I – Theory of Operation

Part I gives a thorough overlook of the System structure and operation, by means of descriptions, figures, photos, schematics, block diagrams and flow charts, together with references to other documents or Sections when needed.

Part II – Troubleshooting

It gives the Maintenance Technicians a path to troubleshoot the System in every condition by means of the available tools:

- The PTU, equipped with the specific SW program
- The IDU
- The Fault Isolation Table

The Part III – Maintenance consists of:

- Preventive Maintenance
- Corrective Maintenance
- Consumable Materials
- Test Equipment, Tools & Special Tools

19-II-01.a LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

The Abbreviations, Acronyms and Symbols commonly used throughout this manual are given below with their related meaning.

Abbreviation	Meaning
ADU	Automatic Display Unit
AI	Analogue Input
ALM	Power Supply
DI	Digital Input
ECU	Electronic Control Unit (Brake)
ER	Event Recorder
FIDI	Fully Isolated Digital Input
FIFO	First In First Out
GTW	Gateway
IDU	Integrated Diagnostic Unit
LED	Light Emitted Diode
LRV	Light Rail Vehicle
MB	Mega Bytes
MTA	Metropolitan Transportation Authority
MVB	Multifunction Vehicle Bus
PC	Personal Computer
PTU	Portable Test Unit
SAM	Software for Analysis Maintenance
TCU	Traction Control Unit
TOM	Train On board Memory
UC	Unit Control
USB	Universal Serial Bus

19-II-01.b LIST OF DEFINITIONS

The Definitions commonly used throughout this manual are given below with their related meaning.

Definition	Meaning
'A' body section	The section of an articulated vehicle containing the pantograph
'B' body section	The section of an articulated vehicle not containing the pantograph
AW0	Empty car operating weight
AW1	Full seated load plus AW0
AW2	Standees at 4 persons per square meter plus AW1
AW3	Standees at 6 persons per square meter plus AW1
AW4	Standees at 8 persons per square meter plus AW1
Front door	The door close to the Operator's Cab
Rear door	The door close to the Articulation Section

19-II-01.c LIST OF MEASUREMENT UNITS AND SYMBOLS

The Measurement Units commonly used throughout this manual are given below with their related meaning.

Definition	Meaning
Ω	Ohm
°C	Celsius degree
°F	Fahrenheit degree
A	Ampere
ft	Foot
g	Gram
gal	Gallon
in	Inch
kg	Kilogram – approx 2.205 pounds
lb	Pound
m	Meter – approx 3.28 feet
mm	Millimeter – approx 0.0394 inches
N	Newton
rms	Root Mean Square Voltage
s	Second
V	Voltage
Vd	Differential Voltage
Vdc	Direct Current Voltage
Vin	Input Voltage
Vm	Common Voltage
W	Watt

19-II-02 TROUBLESHOOTING

The TOM Event Recorder Faults can be divided into:

- Major Faults: a Major Fault is a fault that may impact on the recorder's ability to correctly record mandatory information. The following are considered to be Major Faults:
    - Failure of the power supply board (ALM board)
    - Failure of the CPU board (CPU board)
    - Failure of any TOM digital input board (MEL board)
    - Failure of the cartridge (cartridge board)
    - Failure of the MVB interface unit
- Minor Faults: a Minor Fault will not impact the recording of mandatory information. The following are considered to be Minor Faults:
    - Failure of MVB interface
    - Failure of power supply provided by the Event Recorder to the external equipment (Speed sensor)

In the event of any fault, the TOM Event Recorder will continue to record information to the best of its ability.

Troubleshoot a fault by:

- TOM Event Recorder front side LEDs
- IDU
- PTU

19-II-02.01 Troubleshooting with TOM Event Recorder Front Side LEDs

The most immediate way to troubleshoot the TOM Event Recorder can be accomplished by reading the LEDs on the front side of the TOM Event Recorder Rack.

19-II-02.01.01 LED on the Recorder

A green LED, located on the front panel of the Recorder, indicates that the equipment is working properly.

The label of this LED says "DATA RECORDER HEALTY".

Each time the Data Recorder is powered up, it performs of self-test routines prior to this LED illumination.

If any fault occurs to the Data Recorder or to another part of equipment, the LED is switched off.

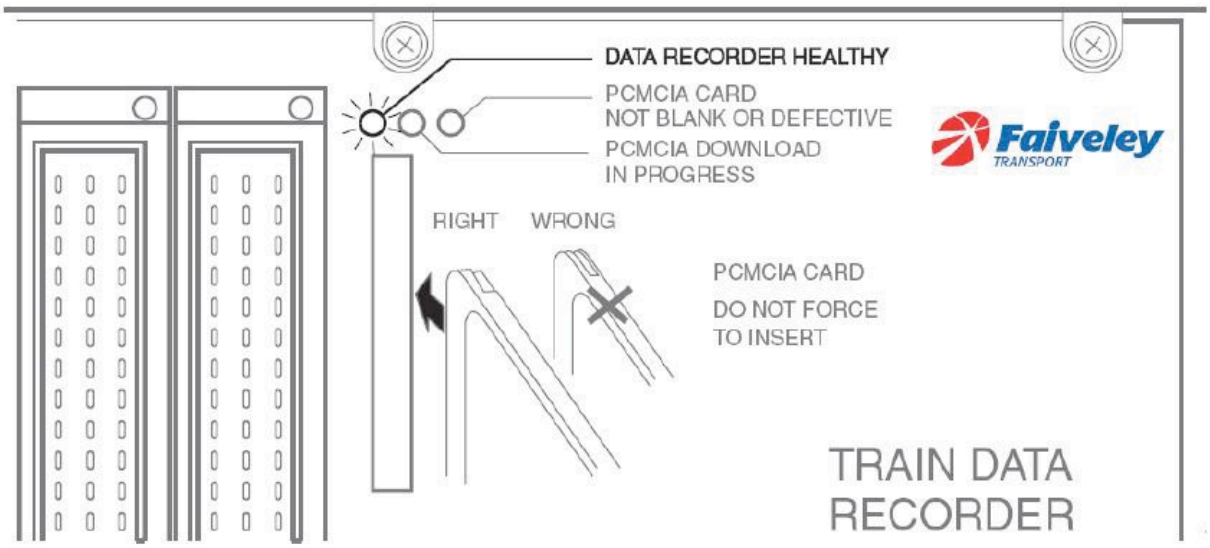


Figure 19-II-02.1 Data Recorder LED

The Minor Faults that switch off the Data Recorder Healthy LED are listed below:

- Failure of the TOM Event Recorder Power Supply;
- Failure of the CPU Board;
- Failure of the Digital Input Board;
- Failure of the MVB Module Board;
- Failure of the analogue inputs.

When the LED is illuminated indicating a fault, carry out the following checks:

1. Connect the PTU (with SAM installed) to the TOM Event Recorder maintenance link and read the recorder's fault message. Replace the faulty element if needed.
   - If the fault is still present, proceed to step 2.
2. Inspect the connection and the wiring between the recorder and the other parts of the equipment.
   - If the connection or wiring between the TOM Event Recorder and the other parts of the equipment is faulty, replace/repair the wiring.

- If connections and wiring are good, proceed to step 3.

3. Check the TOM Event Recorder faults on the IDU Fault List:
   - If the fault is due to an external module, replace that module.
   - If no fault is displayed on the IDU, proceed to step 4.
4. Insert a PCMCIA card in the PCMCIA port to check if the port is faulty:
   - If the yellow indicator above the PCMCIA port indicates that the recorder is not able to access the PCMCIA card, replace the TOM Event Recorder (the Unit Control Board should be replaced by Faiveley Transport personnel).

19-II-02.01.02 LEDs on the MVB Module

A green LED, located on the front panel of the MVB Module, indicates that the equipment is working properly. The label of this LED is “MVB HEALTY”.

The LED is blinking during installation and stays on when no fault is detected. If any fault occurs on the MVB Module, the LED is off.

A yellow LED, located on the front panel of the MVB Module, indicates activity on the link. The Label of this LED is “MVB ACTIVITY”.

The status of this LED changes each time the MVB Module detects a data change on the link. If any fault occurs on the MVB Module, the LED switches off.

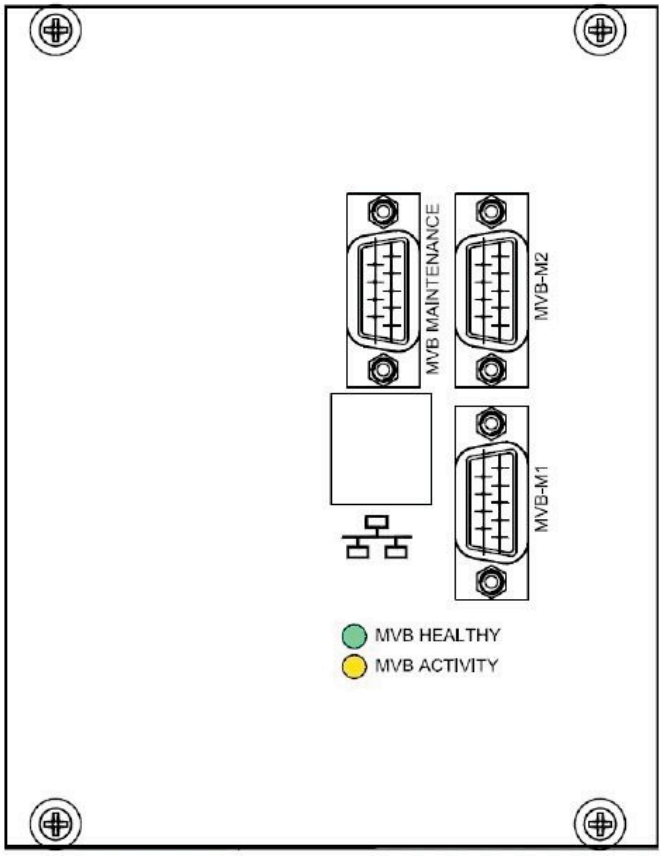


Figure 19-II-02.2 MVB Module LEDs

The MVB HEALTY LED is off when one of the following faults occur:

- Failure of the TOM Event Recorder Power Supply
- Failure of the MVB Board
- Failure of the communication with CPU Board

When the LED is illuminated indicating a fault, carry out the following checks:

1. Connect a PTU (with SAM installed) to the TOM Event Recorder maintenance connector and read the recorder’s fault message.
2. Replace the faulty element if needed.

19-II-02.02 Troubleshooting with the IDU

The IDU interface is made up of a display located in both vehicle cabs.

The IDU can be accessed in two Modes:

- Normal Mode, for the operators
- Maintenance Mode, for maintenance personnel, accessible by means of a numeric password

The Normal Mode provides few, essential information to help the operator start the troubleshooting or to pass the information on to the ROC (Railway Operating Center).

In Maintenance Mode the IDU can display more detailed information, thus giving the Maintenance personnel the possibility to troubleshoot more in depth and more accurately.

19-II-02.02.01 IDU Screen Body

Both in Normal and in Maintenance Mode, the IDU Screen Body lists all the vehicle systems connected with the IDU.

The TOM Event Recorder (named “ER” in the IDU screens) sign is dark when the system is correctly working and becomes red if a fault occurs.

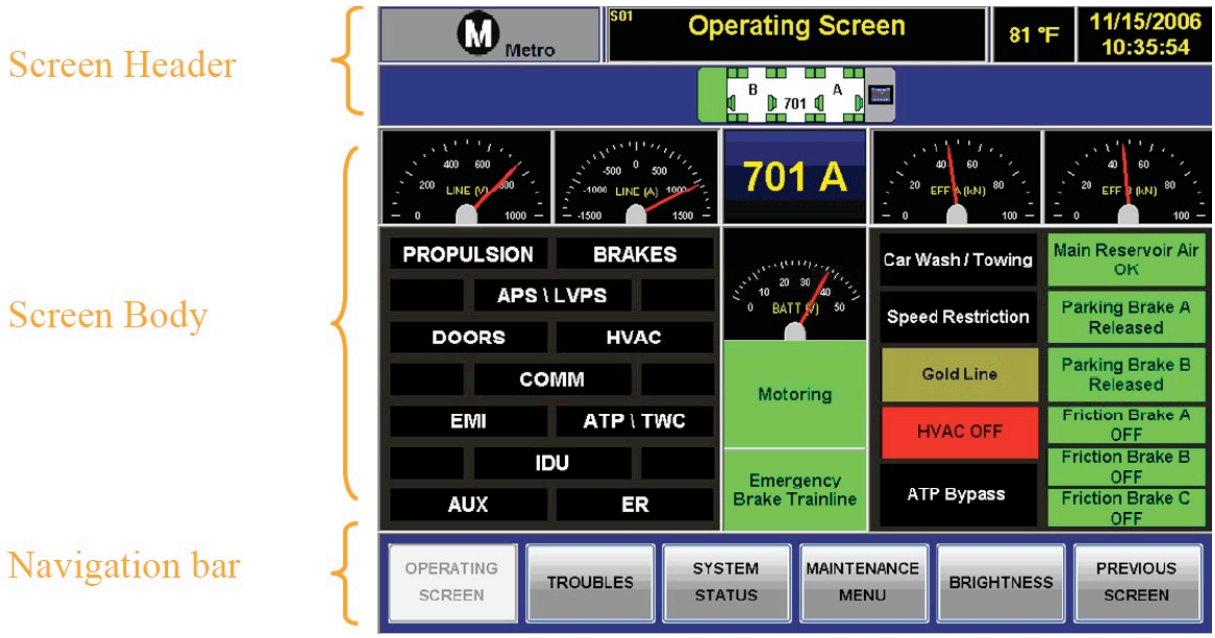


Figure 19-II-02.3 IDU Screen Body

19-II-02.02.02 MVB Bus Control

While in Maintenance Mode (accessible by means of a numerical code), by touching the MONITOR button, the IDU monitor shows information related to the local vehicle and the train. LON Works Bus, MVB bus, Digital I/O and train lines can be monitored.

With regard to the Event Recorder System, it is possible to check if the Event Recorder is working correctly (ER status) by monitoring the MVB bus (selected by touching the MVB BUS button on the MONITOR screen).

The IDU screen shows how much each bus is used by the relevant system.

If, for example, the ER Status bar does not show any signal exchanged (status = 0), probably the Event Recorder is not working properly or is not supplied or is not connected to the MVB bus.

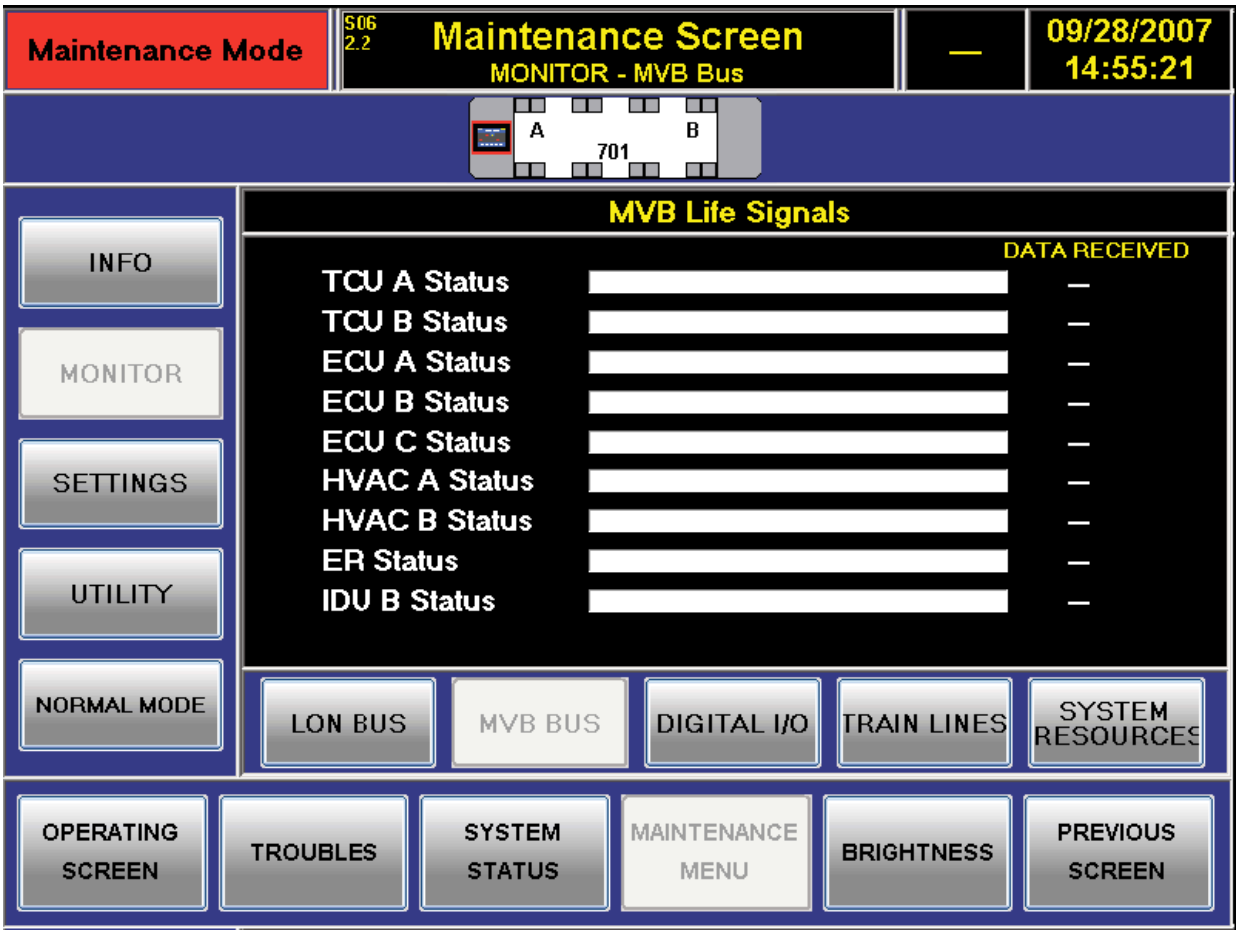


Figure 19-II-02.4 MVB Bus Control

19-II-02.02.03 System Status Screen

1. Normal Mode

In normal Mode, the ER System Status Screen displays only the status (OK or FAULT) of the system.

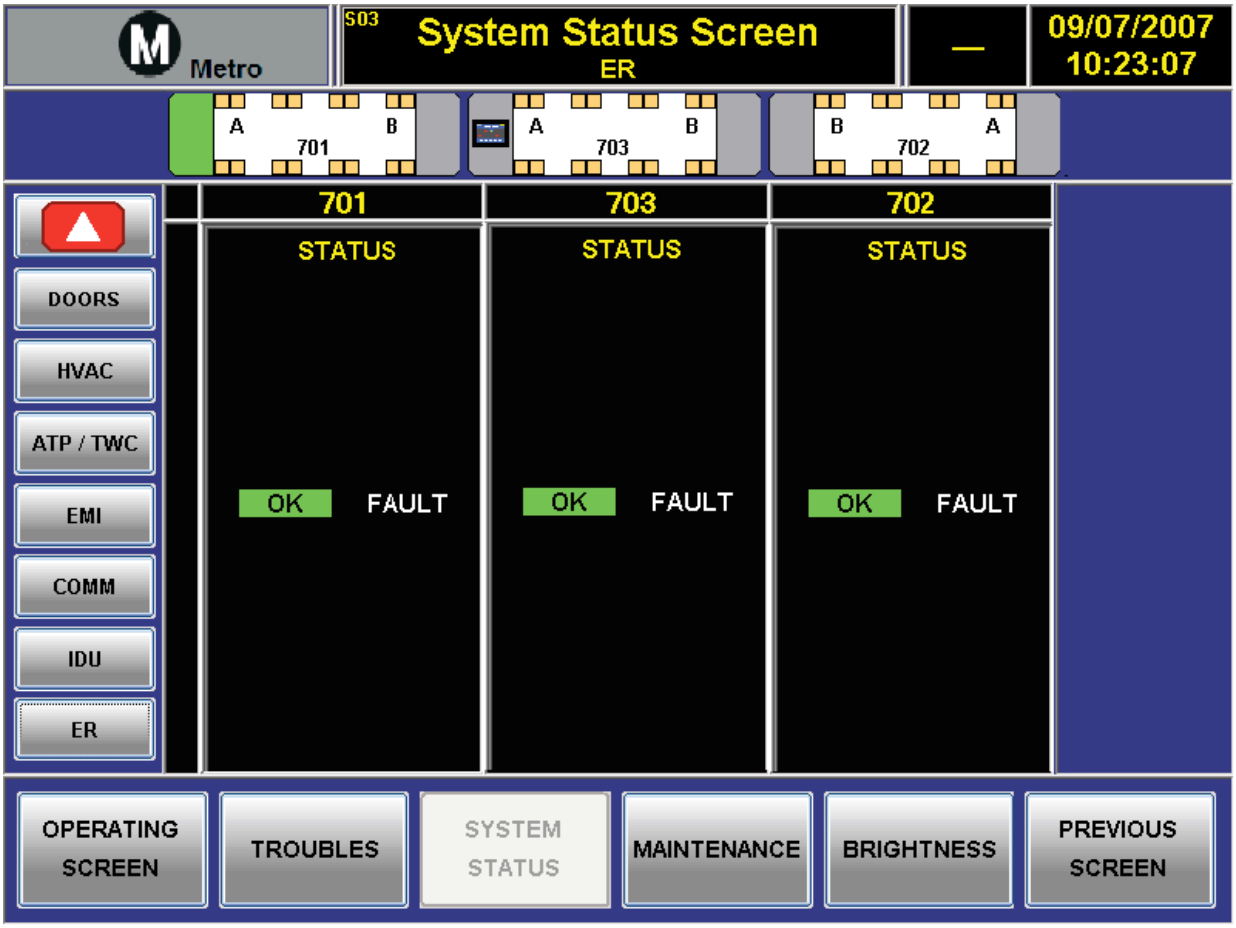


Figure 19-II-02.5 ER System Status Screen – Normal Mode

2. Maintenance Mode

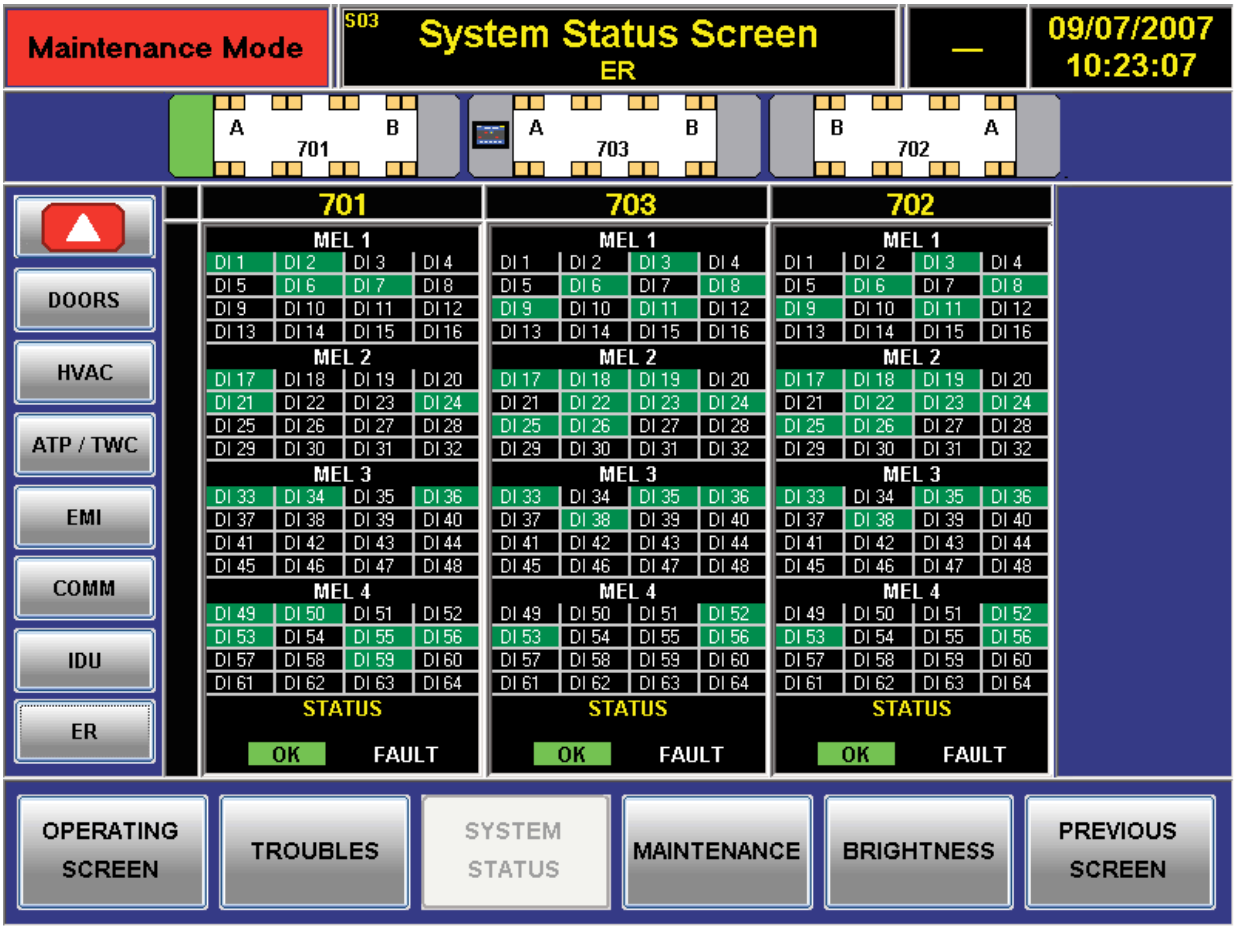


Figure 19-II-02.6 ER System Status Screen – Maintenance Mode

In Maintenance mode information about ER digital input signals is also displayed:

- MEL 1 Card
- MEL 2 Card
- MEL 3 Card
- MEL 4 Card

The equipment status is displayed with different colors in the lower side of the panel, as follows:

- OK (green)
- Fault (red)

The ER digital input signals are listed in Tables 19-II-02.1 through 19-II-02.2.

Table 19-II-02.3 TOM Event Recorder MEL1 Input Signals

Card	Input #	Card Pins		Name of Signal displayed with SAM	Input Voltage	Value displayed with SAM	Type of Signal	Graphic display in SAM
		+	-					
MEL1	1	E12	E10	Logical Input 1	0	0	Vital	Y
					37.5 Vdc	1		
	2	C12	E6	Logical Input 2	0	0	Vital	Y
					37.5 Vdc	10		
	3	E14	C30 E30	Horn & Gong #1	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	4	C14		Logical Input 4	0	0	Non Vital	Y
					37.5 Vdc	1		
	5	E16		Horn & Gong #2	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	6	C16		Logical Input 6	0	0	Non Vital	Y
					37.5 Vdc	1		
	7	E18		Horn & Gong #3	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	8	C18		Logical Input 8	0	0	Non Vital	Y
					37.5 Vdc	1		
	9	E20		Horn & Gong #4	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	10	C20		Logical Input 10	0	0	Non Vital	Y
					37.5 Vdc	1		
	11	E22		Right door CL. M.O	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	12	C22		EMI recorder tripped	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	13	E24		Left door CL. M.O	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	14	C24		Brake appl. Bypass - Car B	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	15	E26		Right door CL. S.O	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	16	C26		No motion bypass - Car B	0	OFF	Non Vital	Y
					37.5 Vdc	ON		

Table 19-II-02.4 TOM Event Recorder MEL2 Input Signals

Card	Input #	Card Pins		Name of Signal displayed with SAM	Input Voltage	Value displayed with SAM	Type of Signal	Graphic display in SAM
		+	-					
MEL2	17	E12	E10	Logical Input 17	0	0	Vital	Y
					37.5 Vdc	1		
	18	C12	E6	Logical Input 18	0	0	Vital	Y
					37.5 Vdc	OFF		
	19	E14	C30 E30	FWD	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	20	C14		Right door bypass - Car B	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	21	E16		REV	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	22	C16		Left door bypass - Car B	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	23	E18		Cab A Act.	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	24	C18		Propulsion cut out - Car B	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	25	E20		Cab B Act.	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	26	C20		TCU2 fault	0	ON	Non Vital	Y
					37.5 Vdc	OFF		
	27	E22		Logical Input 27	0	0	Non Vital	Y
					37.5 Vdc	1		
	28	C22		Logical Input 28	0	0	Non Vital	Y
					37.5 Vdc	1		
	29	E24		F.B fault	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	30	C24		Logical Input 30	0	0	Non Vital	Y
					37.5 Vdc	1		
	31	E26		FSB	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	32	C26		ECUb cut out	0	OFF	Non Vital	Y
					37.5 Vdc	ON		

Table 19-II-02.5 TOM Event Recorder MEL3 Input Signals

Card	Input #	Card Pins		Name of Signal displayed with SAM	Input Voltage	Value displayed with SAM	Type of Signal	Graphic display in SAM
		+	-					
MEL3	33	E12	E10	EB trainline	0	OFF	Vital	Y
					37.5 Vdc	ON		
	34	C12	E6	SCEB trainline	0	OFF	Vital	Y
					37.5 Vdc	ON		
	35	E14	C30 E30	Coast	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	36	C14		Logical Input 36	0	0	Non Vital	Y
					37.5 Vdc	1		
	37	E16		Motoring	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	38	C16		TCU1 fault A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	39	E18		Left door CL. S.O.	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	40	C18		Dead man tripped	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	41	E20		No motion	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	42	C20		Logical Input 42	0	0	Non Vital	Y
					37.5 Vdc	1		
	43	E22		Sanding on	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	44	C22		No motion bypass - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	45	E24		track brakes app.	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	46	C24		Brake appl. Bypass - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	47	E26		35 Mph	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	48	C26		Left door bypass - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		

Table 19-II-02.6 TOM Event Recorder MEL4 Input Signals

Card	Input #	Card Pins		Name of Signal displayed with SAM	Input Voltage	Value displayed with SAM	Type of Signal	Graphic display in SAM
		+	-					
MEL4	49	E12	E10	Logical Input 49	0	0	Vital	Y
					37.5 Vdc	1		
	50	C12	E6	Logical Input 50	0	0	Vital	Y
					37.5 Vdc	1		
	51	E14	C30 E30	Right door release	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	52	C14		TWC	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	53	E16		EMI bypass	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	54	C16		Left door release	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	55	E18		Left door open	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	56	C18		Propulsion cut out - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	57	E20		Right door open	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	58	C20		ECUa cut out	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	59	E22		Left door close	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	60	C22		ECUc cut out	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	61	E24		Right door close	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	62	C24		Power supply bypass	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	63	E26		ATP bypass	0	OFF	Non Vital	Y
					37.5 Vdc	ON		
	64	C26		Right door bypass - Car A	0	OFF	Non Vital	Y
					37.5 Vdc	ON		

19-II-02.02.04 Equipment Status Screen

This screen shows all status signals of the Propulsion System.

Table 19-II-02.7 Status Signals

NAME	UNIT	DESCRIPTION
MPCA	%	Master Controller Position Car A
MPCB	%	Master Controller Position Car B

19-II-02.02.05 IDU Fault List

By touching the “Troubles” button at the bottom of the IDU screen, the Faults Screen pops up with the list of the faults present in all train Systems, with date and time of the occurrence. In this way the Maintenance personnel can detect a fault as soon as it occurs.

As soon as a fault occurs (fault “activated” – red characters), the Train Control and Monitoring System (TCMS - refer to Section 18 for a more detailed description) saves the “image” of the fault in a file of the “A” IDU memory (the B IDU has no memory) named “LogFile.dat”. The system saves an image of the activated fault every 100 ms for a period from 1 s before and 5 s after the activation.

The system saves a sample of the deactivated faults (green characters) once and with the information present at the time of the memorization.

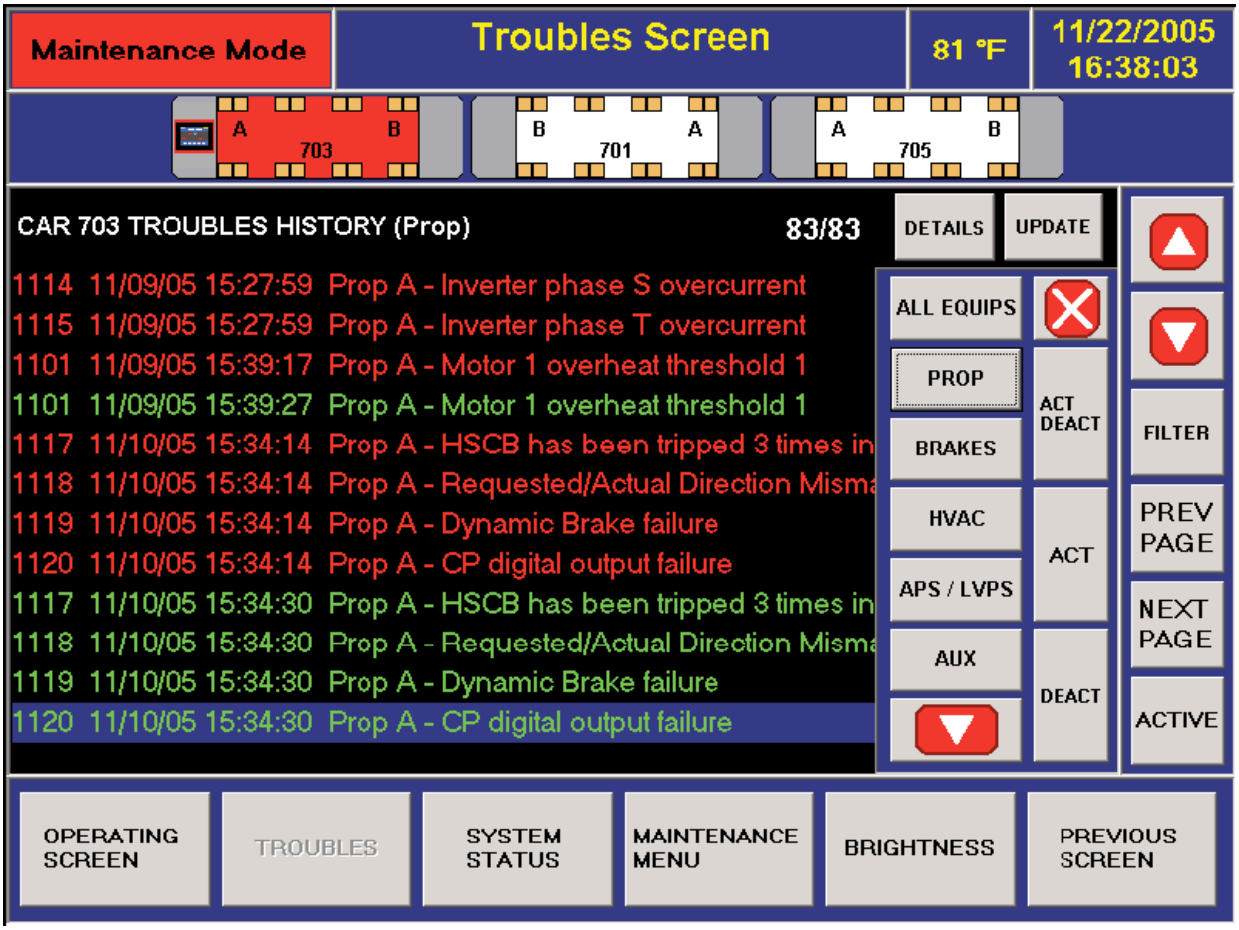


Figure 19-II-02.7 IDU Faults Screen

The complete ER IDU Fault list is described in paragraph 19-II-03.01 and it describes, for each fault type, how to troubleshoot the ER System using the IDU, both in Normal and in Maintenance Mode.

19-II-02.03 Troubleshooting with the PTU

The TOM Event Recorder PTU is made up of the following tools:

- Hardware:
  - A Laptop with a USB Port and a RS232 Port
  - An USB Cable
  - A cross link RS232
- Software:
  - TLCH: programming tool;
  - SAM: Software for Analysis and maintenance
  - 547991.TLC: binary file for TOM Event Recorder Software
  - 547992.CTB: binary file for TOM Event Recorder Configuration
  - 548000.TLC: binary file for MVB Module Software

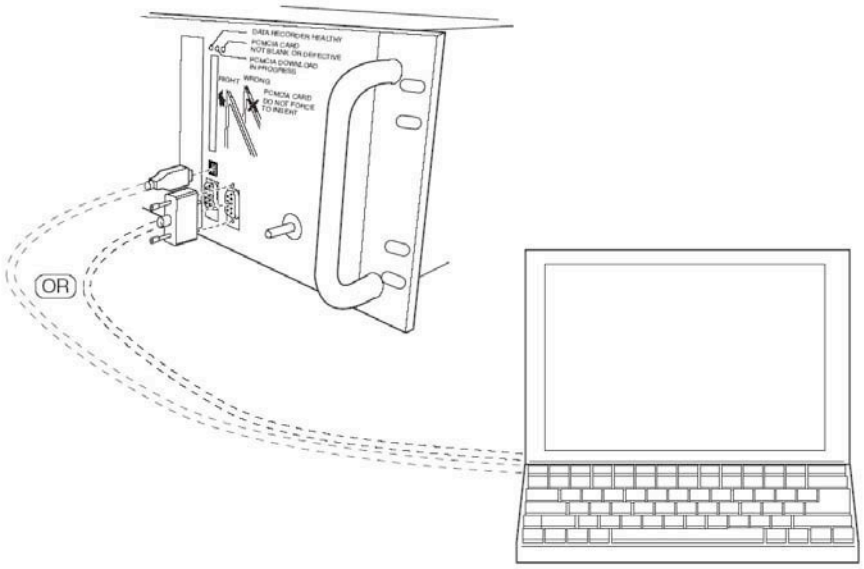


Figure 19-II-02.8 TOM Event Recorder PTU

The minimum Laptop configuration required for installing and using the SAM software is the following:

- Pentium III 800MHz minimum (Pentium IV recommended for journey files analysis)
- RAM memory 256 Mbytes (512 Mbytes recommended for journey files analysis)
- Hard disk space: 5 Gbytes
- RS232 Port
- USB Port
- Windows 98, Windows 2000 or Windows XP operating system (Windows 2000 recommended for protected access)

The SAM Software provides several functions for analyzing the data, such as:

- Visualize recorded data with multiple display modes
- Create new digital signals for display by combining existing signals
- Search for recorded events using complex criteria
- Write annotations on specific points of the journey
- Convert journey data files into a standard format

19-II-02.03.01 Laptop Configuration

1. Check if the PTU is equipped with the Hardware and Software tools listed in paragraph 19-II-02.03.
2. Connect the Laptop to the TOM Event Recorder USB maintenance port.
3. Enter Windows configuration manager and find the COM port used for CP2101 USB. This COM port will be used to upgrade the TOM Event Recorder.

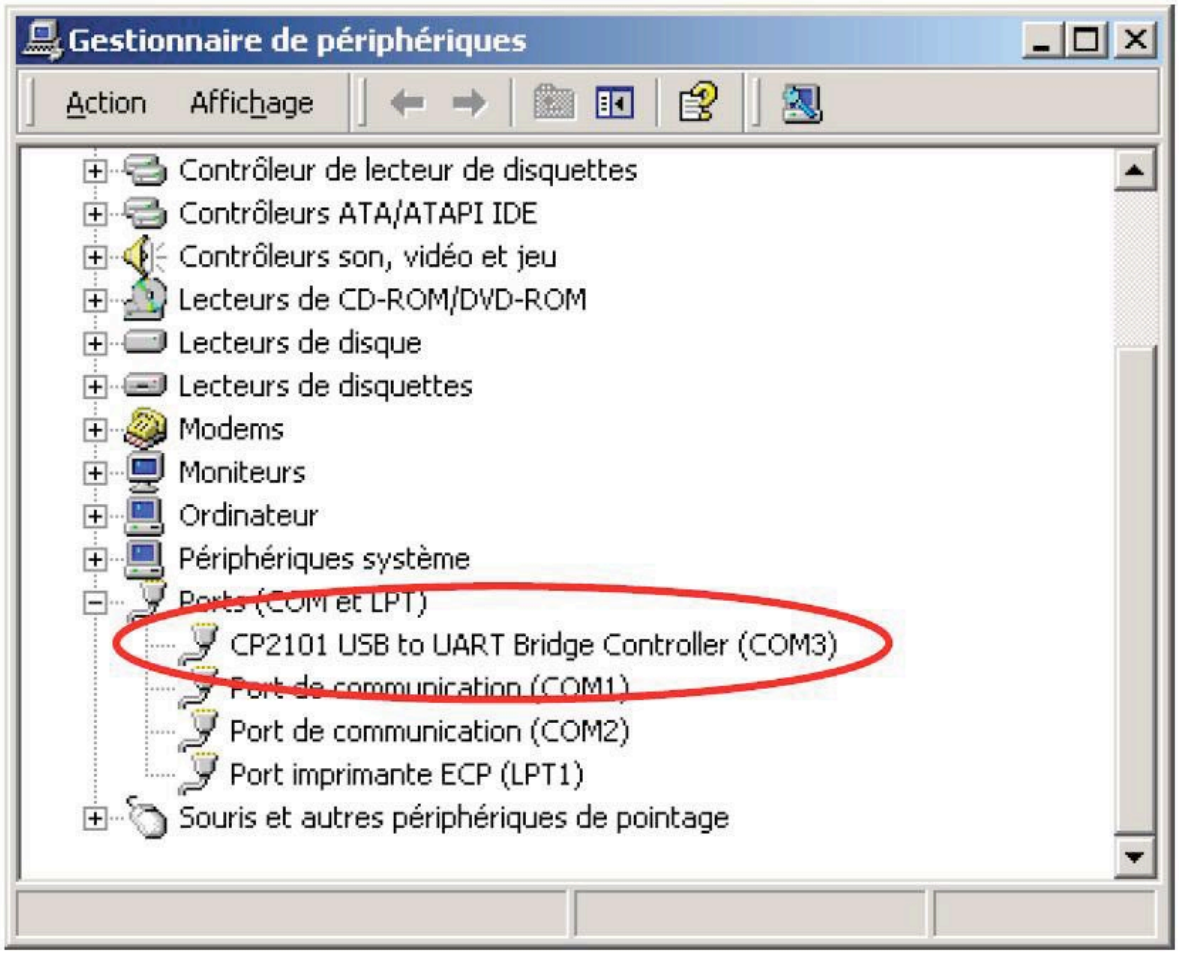


Figure 19-II-02.9 Device Manager

19-II-02.03.02 TOM Event Recorder Software Downloading

1. Connect the Laptop to the TOM Event Recorder USB port.
2. Launch “download_sw_tom.bat” and enter the COM port found in paragraph 19-II-02.03.01 step 3.
3. Reset the TOM Event Recorder to establish the connection.
4. Wait until the download is complete (automatic quit).

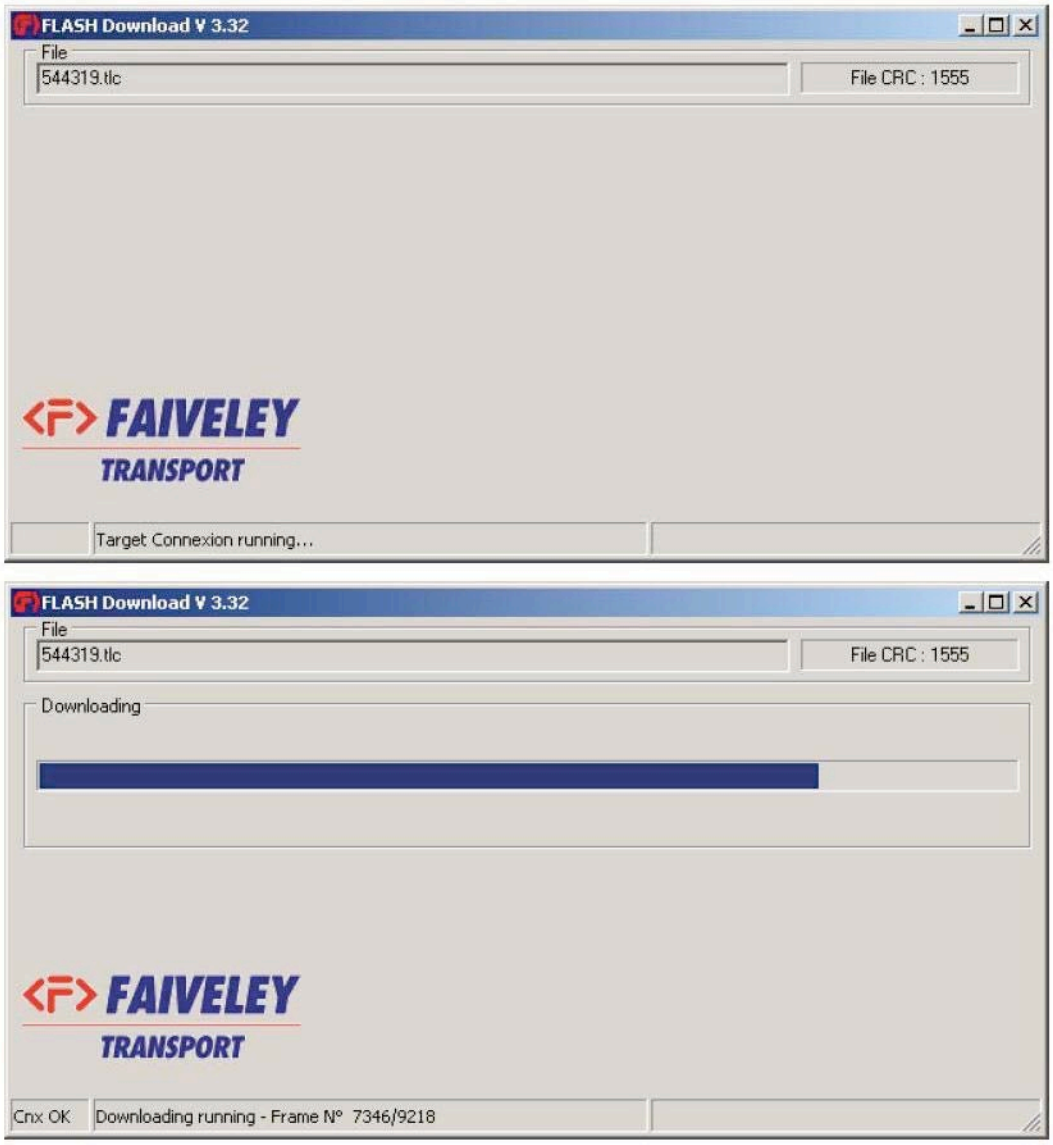


Figure 19-II-02.10 TOM Event Recorder Software Downloading

19-II-02.03.03 MVB Module Software Downloading

1. Connect the Laptop to the MVB maintenance port on the MVB Module.
2. Launch “download_sw_mvb.bat” and enter the COM port found in paragraph 19-II-02.03.01 step 3.
3. Reset the TOM Event Recorder to establish the connection.
4. Wait until the download is complete (automatic quit).

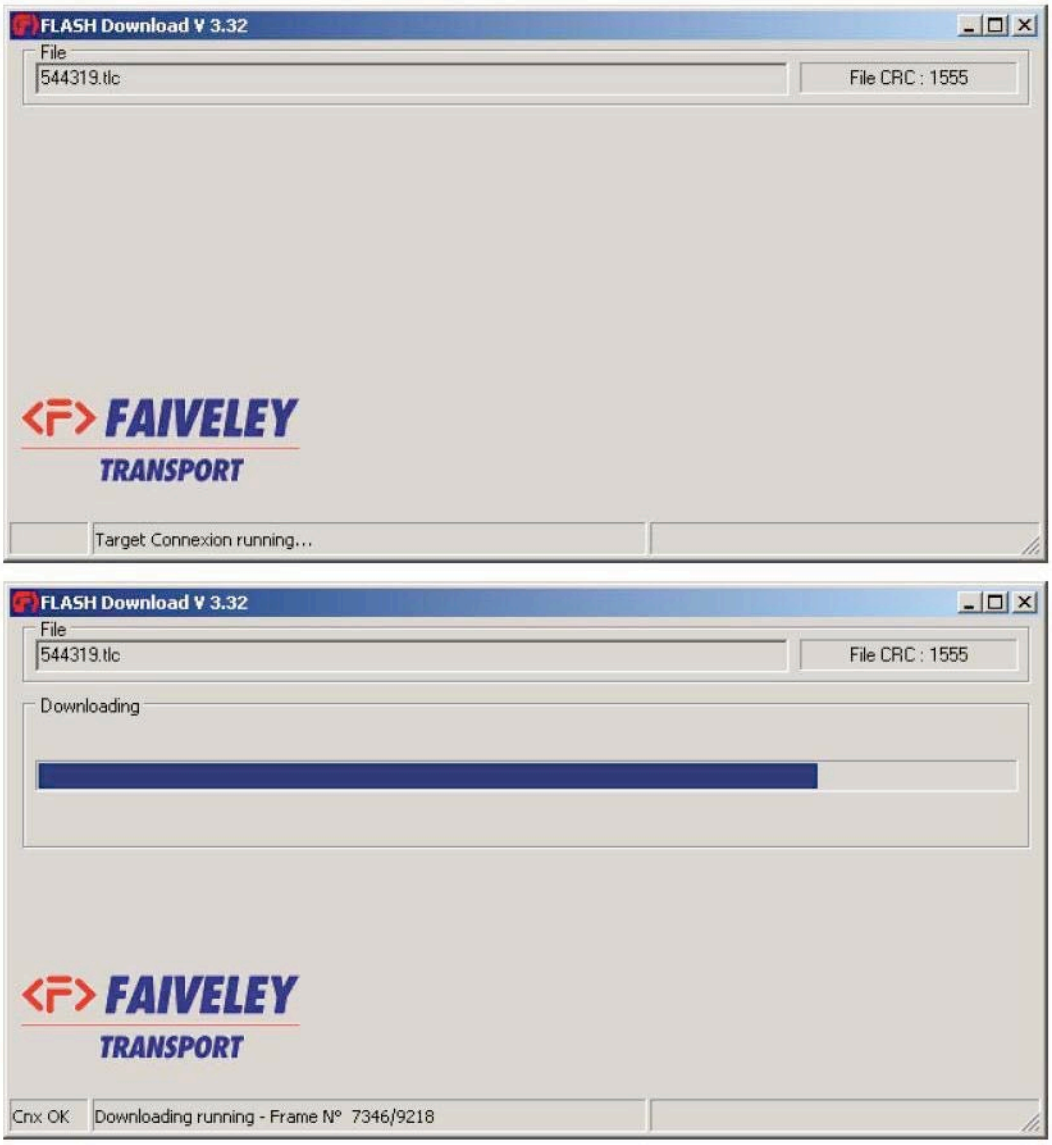


Figure 19-II-02.11 MVB Module Software Downloading

19-II-02.03.04 Configuration File Downloading

1. Connect the Laptop to the TOM Event Recorder USB port.
2. Launch SAM and choose the serial port in menu Communication>Options.
3. Chose menu Communication>TOM>PC->TOM>CPU configuration file and browse the file “547992.ctb”.
4. Click on load File and wait until the end of downloading.

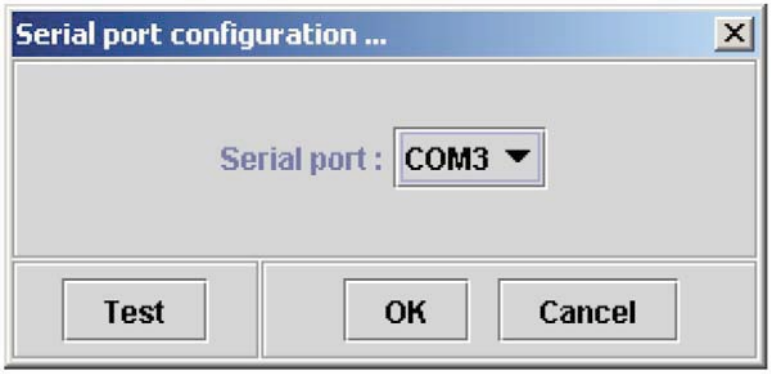


Figure 19-II-02.12 Serial Port Configuration

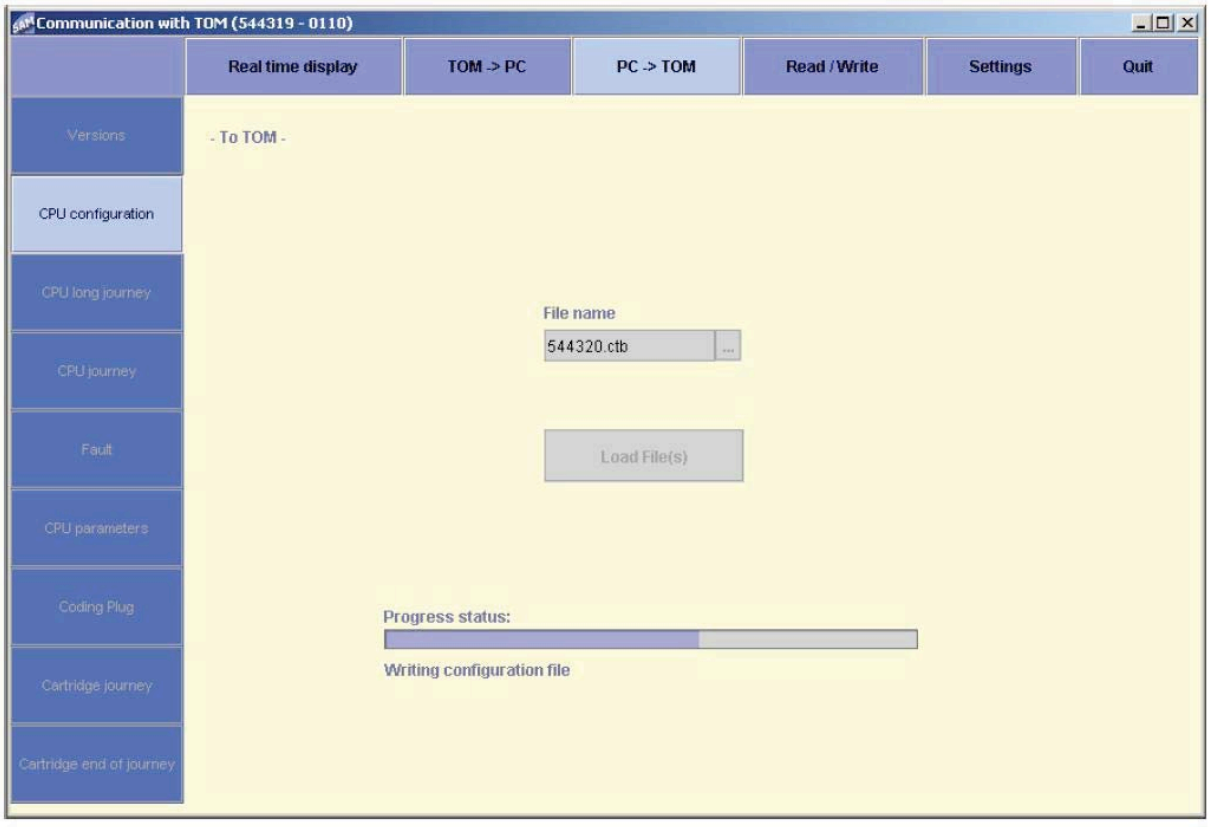


Figure 19-II-02.13 Communication with TOM Event Recorder

19-II-02.03.05 Final Checking

Launch SAM, then choose menu Communication>TOM>Read/Write>Versions and click on Read.

Then check that the versions of the application software, configuration file and alarm file are in accordance with the information indicated in the latest issue of Document ZA548629.000.

If all versions are correct, tick on the front label of the TOM the appropriate mod level (see the latest issue of Document ZA548629.000).

For example, if the TOM mod level indicated in the scope of supply is B, then tick the letter 'B' on the front label as indicated hereunder.

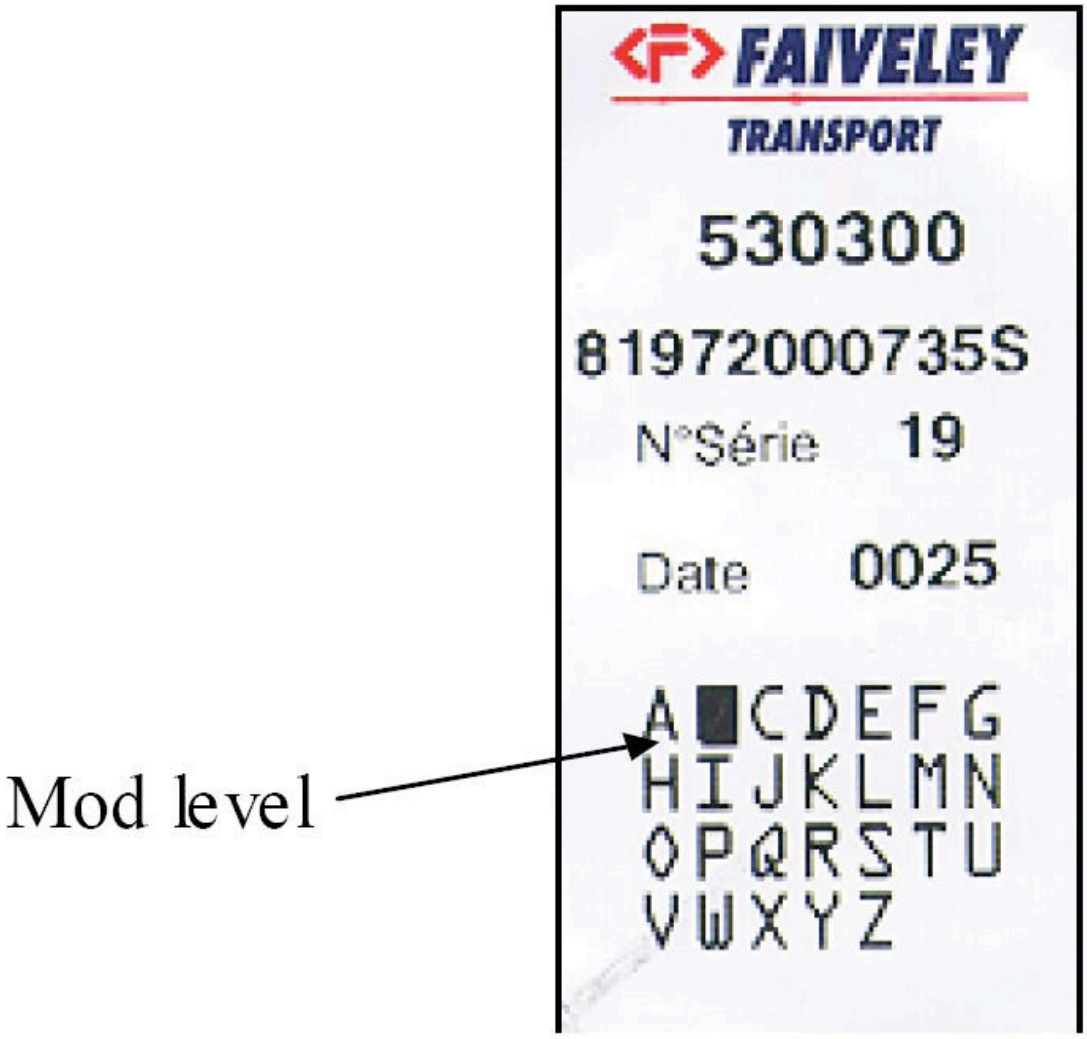


Figure 19-II-02.14 Mod Level

19-II-02.03.06 SAM Software Description

The SAM (Software for Analysis and Maintenance) provides a wide range of functions:

- Reading and analysis of record data (Secure Memory and User Long Memory)
- Train diagnosis and maintenance
- Configuration and customization of TOM Event Recorder

19-II-02.03.06.01 Reading and Analysis of Record Data

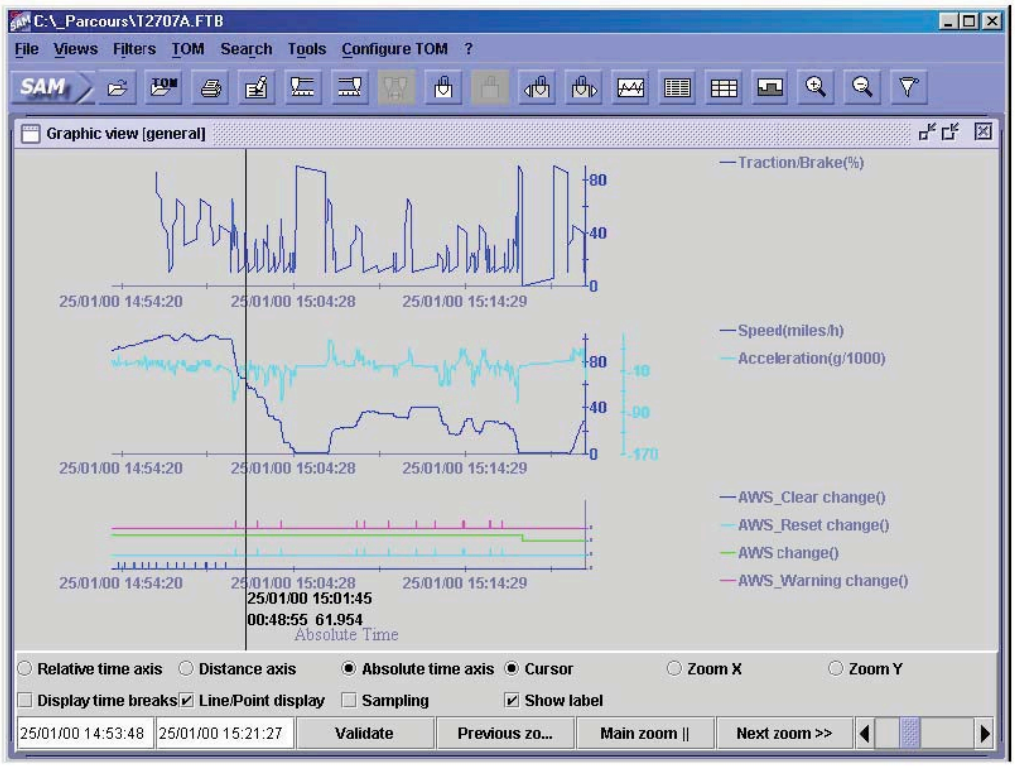


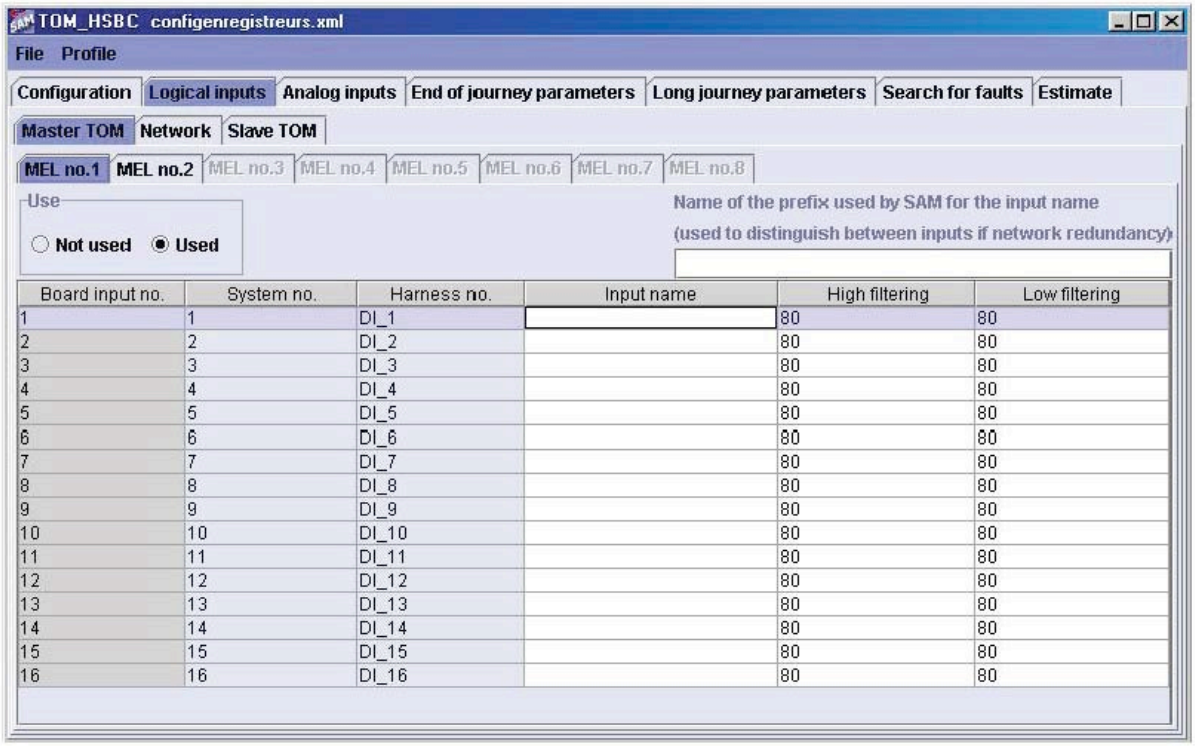
Figure 19-II-02.15 Reading and Analysis of Record Data

- Read recorded data from TOM through the RS232 or USB port of the PC;
- Visualize recorded data with multiple display modes:
  - Graphics with multiple axis mode (time, distance, speed, analogue values…)
  - Text
  - Hexadecimal
- Create new digital signals for display by combining existing signal
- Search for single recorded data using complex criteria
- Write annotations on specific points of the journey
- Convert journey files in a standard format (CSV format)

19-II-02.03.06.02 Maintenance Operation

- Display real time train operations with multiple display modes
- Provide an absolute distance and time counter in order to schedule maintenance Operation
- Detect and debug problems during the train integration phase (or after)
- Display the log file to assist the maintenance staff

19-II-02.03.06.03 Configuration and Customization



Board input no.	System no.	Harness no.	Input name	High filtering	Low filtering
1	1	DI_1		80	80
2	2	DI_2		80	80
3	3	DI_3		80	80
4	4	DI_4		80	80
5	5	DI_5		80	80
6	6	DI_6		80	80
7	7	DI_7		80	80
8	8	DI_8		80	80
9	9	DI_9		80	80
10	10	DI_10		80	80
11	11	DI_11		80	80
12	12	DI_12		80	80
13	13	DI_13		80	80
14	14	DI_14		80	80
15	15	DI_15		80	80
16	16	DI_16		80	80

Figure 19-II-02.16 Configuration and Customization

- Inputs signal labeling
- Programming the events to be detected and recorded
- Associate a set of context variables with each event
- Real time estimation of recording capacity thanks to Journey Capacity Analyzer
- (JCA) tool
- Identify and check the host equipment (vehicle or whole train)

19-II-02.03.07 Software to read a PCMCIA card

PC software is provided in order to read the data stored on a PCMCIA card.

This software is compatible with Windows 98, Windows 2000 and Windows XP Operating Systems.

The following memories can be accessed:

- The User Long Memory of several data recorders
- The log files of several data recorders

The PCMCIA card can be read from a PCMCIA reader linked to the USB port of a desktop.

After reading, the data are stored on the hard disk of the PC. It is then possible to use the SAM software for data analysis.

19-II-03 APPENDIX

19-II-03.01 E.R. IDU Fault List

19-II-03.01.01 "Normal" Mode IDU Fault Charts

All faults related to the Event Recorder System can be shown by the IDU in Normal Mode and the related Operator Guide actions are listed in the following Fault Charts, each one related to a specific fault.

The Operator Guide pops up as soon as the "Details" PB is touched on the "Faults" Screen and is referred to the relevant fault listed in the screen.

Fault#	Date	Time	Vehicle#	System	Description
B009	mm/dd/aa	hh:mm:ss	xxx		Major Fault
Operator Guide					

Fault#	Date	Time	Vehicle#	System	Description
B010	mm/dd/aa	hh:mm:ss	xxx		Minor Fault
Operator Guide					

19-II-03.01.02 "Maintenance" Mode IDU Fault Chart

All faults related to the Event Recorder System, that can be shown by the IDU in Maintenance Mode and the relative Operator Guide Actions are listed in the following Fault Charts.

The "Operator Guide" pops up by touching the "Details" Button and is referred to the relevant fault listed on the screen.

The Normal Mode Faults are more general that the Maintenance Faults. A Normal Fault (visible by the Operator) can contain one or more Maintenance Faults; in other words, a Normal Fault can be generated from more than one Maintenance Fault. The Maintenance Fault better focalizes the problem.

Table 19-II-03.1 describes the Normal and Maintenance Fault relationship.

Table 19-II-03.1 Event Recorder Normal and Maintenance Fault Relationship

Normal Mode Fault Code	Maintenance Mode Fault Code			
B009	B001	B002	B003	
B010	B004 B008	B005	B006	B007

Fault#	Date	Time	Vehicle#	System	Description
B001	mm/dd/aa	hh:mm:ss	xxx		UC Card Failure
Operator Guide					

Fault#	Date	Time	Vehicle#	System	Description
B002	mm/dd/aa	hh:mm:ss	xxx		IFT Card Failure
Operator Guide					

Fault#	Date	Time	Vehicle#	System	Description
B003	mm/dd/aa	hh:mm:ss	xxx		Cartridge Card Failure
Operator Guide					

Fault#	Date	Time	Vehicle#	System	Description
B004	mm/dd/aa	hh:mm:ss	xxx		MEL1 Card Failure
Operator Guide					

Fault#	Date	Time	Vehicle#	System	Description
B005	mm/dd/aa	hh:mm:ss	xxx		MEL2 Card Failure
Operator Guide					

Fault#	Date	Time	Vehicle#	System	Description
B006	mm/dd/aa	hh:mm:ss	xxx		MEL3 Card Failure
Operator Guide					

Fault#	Date	Time	Vehicle#	System	Description
B007	mm/dd/aa	hh:mm:ss	xxx		MEL4 Card Failure
Operator Guide					

Fault#	Date	Time	Vehicle#	System	Description
B008	mm/dd/aa	hh:mm:ss	xxx		MVB Card Failure
Operator Guide					

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SECTION 19

EVENT RECORDER

PART III

MAINTENANCE

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SECTION 19

EVENT RECORDER

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SECTION 19

EVENT RECORDER

19-III-01 INTRODUCTION

The Event Recorder Part III – Maintenance consists of:

- Preventive Maintenance
- Corrective Maintenance
- Consumable Materials
- Test Equipment & Special Tools

19-III-01.a List of Abbreviations, Acronyms & Symbols

The Abbreviations, Acronyms and Symbols commonly used throughout this Section are given below with their relevant meaning.

Abbreviation	Meaning
AB	AnsaldoBreda
ADU	Automatic Display Unit
AI.	Analogue Input
ALM	Power Supply
DI	Digital Input
ECU	Electronic Control Unit (Brake)
ER	Event Recorder
FIDI	Fully Isolated Digital Input
FIFO	First In First Out
GTW	Gateway
IDU	Integrated Diagnostic Unit
LED	Light Emitted Diode
LRV.	Light Rail Vehicle
MB	Mega Bytes
MTA	Metropolitan Transportation Authority
MVB	Multifunction Vehicle Bus
PC	Personal Computer
PTU	Portable Test Unit
R-CML	Running Consumable Material List
R-CMS	Running Corrective Maintenance Sheet
RMSM	Running Maintenance & Service Manual
R-PMM	Running Preventive Maintenance Matrix
R-PMR	Running Preventive Maintenance Report
R-PMS	Running Preventive Maintenance Sheet
R-TESTL	Running Test Equipment, Tools & Special Tools List
SAM	Software for Analysis Maintenance
SCPM	Safety Critical Preventive Maintenance
SYS	System
TBD	To Be Defined
TBS	To Be Supplied
TCU	Traction Control Unit
TOC	Table Of Content
TOM	Train On board Memory
TTEM	Tools & Test Equipment Manual
UC	Unit Control
USB	Universal Serial Bus
VAC	Voltage Alternate Current
VDC	Voltage Direct Current
W/	With
W/O	Without

19-III-01.b List of Definitions

The Definitions commonly used throughout this Section are given below with their relevant meaning.

Definition	Meaning
'A' body section	The section of an articulated vehicle containing the pantograph
'B' body section	The section of an articulated vehicle not containing the pantograph
AW0	Empty car operating weight
AW1	Full seated load plus AW0
AW2	Standees at 4 persons per square meter plus AW1
AW3	Standees at 6 persons per square meter plus AW1
AW4	Standees at 8 persons per square meter plus AW1
Front door	The door close to the Operator's Cab
Rear door	The door close to the Articulation Section
MC Handle	Master Controller Handle
"A" Cab (or Cab A)	Operator Cab in the A body section
"B" Cab (or Cab B)	Operator Cab in the B body section

19-III-01.c List of Measurement Units

The Measurement Units commonly used throughout this Section are given below with their relevant meaning.

Definition	Meaning
ft	Foot (Length)
gal	Gallon (Volume)
in	Inch (Length)
kg	Kilogram – approx 2.205 pounds (Weight)
km	Kilometer – approx 0.621 miles (Length)
lb	Pound (Weight)
lb-ft	Pound force (Force)
m	Meter – approx 3.28 feet (Length)
mm	Millimeter – approx 0.0394 inches (Length)
mph	Miles per hour (Velocity)
Km/h	Kilometers per hour (Velocity)
s	Seconds (Time)
V	Volt (Tension)
Vdc	Direct Voltage (Tension)
Vac	Alternate Voltage (Tension)
kVA	Kilo-Volt-Ampere (Power)
kW	Kilo-Watt (Power)
W	Watt (Power)
F	Farad (Capacity)
H	Henry (Inductance)
Ω	Ohm (Resistance)
°F	Fahrenheit (Temperature)
°C	Celsius (Temperature)
A	Ampere (Current)
Hz	Hertz (Frequency)
rpm	Revolution per Minute (Frequency)
N	Newton (Force)
Nm	Newton-Meter (Torque)
mphps	Mile Per Hour Per Second (Acceleration)

19-III-01.d References

Refer to Section 00 of this RMSM for details relevant to the following Topics :

Topic	Paragraph
MANUAL PURPOSE	*00-02*
MANUAL ARRANGEMENT	*00-03*
MANUAL APPLICABILITY	*00-04*
ACQUISITION OF COPIES, REVISIONS AND CHANGES	*00-05*
TECHNICAL PUBLICATIONS DISCREPANCY REPORT	*00-06*
UPDATING	*00-07*
MANUAL CONTENT	*00-08*
MANUAL ILLUSTRATIONS	*00-09*
REFERENCE TO MAINTENANCE MANUALS SET	*00-10*
MTA PHILOSOPHY OF MAINTENANCE	**00-11**
SAFETY	**00-12**
Vehicle Hazard Areas	**00-12.01**
General Safety Precautions	**00-12.02**
Safety Precautions around Electrical Equipment	**00-12.03**
Safety & Environmental Precautions with Chemicals	**00-12.04**
GENERAL MAINTENANCE GUIDE	**00-13**
Hardware	**00-13.01**
Cable Ties (Tie Wraps)	**00-13.02**
Wiring	**00-13.03**
Fuses	**00-13.04**
Lubrication and Cleaning	**00-13.05**
ELECTROSTATIC DISCHARGE	**00-14**
Description	**00-14.01**
Methods of Protection	**00-14.02**
STORAGE AND HANDLING	**00-15**
General Storage Requirements	**00-15.01**
Special Storage Requirements	**00-15.02**
P2550 SOFTWARE CONFIGURATION	**00-21**
P2550 PTU /LAPTOP SOFTWARE LIST	**00-22**
P2550 STANDARD TORQUE LIST	**00-23**
HOW TO USE IPC	**00-24**
HOW TO USE THE FUNCTIONAL SCHEMATICS	**00-25**
HOW TO USE THE TOPOGRAPHIC SCHEMATICS	**00-26**
HOW TO USE THE ANSALDOBREDA DATABASE	**00-27**

19-III-02 P2550 ANSALDOBREDA MAINTENANCE PLAN

The AB Preventive Maintenance Plan (PMP) has been designed in order to permit a 30-year Structural and Service Vehicle Life with the following basic assumptions:

•Yearly mileage: 120,000 Miles

•Motor and Trailer Truck removal: Every 5 years. (600,000 Miles)

The AB Preventive Maintenance Plan (PMP) provides the Preventive Maintenance Tasks to be performed according the following Mileage Intervals:

Running Maintenance		**Heavy Maintenance**	
Daily			
10,000	Miles		
30,000	Miles	600,000	Miles
60,000	Miles	1,200,000	Miles
120,000	Miles	1,800,000	Miles

In accordance with the Preliminary Version of the AB Preventive Maintenance Plan, the Scheduled Maintenance Tasks for the entire Vehicle Life have been grouped into:

- Running Preventive Maintenance
- Heavy Preventive Maintenance

In accordance with the AB Corrective Maintenance Analysis, the Corrective Maintenance Tasks for the entire Vehicle Life have been grouped into:

- Running Corrective Maintenance
- Heavy Corrective Maintenance

19-III-03 RUNNING -PREVENTIVE MAINTENANCE

19-III-03.01 Running -Preventive Maintenance Matrixes (R-PMM)

The Event Recorder Running -Preventive Maintenance Matrix (R-PMM) provides the Preventive Maintenance Plan of the Event Recorder up to 120,000 Miles. The Event Recorder (R-PMM) is provided in two different arrangements as follows:

- **R-PMM Component Based**

It lists the Event Recorder Running - Preventive Maintenance Tasks ordered by Subsystem
/Assemblies / Component break down, followed by the PM Task Description and Scheduled
Task Interval and linked to the relevant R-PM Sheet Code.

The R-PMM Component Based provides the Maintainer with the following data:

- SUBSYSTEM /ASSEMBLY/UNIT/COMPONENT
- TASK
- SCPM
- INSPECTION INTERVAL
- SHEET CODE

- **R-PMM Mileage Based**

It lists the Event Recorder Running - Preventive Maintenance Tasks ordered by Scheduled Maintenance Interval and broken down into the related Subsystem /Assemblies/Component followed by the PM Task Description and Person Hours and linked to the relevant R-PM Sheet Code.

The R-PMM Mileage Based provides the Users with the following data:

- INSPECTION INTERVAL
- SYSTEM/SUBSYSTEM /ASSEMBLY/UNIT/COMPONENT
- TASK
- SCPM
- PERSON HOURS
- SHEET CODE

The data listed in this Matrix are the same of those listed in the R-PMM Component Based with the exception of the PERSON HOURS.

19-III-03.01.01 Definitions

The following definitions are applicable to both types of R-PMM

Tasks

Cleaning: Methods and processes required (Step-By-Step Procedural Instructions) for cleaning specific parts or areas of the Vehicle.

Inspection: Preventive Maintenance procedures such as those required to ascertain the serviceability of a Part, Assembly, System or the specific interrelationship of Parts that perform a functional operation.

Lubrication: Provides component lubrication Instructions.

Replacement Provides the Components / Assemblies and Subassemblies removal & installation in a logical sequential order.
Maintenance procedures identified in this topic include Components that are replaced within a 4 hours window.

Service: Operation performed to replenish Sand, Windshield Wiper Washer Fluid, HVAC Coolant, Gear and Compressor Oil, and Vehicle Lubrication.

Test: Procedures and Parameters to evaluate the operational efficiency and integrity of a System /Subsystem/Component and the interrelationship of Parts performing functional operations.

19-III-03.01.02 Inspection Intervals

The Running - Preventive Maintenance Intervals for the P2550 LRV Fleet are scheduled as follows:

Daily	10,000 Miles	30,000 Miles	60,000 Miles	120,000 Miles

The marker "●" in the INSPECTIONS INTERVAL column, indicates the periodicity of the corresponding Task.

19-III-03.01.03 Safety Critical Preventive Maintenance (SCPM) Tasks

The marker "☑" in the SCPM column, indicates that the corresponding Task is a Safety Critical Preventive Maintenance (SCPM) Task, as per the results of the Safety Analyses performed, on Vehicle Subsystems, according to Vehicle Specification.

19-III-03.01.04 Sheet Code

The Sheet Code column, indicates the reference to Running -Preventive Maintenance Sheet where the Procedure to be performed is described and illustrated.

THE SHEET CODE IS THE EXPLICIT LINK BETWEEN R-PM MATRIXES, R-PMR /JOB CARDS AND R-PM SHEETS

Refer to Paragraph 19-III-03.03.01 for Running- Preventive Maintenance Sheet (R-PMS) Form for detailed explanation.

19-III-03.01.05 Person Hours

It indicates the time required to perform the corresponding Task with the basic assumption that the Vehicle is on an Inspection Pit or Stand Up Rail and the Consumables, Tools and Spare Parts needed to accomplish the Task are available at the Location of the Equipment to be maintained.

Refer to:

- Table 19-III-03.1 for Running - Preventive Maintenance Matrix (R-PMM) (Component Based)
- Table 19-III-03.2 for Running - Preventive Maintenance Matrix (R-PMM) (Mileage Based)

19-III-03.01.06 Running Preventive Maintenance Matrix (Component Based)

Table 19-III-03.1 Running Preventive Maintenance Matrix (Component Based)

SYSTEM 19 EVENT RECORDER

SUBSYSTEM ASSY/UNIT/COMPONENT	TASK	SCPM	INSPECTION INTERVAL MILES					SHEET CODE
			Daily	10K	30K	60K	120K	
EVENT RECORDER	TEST						•	R-P-19-01-00-00/T-00

19-III-03.01.07 Running Preventive Maintenance Matrix (Mileage Based)

Table 19-III-03.2 Running Preventive Maintenance Matrix (Mileage Based)

SYSTEM 19 EVENT RECORDER

SUBSYSTEM	TASK	SCPM	PERSON HOURS	SHEET CODE
120,000 MILES				
EVENT RECORDER	TEST		0.2	R-P-19-01-00-00/T-00

19-III-03.02 Running -Preventive Maintenance Reports (R-PMR/Job Cards)

This paragraph describes the contents of the Event Recorder Running -Preventive Maintenance Reports (R-PMR/Job Cards) for the Running - Preventive Maintenance Tasks.

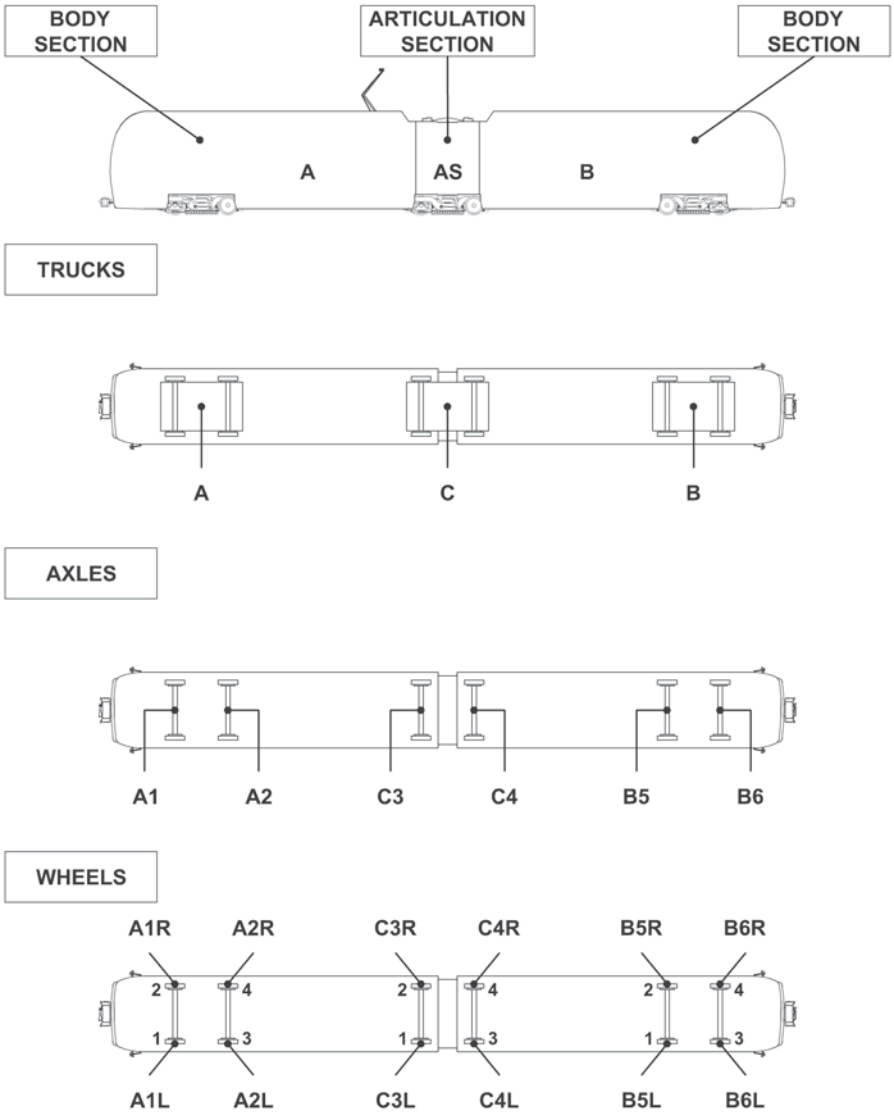
19-III-03.02.01 R-PMR/Job Card Form Content

The R-PMR/JOB CARDS are broken down into two main topics:

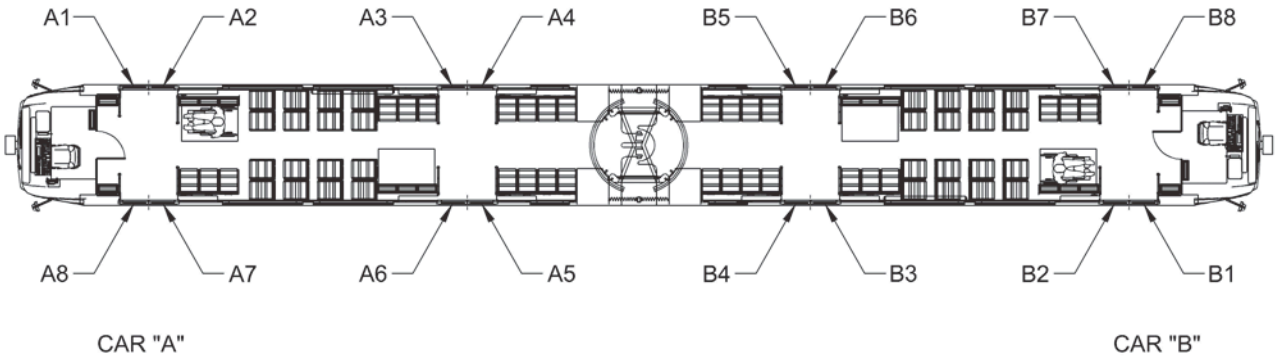
Specific Data and R-PM Data

Refer to Figure 19-III-03.1 for R-PMR/JOB CARD Form example

RUNNING PREVENTIVE MAINTENANCE REPORTS (R-PMR/JOB CARDS) FORM		
SPECIFIC DATA TO BE FILLED IN BY THE MAINTAINER		
ITEM #	**TITLE**	**EXPLANATORY NOTE**
1	**VEHICLE #**	This field indicates the Vehicle Identification Number
2	**DATE**	This field indicates the Vehicle entering to Maintenance Shop Date
3	**RUNNING HOURS**	This field indicates the Vehicle Running Hours at the above Date
4	**MILES**	This field indicates the Vehicle Running Miles at the above Date.
5	**EMPLOYEE # & SIGNATURE**	This Field indicates the Employee # & Signature of the Maintainer(s) that perform the referred Task(s)
6	**STARTING DATE**	This field indicates the Starting Date of the referred Task(s).
7	**WORK HOURS**	This field indicates the Work duration to perform the referred Task(s).
8	**COMPLETION DATE**	This field indicates the Completion Date of the referred Task(s).
9	**DEFECT FOUND/COMMENTS**	This field indicates the result of the Task(s) execution and/ or note related to any items of the maintained Equipment requiring Corrective Maintenance
A	**P2550 RUNNING PREVENTIVE MAINTENANCE REPORT SYSTEM (Maintenance Interval) JOB CARD**	This field provides R-PMR Title. The R-PM Maintenance Intervals are the following: Daily; 10,000 Miles; 30,000 Miles; 60,000 Miles;120,000 Miles
B	**WORK AREA**	This column lists the On Vehicle Areas where the Equipment to be maintained is located The Work Areas are provided to optimize the jobs organization of the Preventive Maintenance tasks in order to: 1- respect the Safety Precautions to be followed 2- complete the preparation and the availability of the Consumables, Tools and Spare Parts, needed to perform the referred Task. 3- respect the time (PERSON HOURS) established to perform the referred Task (with the basic assumption that the Vehicle is on an Inspection Pit or Stand Up Rail and the Consumables, Tools and Spare Parts are available at the location of the Equipment to be maintained.) The On Vehicle Work Areas are the following: Exterior - Interior - Roof - Truck - Undercar - Vehicle (Vehicle as a whole)

RUNNING PREVENTIVE MAINTENANCE REPORTS (R-PMR/JOB CARDS) FORM (cont'd)		
SPECIFIC DATA TO BE FILLED IN BY THE MAINTAINER		
ITEM #	**TITLE**	**EXPLANATORY NOTE**
C	**ITEM**	This column lists the Subsystem/Assembly, Unit, Component to be maintained
D	**TASK**	This column lists the R-PM tasks to be performed for each Assembly/Unit/Component (i.e., Cleaning, Inspection, Test) The R-PM Tasks are the following: Cleaning - Inspection -Lubrication – Replacement – Service- Test
E	**LOCATION**	This column lists the On Board Vehicle Location of all Equipment to be maintained according to the following Location identification Codes 

RUNNING PREVENTIVE MAINTENANCE REPORTS (R-PMR/JOB CARDS) FORM (cont'd)	
SPECIFIC DATA TO BE FILLED IN BY THE MAINTAINER	
ITEM #	**TITLE**
E (cont'd)	**LOCATION (cont'd)**
EXPLANATORY NOTE	



Door Numbering

ITEM #	TITLE	EXPLANATORY NOTE
F	**PM SHEET CODE**	This column lists the reference to Running-Preventive Maintenance Sheet where the Procedure to be performed is described and illustrated. Refer to Running-Preventive Maintenance Sheet (R-PMS) Form for detailed explanation.
G	**SHEET ….OF……**	This field indicates the progressive sheet page number of each. R-PMR/JOB CARD

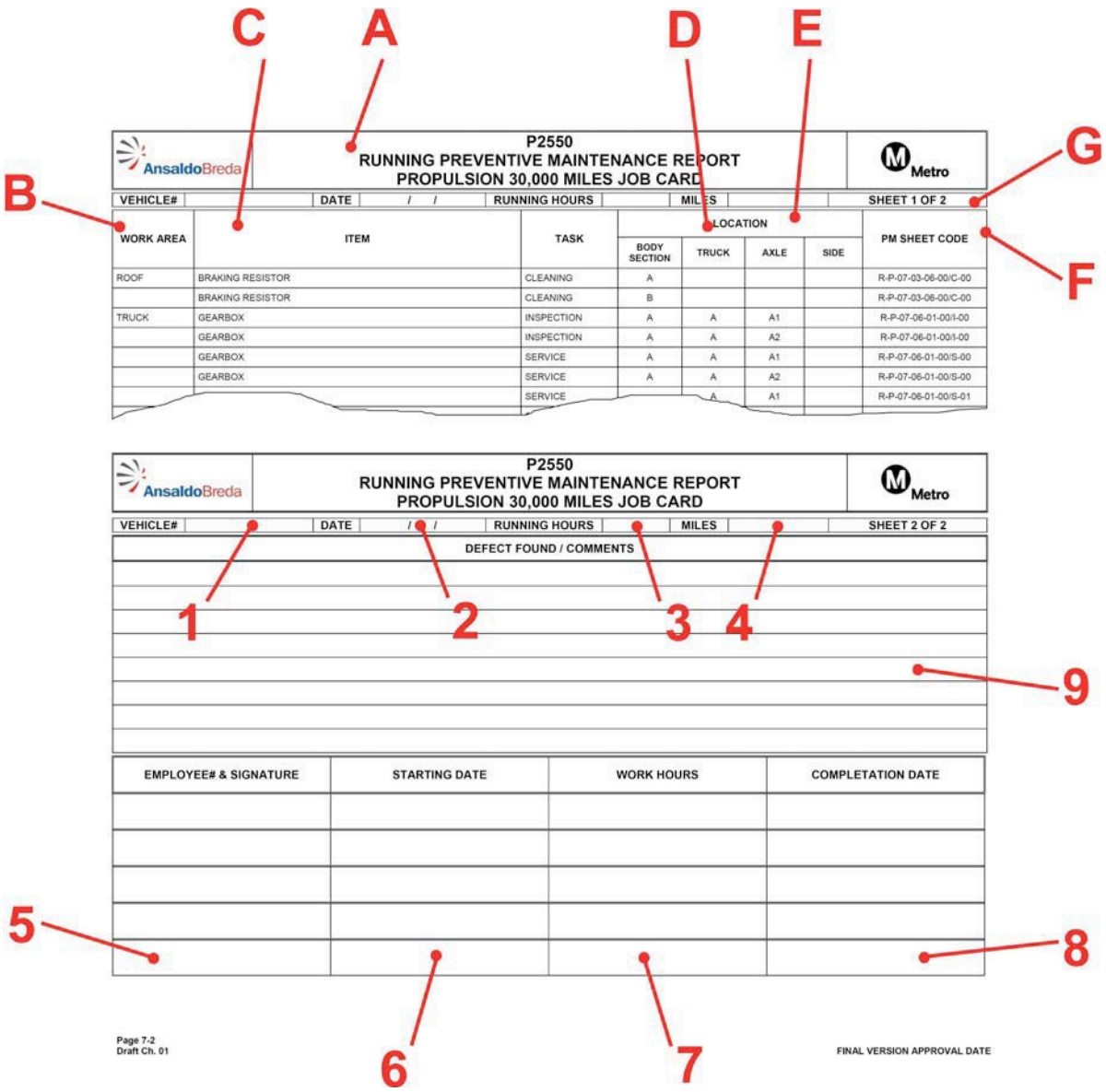


Figure 19-III-03.1 R-PMR/Job Card Form –Example

19-III-03.02.02 R-PMR/Job Card Sequence

The R-PMR/JOB CARDS provided in this Section are grouped according to the following sequence:

Daily 10,000 Miles 30,000 Miles 60,000 Miles 120,000 Miles

19-III-03.02.03 Running –Preventive Maintenance Cycle & R-PMR/Job Card Content

The Running –Preventive Maintenance Cycle and the relevant R-PMR/JOB CARD content are as follows:

MAINTENANCE INTERVAL	PMR /JOB CARD TITLE	PMR /Job Card CONTENT
DAILY	DAILY JOB CARD	• List of Assemblies/Components and related Tasks to be performed **DAILY**
10,000 Miles	10,000 MILES JOB CARD	• DAILY Job Card content + List of Assemblies/Components and related Tasks to be performed at **10,000** Miles
30,000 Miles	30,000 MILES JOB CARD	• DAILY Job Card content + 10,000 Job Card content + List of Assemblies/Components and related Tasks to be performed at **30,000** Miles
60,000 Miles	60,000 MILES JOB CARD	• DAILY Job Card content + 10,000 Job Card content + 30,000 Job Card content + List of Assemblies/Components and related Tasks to be performed at **60,000** Miles
120,000 MILES	120,000 MILES JOB CARD	• DAILY Job Card content + 10,000 Job Card content + 30,000 Job Card content + 60,000 Job Card content + List of Assemblies/Components and related Tasks to be performed at **120,000** Miles

19-III-03.02.04 R-PMR/Job Card Data Presentation Sequence

The Subsystems / Assemblies / Units / Components listed in the ITEMS column of each R-PMR/JOB CARD are grouped by Work Area and Vehicle Systems' and sequenced, in alphabetical order, in conjunction with their On Vehicle Locations and Tasks to be performed.

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19-III-03.02.05 Running Preventive Maintenance Reports R-PMR/Job Cards

EVENT RECORDER

Running – Preventive Maintenance Reports

R-PMR/JOB CARDS

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EVENT RECORDER
RUNNING PREVENTIVE MAINTENANCE REPORT
120,000 MILES JOB CARD

VEHICLE #		DATE		RUNNING HOURS		MILES		SHEET 1 OF 1

WORK AREA	SYSTEM	ITEM	TASK	LOCATION				PM SHEET CODE
				BODY SECT	TRUCK	AXLE	SIDE	
INTERIOR	EVENT RECORDER	EVENT RECORDER	TEST	B				R-P-19-01-00-00/T-00

DEFECT FOUND / COMMENTS

EMPLOYER # & SIGNATURE	STARTING DATE	WORK HOURS	COMPLETION DATE

19-III-03.03 Running -Preventive Maintenance Sheets (R-PMS)

Each R-PMS provides the following data consistent with Preventive Maintenance Plan (PMP), AB Design Documentation and Vehicle Systems Functional Tree:

- **R-PM Sheet Code**
- **SYSTEM, SUBSYSTEM /ASSEMBLY, UNIT**, **Component** (Names)
- **SYSTEM, SUBSYSTEM /ASSEMBLY, UNIT**, **Component** (Location)
- **Maintenance Interval** (Miles)
- **Maintenance Task**,
- **Man Hours**, needed to perform the Task
- **SPARE PARTS**, needed to perform the Task

Each R-PMS provides also:

- **SAFETY PRECAUTIONS**, to be followed to safely accomplish the Task
- **TOOLS**, including Special Tools and Test Equipment, needed to accomplish the Task
- **CONSUMABLES**, required to accomplish the Task and consistent with those used by MTA
- **PROCEDURE**, consisting of **Preliminary Operations** and **Procedural Steps**, to be followed while performing Maintenance Tasks.
- **Illustrations** and **Pictures** are inserted in the text to facilitate the understanding of the topics and/or to explain step-by-step procedure.

19-III-03.03.01 Running- Preventive Maintenance Sheet (R-PMS) Form

The R-PMS Form (refer to Figure 19-III-03.2) consists of several fields containing the following data/ information:

RUNNING -PREVENTIVE MAINTENANCE SHEET (RPMS) Form			
ITEM #	**TITLE**	**CONTENT**	**EXPLANATORY NOTES**
1	**Card code**	**Sheet code**	The Sheet Code is an alphanumerical code that identifies each R-PM Sheet. **THE SHEET CODE IS THE EXPLICIT LINK BETWEEN R-PM MATRIXES, R-PMR /JOB CARDS AND R-PM SHEETS** The Sheet Code consists of letters R-P followed by an 11 digit code number as follows: **R-P-nn-mm-zz-ww/Y-kk** **R** = **R**unning **P**= **P**reventive **nn** may vary from 02 to 19, identifying the System/ Manual Section number. **mm-zz-ww** each one may vary from 00 to 99, according to AB System Functional Tree, allowing the identification of the Assembly/Unit/Component **Y** Maintenance Task Code. It may be one of the following: **C=C**leaning **I =I**nspection **L = L**ubrication **R=R**eplacement **S=S**ervice **T=T**est **kk** It may vary from 00 to 99. It is a progressive number allowing the explicit identification of RPMS when one of the following cases occur: 1- same Maintenance Task pertaining to vehicle as a whole or to the same System/Subsystem/Assembly to be performed at same Maintenance Interval in different Vehicle Area (i.e Vehicle as a Whole DAILY Exterior /Interior INSPECTION) 2- same Maintenance Task pertaining to the same Assembly/Unit/Component to be performed at different Maintenance Intervals and for this reason consisting of different Maintenance Procedure
2	**System**	**System name**	This field indicates the System to which the Assembly/Unit/Component belongs.
3	**Subsyste m/ Assembly**	**Subsystem/ Assembly name**	This field indicates the Subsystem/Assembly to which the Unit/Component belongs.
4	**Unit**	**Unit name**	This field indicates the Unit to which the Component belongs.
5	**Component**	**Component name**	This field indicates the Component the Maintenance Task is referring to
6	**Maintenance Task**	**Maintenance Task name**	This field indicates the Maintenance Task to be performed.
7	**Interval Miles**	**Number**	This field indicates the maintenance Interval Miles. It may be DAILY, 10,000 Miles, 30,000 Miles, 60,000 Miles, 120,000 Miles

RUNNING -PREVENTIVE MAINTENANCE SHEET (RPMS) Form (cont'd)			
ITEM #	**TITLE**	**CONTENT**	**EXPLANATORY NOTES**
8	**Man Hours**	**Number**	The Man Hour field indicates the time needed to perform the corresponding Maintenance Task, with the basic assumption that the Vehicle is staged on an Inspection Pit/Jacking tracks with the required Consumables, Tools and Materials Available.
9	**Sheet**	**Pages numbering**	This field indicates the progressive R-PMS sheet page number.
10	**LOCATION**	**Illustration**	This field indicates the On Board Location of the Equipment to be maintained The following Graphic Symbols are used for: Assembly/Unit/Component ● for System/Subsystem/Vehicle as a Whole ▭
11	**R**	**Letter**	This field indicates that the Sheet pertains to Running Maintenance
12	**P**	**Letter**	This field indicates that the Sheet pertains to Preventive Maintenance
13	**nn**	**Number**	This field indicates the System/Manual Section number to which the Sheet pertains. It may vary from 01 to 19
14	**rr**	**Number**	This field indicates the Sheet Revision number
15	**Page ##**	**Page ##**	This field indicates the RMSM Section Page number
16	**-#**	**Number**	This field indicates the RMSM Section Revision number
17	**SAFETY PRECAUTIONS**	**Text**	This field presents the General and/or specific Safety Precautions to be followed to accomplish safely the relevant Maintenance Tasks.
18	**TOOLS**	**Text**	This field lists the description and the P/N of the Standard tools, Special Tools and Test Equipment needed to accomplish the Maintenance Task. Refer to the TTE Manual for the TE and Special Tools detailed descriptions and tools maintenance.
19	**CONSUMABLES**	**Text**	This field lists the Consumables Materials (consistent with those used by MTA with the related P/N.) needed to accomplish the Maintenance Task. Cleaning agents are included
20	**SPARE PARTS**	**Text**	This field lists the Description and PN of Spare Parts (consistent with Illustrated Parts Catalog) needed to accomplish the Maintenance Task.
21	**PROCEDURE**	**Text**	The Procedure field provides Preliminary Operations and Procedural step by step Instructions to be followed while performing the Maintenance Task. Illustrations and Pictures are inserted in the text to facilitate the understanding of the topics and/or to explain step-by-step procedure.

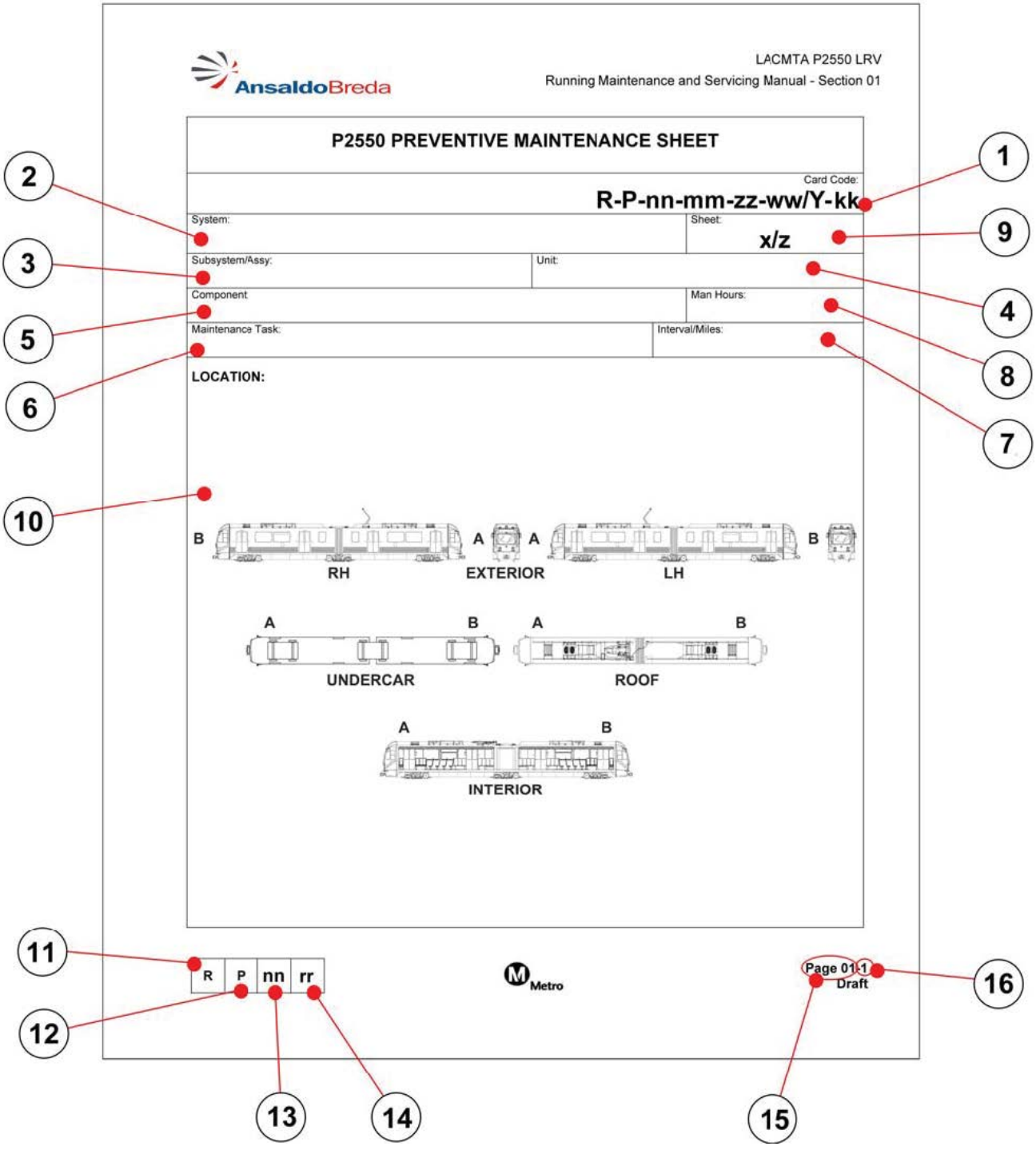

Figure 19-111-03.2 R-PMS Form
(Sheet 1 of 2)

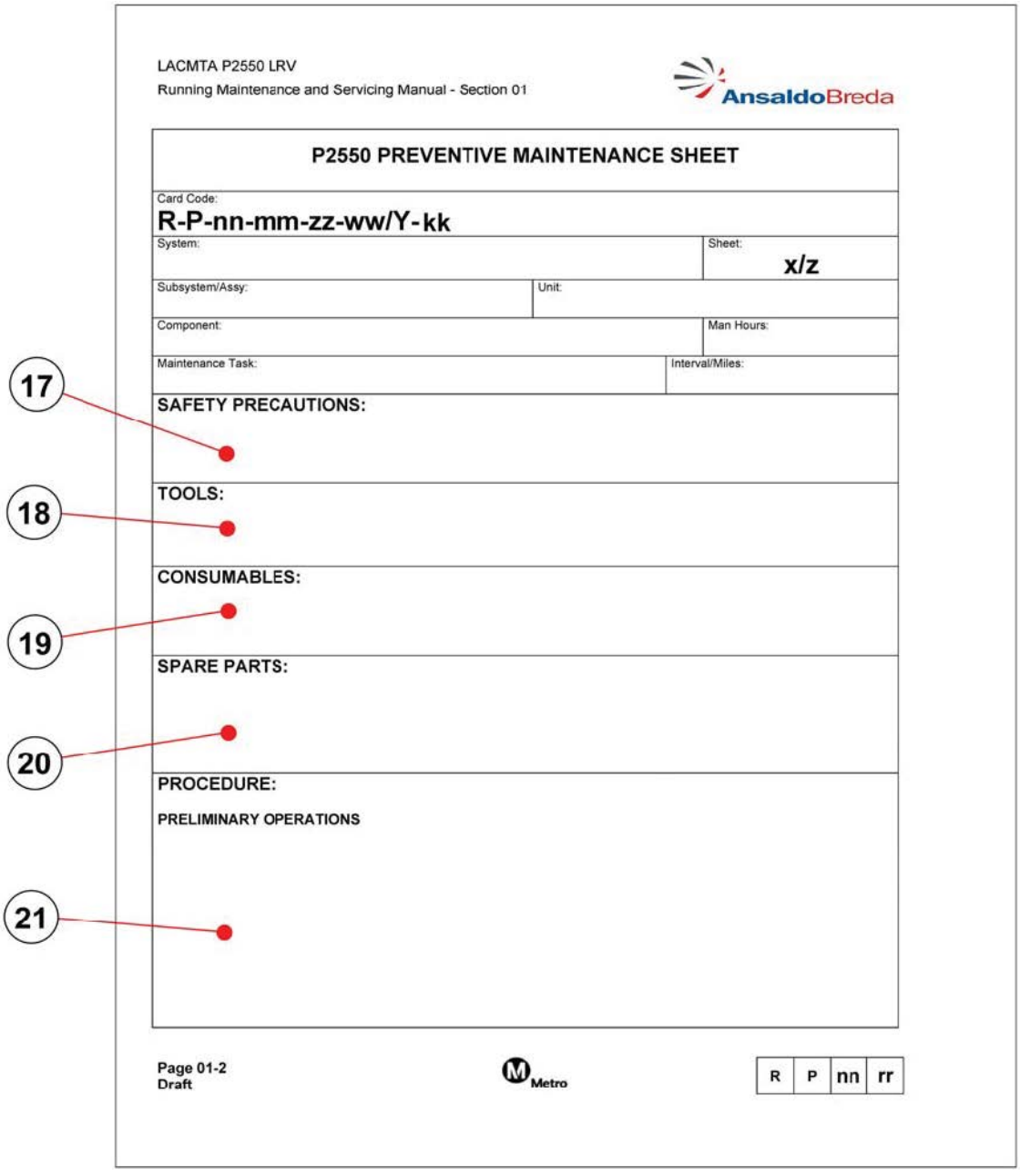

Figure 19-111-03.2 R-PMS Form Front Page
(Sheet 2 of 2)

19-III-03.03.02 How to Use the R-PM Sheets and R-PMR /Job Cards

To optimize the job organization, proceed as follows:

1. At Scheduled Preventive Maintenance Interval Expiration Date

a) Use the relevant (Maintenance Interval) R-PMR/JOB CARD where the Subsystems/Assemblies/Units/Components, listed in the ITEMS column, are grouped by Work Area and Vehicle System and sequenced, in alphabetical order, in conjunction with their On Vehicle Location and Task to be performed.

b) Select the Work Area and the System.

c) Select the first Equipment listed in the ITEMS column and the Sheet Code listed in conjunction with the Task to be performed and gather the relevant Sheet.

d) Read carefully the Sheet to fully understand the provided Data/Instructions.

e) Carefully read:

- The Safety Precautions to perform the Task safely
- The Preliminary Operations to set the Vehicle in safety conditions according to
- MTA Maintenance Shop Regulations
- The Tools, Consumables and Spare Parts listed in each Sheet which are needed to accomplish the Task, in order to have all of them available next to the location of the Equipment to be maintained before starting the activities

f) Fill the R-PMR/JOB CARD with the data required by the Maintainer at the start of the Maintenance Activities.

2. Task Execution

a) Follow carefully the prescribed Safety Precautions and Maintenance Procedural Steps provided in the R-PM Sheet.

b) Perform the Maintenance Task Procedure on the first Equipment (listed in the ITEMS column of the relevant R-PMR /JOB CARD) at its On Vehicle LOCATION. as indicated in the LOCATION column of the R-PMR /JOB CARD.

c) Once completed the Maintenance Task on the first Equipment, highlight (with a flag) its LOCATION field on the R-PMR / JOB CARD.

d) Note Equipment Defect Found and / or your Comments on the End Page of the R-PMR / JOB CARD.

e) Proceed to perform the same Task on the second (same) Equipment listed in the R-PMR / JOB CARD at its On Vehicle LOCATION, (different from the previous one) as indicated in the LOCATION column of the R-PMR /JOB CARD.

f) Proceed as above to perform the same Task on every Equipment (to which the same Sheet Code refers) listed in the ITEMS column of the relevant (Maintenance Interval) R-PMR /JOB CARD.

g) During Task execution, note any Areas / Items of the Assembly / Unit/ Component under Preventive Maintenance Process requiring Corrective Maintenance.

h) Gather as much information about the Equipment as is practical to increase your Equipment knowledge (i.e.; knowledge about the malfunction in terms of correctly operating and incorrectly operating equipment processes).

3 At every Task Completion

a) Follow carefully the prescribed Safety Precautions before restoring Electrical Power to Vehicle.

b) Check the correct operation and/or functions of the Subsystem to which the maintained Equipment pertains.

c) Perform this check on the IDU “A “as follows:

NOTE: Through the IDU you can check if all Systems are exchanging data through the MVB or LonWorks Bus and the Trainlines Status.

The IDU Display also shows in real time the Status of all Vehicle Systems.

Reading the IDU Fault List it is possible to immediately detect a fault

Using the IDU in Normal Mode the Fault Indications are generic,

Using the IDU in Maintenance Mode the same Fault has a detailed description.

An alternate way for a very detailed System troubleshooting is to directly connect a PTU to the STB and PCA board using the Connectors located in the Electronic Box of the A or B Section.

1. On IDU “A” access to the Maintenance Menu first and then to the “Faults” Screen by selecting, in sequence, the relevant icons.
2. Check, On IDU “A” through the list of the Current Active Faults shown in the “Faults” Screen, for “Fault” Codes related to the Subsystem to which the maintained Equipment pertains.

   Refer to Section 18 of RMSM for Fault Signals Details.
3. As per “Fault” Codes check results proceed as follows:

   - **No Faults are listed in the “Faults” Screen**

     a) Key OFF the Vehicle.

     b) Record Service and Test results on the Defect Report Card for administrative and maintenance planning.

     c) Fill the R-PMR /JOB CARD with the data required to the Maintainer at the completion of the Maintenance Activities and include your comments

- **Fault Codes are listed in the "Faults" Screen**

a) Investigate/troubleshoot the Equipment previously maintained first and then the System/Subsystem/Assembly/Unit for Fault Probable Causes
b) Gather as much information about the failure symptoms as is practical.
c) Refer to Section 18 of RMSM for Fault Signals Details
d) Try to identify the malfunction in terms of correctly operating and incorrectly operating equipment processes.
e) Identify which equipment signals or parameters will best help you to localize the failure.
f) Identify the source of the problem.
g) Repair or replace the defective component.
h) Verify that the repair is effective in eliminating all of the failure symptoms.
i) Evaluate whether or not the defective component was the root cause of the failure.
j) Once the Fault Codes are not found in the "Faults" Screen perform steps from 3-a through 3-c (previous subparagraph **"No Faults are listed in the "Faults" Screen)**

19-III-03.03.03 Running- Preventive Maintenance Sheet (R-PMS) List

The Event Recorder Running- Preventive Maintenance Sheets (R-PMS) List is provided in the following pages

The R-PM Sheets are listed by Subsystem / Assembly / Unit / Component and sequenced by Maintenance Interval in conjunction with their Sheet Codes and Tasks (including SCPM flag) to be performed

Table 19-III-03.3 Running Preventive Maintenance Sheets List

SYSTEM 19 EVENT RECORDER					
SUBSYSTEM/ ASSY	**ASSY /UNIT/ COMPONENT**	**SCPM**	**TASK**	**MAINTEN. INTERVAL (MILES)**	**SHEET CODE**
EVENT RECORDER	EVENT RECORDER		TEST	120,000	R-P-19-01-00-00/T-00

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19-III-03.03.04 Running- Preventive Maintenance Sheets (R-PMS)

EVENT RECORDER

Running – Preventive Maintenance Sheets

R-PMS

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P2550 PREVENTIVE MAINTENANCE SHEET

Card Code
R-P-19-01-00-00/T-00

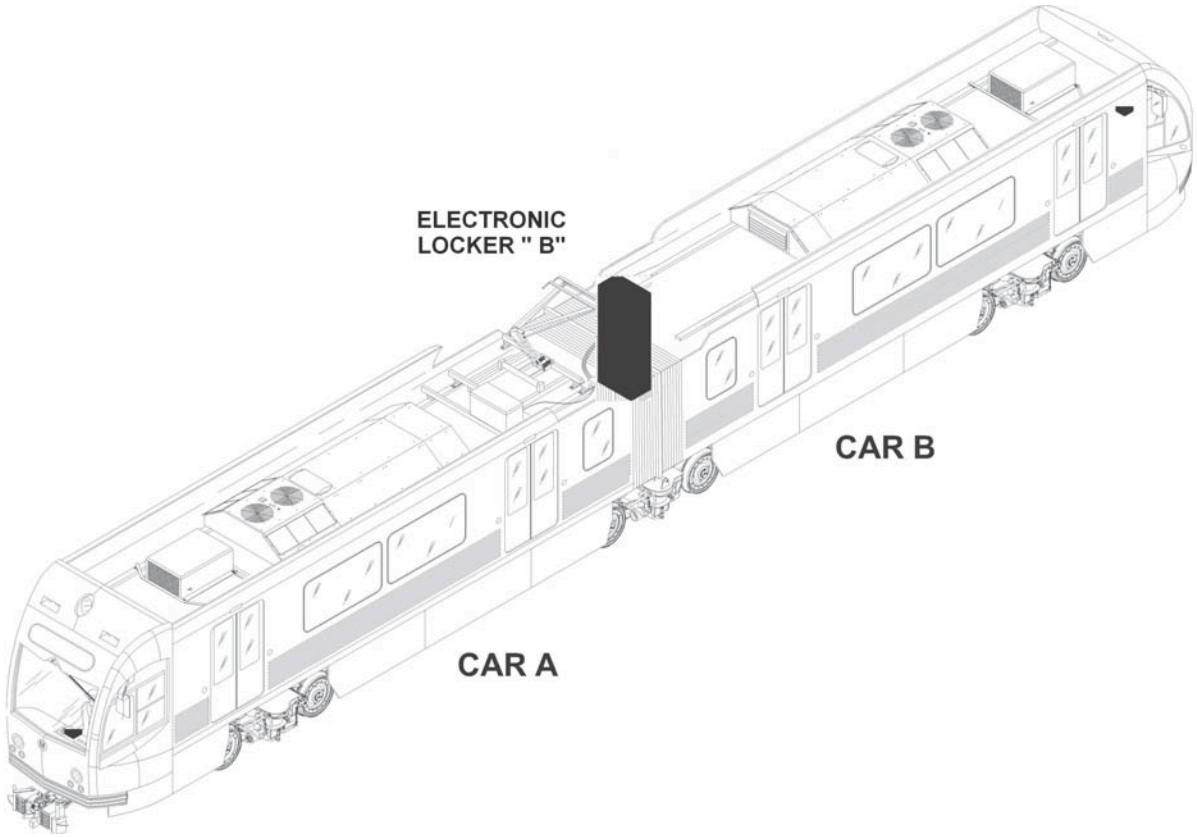
System	Sheet
EVENT RECORDER	**1/4**

Subsystem/Assy	Unit
EVENT RECORDER	**EVENT RECORDER**

Component	Man Hours
	0.2

Maintenance Task	Interval/Miles
TEST	**120,000**

LOCATION:



P2550 PREVENTIVE MAINTENANCE SHEET

Card Code **R-P-19-01-00-00/T-00**		
System **EVENT RECORDER**		Sheet **2/4**
Subsystem/Assy **EVENT RECORDER**	Unit **EVENT RECORDER**	
Component		Man Hours **0.2**
Maintenance Task **TEST**	Interval/Miles **120,000**	

SAFETY PRECAUTIONS:

LACMTA Maintenance Shop Safety Rules & Regulations

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

NA

SPARE PARTS:

N/A

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code
R-P-19-01-00-00/T-00

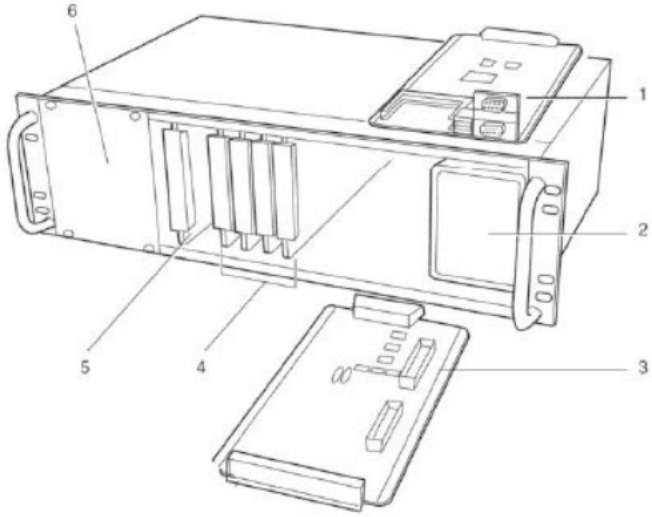
System	Sheet
EVENT RECORDER	**3/4**

Subsystem/Assy	Unit
EVENT RECORDER	**EVENT RECORDER**

Component	Man Hours
	0.2

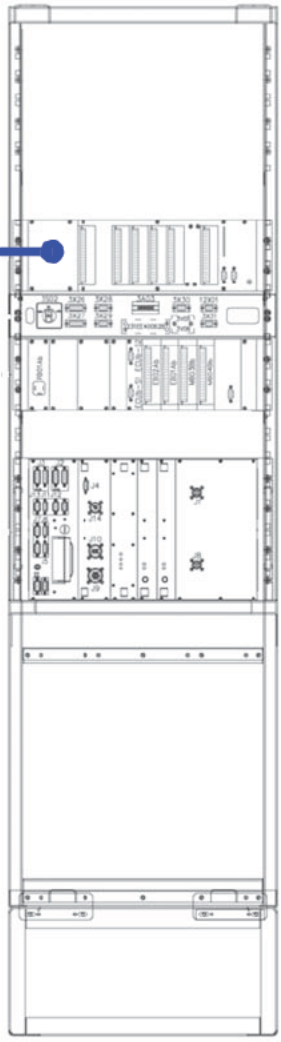
Maintenance Task	Interval/Miles
TEST	**120,000**

EVENT RECORDER EXTERIOR VIEW



1 Unit Control board (shown extracted from TOM)
2 Secure memory module
3 IFT board (shown extracted from TOM)
4 MEL boards
5 Power supply board
6 MVB Module board

EVENT RECORDER- COMPONENTS



ELE LOCKER " B "
EVENT RECORDER LOCATION

P2550 PREVENTIVE MAINTENANCE SHEET

Card Code **R-P-19-01-00-00/T-00**		
System **EVENT RECORDER**		Sheet **4/4**
Subsystem/Assy **EVENT RECORDER**	Unit **EVENT RECORDER**	
Component		Man Hours **0.2**
Maintenance Task **TEST**	Interval/Miles **120,000**	

PROCEDURE (CONT'D)

To perform the Digital Input Test proceed as follows.

TBD

19-III-04 RUNNING -CORRECTIVE MAINTENANCE

19-III-04.01 Running -Corrective Maintenance Sheets (R-CMS)

Each R-CMS provides the following data consistent with Corrective Maintenance Analysis (CMA), AB Design Documentation and Vehicle Systems Functional Tree:

- **R-CM Sheet Code**
- **SYSTEM, SUBSYSTEM /ASSEMBLY, UNIT, Component** (Names)
- **SYSTEM, SUBSYSTEM /ASSEMBLY, UNIT, Component** (Location)
- **Maintenance Task**

  The following definitions are applicable to the R-CM Tasks

Inspection:	Maintenance procedures such as those required to ascertain the serviceability of a Part, Assembly, System or the specific interrelationship of Parts that perform a functional operation.
Leveling:	Procedure to adjust the distance between the Vehicle Floor to the Top Of Rail and the designated Vehicle Height
Replacement:	Provides the Components / Assemblies and Subassemblies removal & installation in a logical sequential order.
Re-Profiling:	Provides the procedure to maintain the safe and proper "wheel profile".
Repair:	Provides detailed procedures for the repair of a specific Equipment / Component
Service:	Operation performed to replenish Sand, Windshield Wiper Washer Fluid, HVAC Coolant, Gear and Compressor Oil, and Vehicle Lubrication.

- **Man Hours,** needed to perform the Task
- **SPARE PARTS,** needed to perform the Task

Each R-CMS provides also:

- **SAFETY PRECAUTIONS,** to be followed to safely accomplish the Task
- **TOOLS,** including Special Tools and Test Equipment, needed to accomplish the Task
- **CONSUMABLES,** required to accomplish the Task and consistent with those used by MTA
- **PROCEDURE,** consisting of Preliminary Operations and Procedural Steps, to be followed while performing Maintenance Tasks
- **Illustrations and Pictures** are inserted in the text to facilitate the understanding of the topics and/or to explain step-by-step procedure

Each R-CM Sheet refers to one Task and consists of several pages where Safety Precautions and Maintenance Instructions to perform safely the Task are provided by Procedural Steps in conjunction with Illustrations and Pictures.

19-III-04.01.01 Running- Corrective Maintenance Sheet (R-CMS) Form

The R-CMS Form (refer to Figure 19-III-04.1) consists of several fields containing the following data/ information:

RUNNING -CORRECTIVE MAINTENANCE SHEET (R-CMS) Form			
ITEM #	**TITLE**	**CONTENT**	**EXPLANATORY NOTES**
1	**Card code**	**Sheet code**	The Sheet Code is an alphanumerical code that identifies each R-CM Sheet. **THE SHEET CODE IS EXPLICIT** The Sheet Code consists of letters **R-C** followed by an 11 digit code number as follows: **R-C-**nn-mm-zz-ww/Y-kk **R = Running** **C= Corrective** **nn** may vary from 02 to 19, identifying the System/ Manual Section number. **mm-zz-ww** each one may vary from 00 to 99, according to AB System Functional Tree, allowing the identification of the Assembly/Unit/Component **Y** Maintenance Task Code. It may be one of the following: **I =** **I**nspection **LL =L**eveling **R =** **R**eplacement **RP=** **R**e-**P**rofiling **RR = R**epair **S = S**ervice **SP = S**afety **P**recautions **kk** It may vary from 00 to 99. It is a progressive number allowing the explicit identification of R-CMS **NOTE:** The code R-C-nn-00-00-00-R-kk identifies a Typical Replacement Procedure The Typical Replacement Procedure is provided for the following items: Board, Circuit Breaker, Diode, Indicator Lamp, Main Contactor, Switch & Relays.
2	**System**	**System name**	This field indicates the System to which the Assembly/Unit/Component belongs.
3	**Subsystem/ Assembly**	**Subsystem/ Assembly name**	This field indicates the Subsystem/Assembly to which the Unit/Component belongs.
4	**Unit**	**Unit name**	This field indicates the Unit to which the Component belongs.
5	**Component**	**Component name**	This field indicates the Component the Maintenance Task is referring to
6	**Maintenance Task**	**Maintenance Task name**	This field indicates the Maintenance Task to be performed.
7	**Man Hours**	**Number**	The Man Hour field indicates the time needed to perform the corresponding Maintenance Task. with the basic assumption that the Vehicle is staged on an Inspection Pit/Jacking tracks with the required Consumables, Tools and Materials available.

RUNNING -CORRECTIVE MAINTENANCE SHEET (R-CMS) Form (cont'd)			
ITEM #	**TITLE**	**CONTENT**	**EXPLANATORY NOTES**
8	**Sheet**	**Pages numbering**	This field indicates the progressive R-CMS sheet page number.
9	**LOCATION**	**Illustration**	This field indicates the On Board Location of the Equipment to be maintained The following Graphic Symbols are used for: Assembly/Unit/Component ● for System/Subsystem/Vehicle as a Whole ▭
10	**R**	**Letter**	This field indicates that the Sheet pertains to Running Maintenance
11	**C**	**Letter**	This field indicates that the Sheet pertains to Corrective Maintenance
12	**nn**	**Number**	This field indicates the System/Manual Section number to which the Sheet pertains. It may vary from 01 to 19
13	**rr**	**Number**	This field indicates the Sheet Revision number
14	**Page ##**	**Page ##**	This field indicates the RMSM Section Page number
15	**-#**	**Number**	This field indicates the RMSM Section Revision number
16	**SAFETY PRECAUTIONS**	**Text**	This field presents the General and/or specific Safety Precautions to be followed to accomplish safely the relevant Maintenance Tasks.
17	**TOOLS**	**Text**	This field lists the description and the P/N of the Standard tools, Special Tools and Test Equipment needed to accomplish the Maintenance Task. Refer to the TTE Manual for the TE and Special Tools detailed descriptions and tools maintenance.
18	**CONSUMABLES**	**Text**	This field lists the Consumables Materials (consistent with those used by MTA with the related P/N.) needed to accomplish the Maintenance Task. Cleaning agents are included
19	**SPARE PARTS**	**Text**	This field lists the Description and PN of Spare Parts (consistent with Illustrated Parts Catalog) needed to accomplish the Maintenance Task.
20	**PROCEDURE**	**Text**	The Procedure field provides Preliminary Operations and Procedural step by step Instructions to be followed while performing the Maintenance Task. Illustrations and Pictures are inserted in the text to facilitate the understanding of the topics and/or to explain step-by-step procedure.

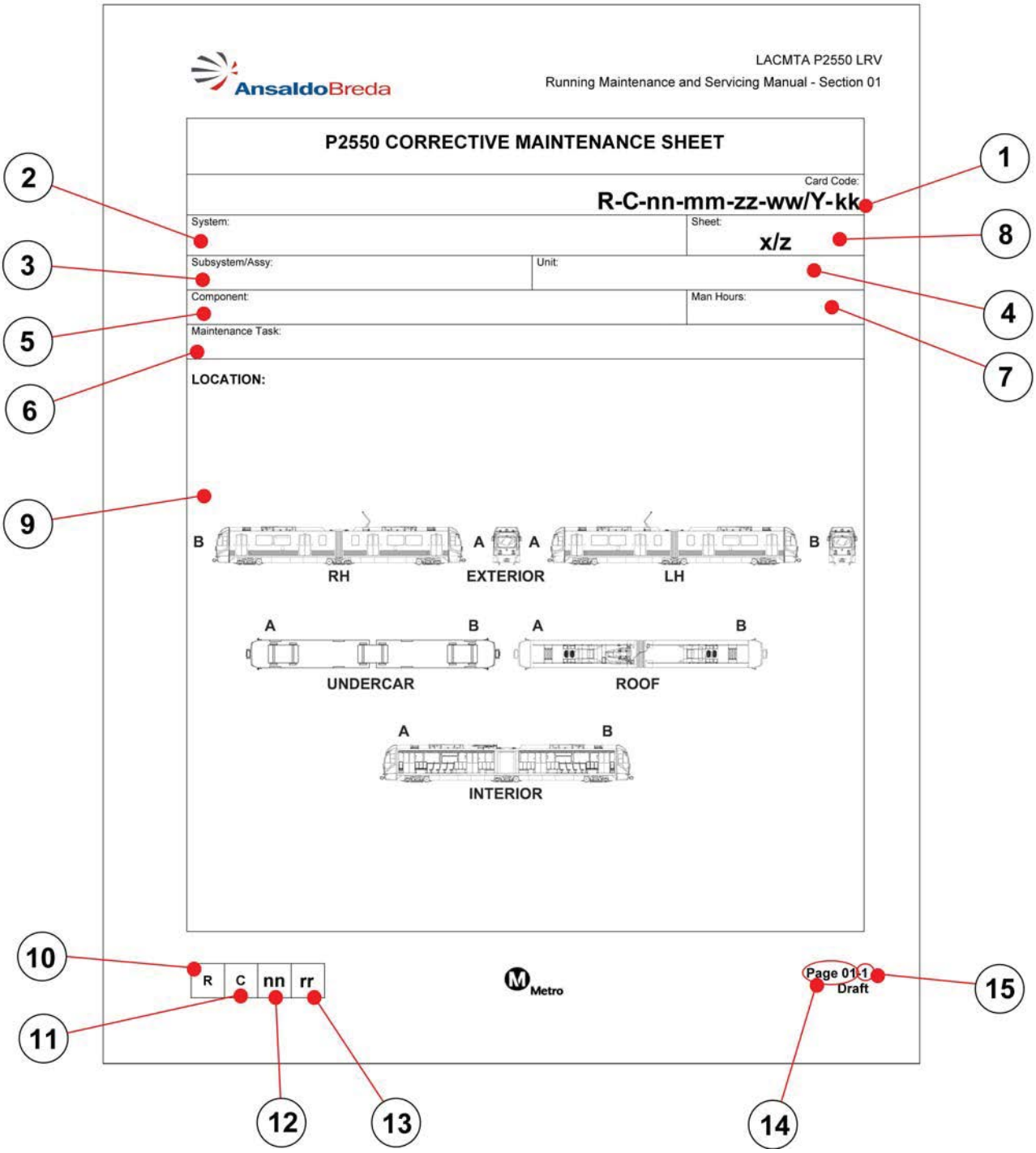


Figure 19-111-04.1 R-CMS Form
(Sheet 1 of 2)

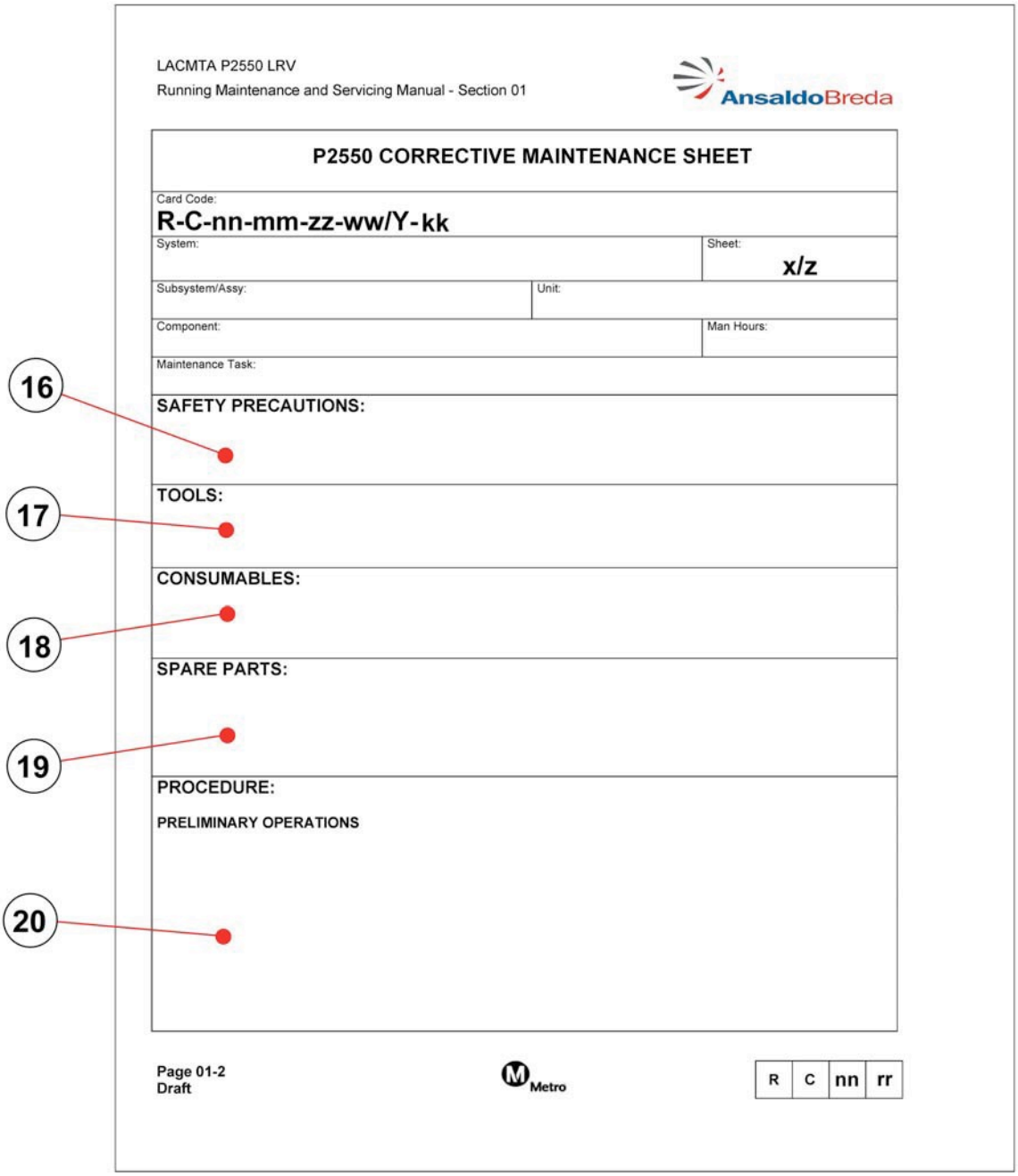


Figure 19-III-04.1 R-CMS Form
(Sheet 2 of 2)

19-III-04.01.02 How to Use the R-CM Sheets

To optimize the job organization it is suggested to proceed as follows:

1. Before Task Execution

a) Read accurately the Sheet to fully knowledge the provided Data /Instructions

b) Particularly read

- The Safety Precautions to perform safely the Task
- The Preliminary Operations to set the Vehicle in safety conditions according to MTA Maintenance Shop Regulations
- The Tools, Consumables and Spare Parts listed in each Sheet and needed to accomplish the Task, to have all of them available next the location of the Equipment to be maintained before to start the activities

2. During Task Execution

a) Follow accurately the prescribed Safety Precautions and Maintenance Procedural Steps

b) Note any Areas/Items of the Assembly/Unit/Component under Corrective Maintenance Process requiring further Corrective Maintenance

c) Gather as much information about the Equipment as is practical (i.e. knowledge about the malfunction in terms of correctly operating and incorrectly operating equipment processes) to increase your equipment knowledge

3. At every Task Completion

a) Follow carefully the prescribed Safety Precautions before restoring the Electrical Power to the Vehicle.

b) Check the correct operation and/or functions of the Subsystem to which the maintained Equipment pertains.

c) It is suggested to perform this check on the IDU “A “as follows:

NOTE: Through the IDU you can check if all Systems are exchanging data by MVB or LonWorks Bus and the Trainlines Status.

The IDU Display also shows in real time the Status of all Vehicle Systems.

Reading the IDU Fault List it is possible to immediately detect a fault.

Using the IDU in Normal Mode, the Fault Indications are generic.

Using the IDU in Maintenance Mode, the same Fault has a detailed description.

An alternate way for a very detailed System troubleshooting is to directly connect a PTU to the STB and PCA board using the Connectors located in the Electronic Box of the A or B Section.

1. On IDU "A" access to the Maintenance Menu first and then to the "Faults" Screen by selecting, in sequence, the relevant icons.
2. Check, On IDU "A" through the list of the Current Active Faults shown in the "Faults" Screen, for Fault Codes related to the Subsystem to which the maintained Equipment pertains.

   Refer to Section 18 of RMSM for Fault Signals Details.
3. As per "Fault" Codes check results proceed as follows:

   - **No Faults are listed in the "Faults" Screen**
     a) Key OFF the Vehicle
     b) Record Service and Test results on the Defect Report Card for administrative and maintenance planning

   - **Trouble Code(s) are listed in the Trouble Screen**
     a) Investigate/troubleshoot the Equipment previously maintained first and then the System/Subsystem/Assembly/Unit for Fault Probable Causes
     b) Gather as much information about the failure symptoms as is practical.
        Refer to Section 18 of RMSM for Fault Signals Details
     c) Try to identify the malfunction in terms of correctly operating and incorrectly operating equipment processes
     d) Identify which equipment signals or parameters will best help you to localize the failure
     e) Identify the source of the problem
     f) Repair or replace the defective component
     g) Verify that the repair is effective in eliminating all of the failure symptoms
     h) Evaluate whether or not the defective component was the root cause of the failure
     i) Once the Fault Codes are not found in the "Faults" Screen perform steps from 3-a through 3-b (previous subparagraph **"No Faults are listed in the "Faults" Screen)**

19-III-04.01.03 Running- Corrective Maintenance Sheet (R-CMS) List

The Event Recorder Running- Corrective Maintenance Sheets (R-CMS) List is provided in the following Table 19-III-04.1.

The R-CM Sheets are listed by Subsystem / Assembly / Unit / Component and sequenced by Sheet Codes and Tasks to be performed.

Table 19-III-04.1 Running Corrective Maintenance Sheets List

SYSTEM 19 EVENT RECORDER				
SUBSYSTEM / ASSY	**UNIT**	**COMPONENT**	**TASK**	**SHEET CODE**
EVENT RECORDER	EVENT RECORDER	BOARDS	REPLACEMENT	R-C-19-01-00-00/R-00

19-III-04.01.04 Running- Corrective Maintenance Sheets (R-CMS)

EVENT RECORDER

Running – Corrective Maintenance Sheets

R-CMS

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P2550 CORRECTIVE MAINTENANCE SHEET

Card Code
R-C-19-01-00-00/R-00

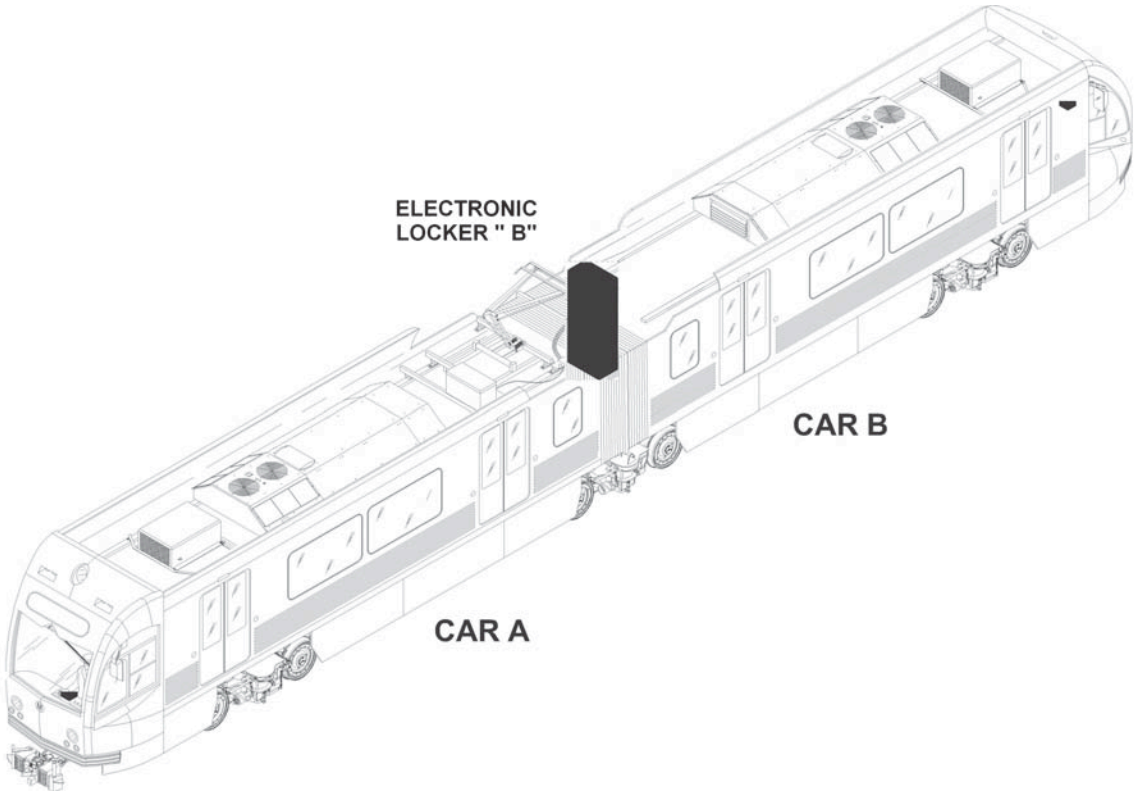
System	Sheet
EVENT RECORDER	**1/4**

Subsystem/Assy	Unit
EVENT RECORDER	**EVENT RECORDER**

Component	Man Hours
BOARDS	**0.5**

Maintenance Task
REPLACEMENT

LOCATION:



P2550 CORRECTIVE MAINTENANCE SHEET

Card Code **R-C-19-01-00-00/R-00**		
System **EVENT RECORDER**		Sheet **2/4**
Subsystem/Assy **EVENT RECORDER**	Unit **EVENT RECORDER**	
Component **BOARDS**		Man Hours **0.5**
Maintenance Task **REPLACEMENT**		

SAFETY PRECAUTIONS:

NA

TOOLS:

LACMTA Maintenance Shop Standard Tools Kit

CONSUMABLES:

SPARE PARTS:

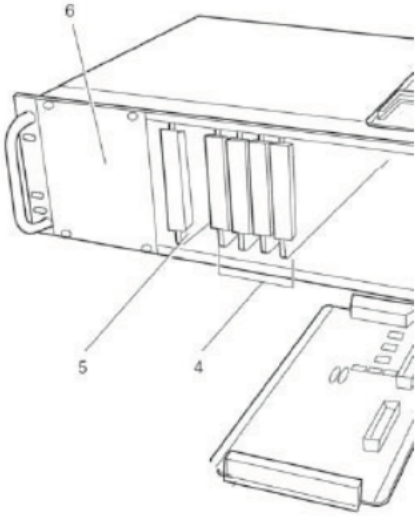
N/A

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code
R-C-19-01-00-00/R-00

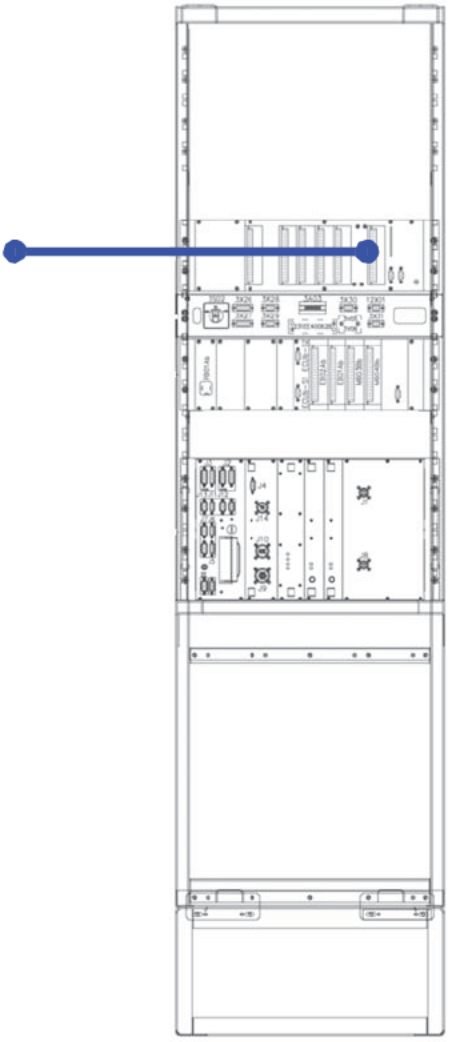
System	Sheet
EVENT RECORDER	**3/4**
Subsystem/Assy: **EVENT RECORDER**	Unit: **EVENT RECORDER**
Component: **BOARDS**	Man Hours: **0.5**
Maintenance Task: **REPLACEMENT**	

EVENT RECORDER EXTERIOR VIEW



1 Unit Control board (shown extracted from TOM)
2 Sec
3 IFT board (shown extracted from TOM)
4 MEL
5 Power supply board
6 MVE

EVENT RECORDER- COMPONENTS



ELE LOCKER " B "
EVENT RECORDER LOCATION

P2550 CORRECTIVE MAINTENANCE SHEET

Card Code
R-C-19-01-00-00/R-00

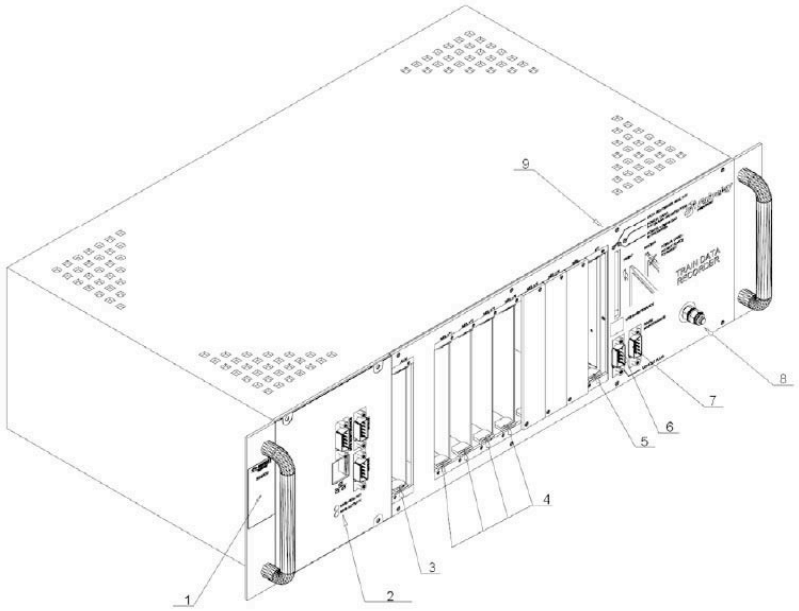
System	Sheet
EVENT RECORDER	**4/4**

Subsystem/Assy	Unit
EVENT RECORDER	**EVENT RECORDER**

Component	Man Hours
BOARDS	**0.5**

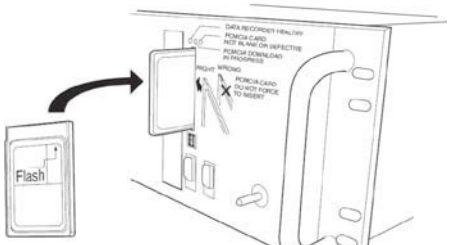
Maintenance Task
REPLACEMENT

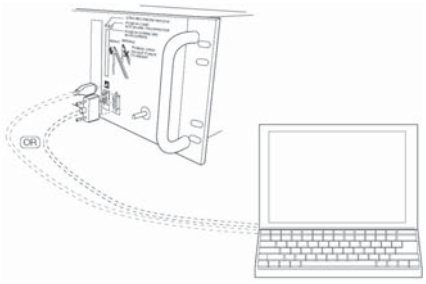
PROCEDURE: TBS



1 Label
2 Connector for MVB Link and MVB Maintenance, RJ45
3 Connector for power supply
4 Connectors for MEL
5 Connector for IFT board
6 Connector for coding plug
7 Connector for maintenance
8 Earth stud
9 PCMCIA port and Led

EVENT RECORDER- FRONT PANEL COMPONENTS





PCMCIA CARD INSERTION
EVENT RECORDER –PTU CONNECTION

19-III-05 CONSUMABLE MATERIALS LIST (R-CML)

The Consumable Materials needed to accomplish the Event Recorder Running Maintenance are listed, sequenced in alphabetical order, by SUBSYSTEM /ASSY -UNIT / COMPONENT, in the following Table 19-III-05.1.

Table 19-III-05.1 Running Maintenance Consumable Materials List (R-CML)

SYSTEM 19	EVENT RECORDER		
SUBSYSTEM /ASSY - UNIT / COMPONENT	**AGENT**	**PN**	**MTA PN**
EVENT RECORDER	CLEANER FOR ELECTRONIC INSTRUMENTS	**TBS**	

19-III-06 TEST EQUIPMENT & SPECIAL TOOLS LIST (R-TESTL)

The Tools and Test Equipment needed to accomplish the Event Recorder Running Maintenance are listed, sequenced in alphabetical order, by SUBSYSTEM /ASSY - UNIT / COMPONENT, in the following Table 19-III-06.1.

Refer to “Tools and Test Equipment Manual” for Special Tools / Test Equipment Description and Maintenance.

Table 19-III-06.1 Running -Test Equipment & Special Tools List (R-TESTL)

SYSTEM 19	EVENT RECORDER			
SUBSYSTEM /ASSY - UNIT / COMPONENT	**LACMTA STANDARD TOOLS KIT**	**LACMTA WORKSHOP DEVICES**	**SPECIAL TOOL / TEST EQUIPMENT**	**PN**
EVENT RECORDER	X	NA	Cable Certifier (Type LT 8600)	TBS
			Portable Test Unit (PTU) (Dell-)	TBS
			Multimeter (Fluke 87 V/E)	4EB19

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