

# Fault Finding Instruction

## Propulsion and auxiliary system

MITRAC 1110

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# 1 Introduction

This document forms part of a package of documentation produced by Bombardier Transportation Sweden for fault finding purposes in the trains. For further details concerning this package refer to the top document (see Table 1).

The instructions in this document require a certain level of system knowledge from the reader, as well as capability of reading/understanding vehicle circuit diagrams.

The vehicle circuit diagram is necessary to have at hand in the fault finding process.

The routine test instructions are necessary to have at hand in some cases, as certain test procedures are described there.

Doc.No	Document name	Comment
3EST000235-5963	Fault finding Overview, PPC Scope of Supply	Top document for the fault finding documentation package
This document	Fault finding Instruction, PPC Scope of Supply	
3EST000235-5980	Routine test instruction, Customer, MCM	Fault finding at routine testing of MCM
3EST000235-5982	Fault finding instruction, Routine test instuction, Customer, MCM	
3EST000235-5976	Routine test instruction, Customer, ACM	Fault finding at routine testing of ACM
3EST000235-5979	Fault finding instruction, Routine test instuction, Customer, ACM	

*Table 1 Related documents*

When a fault occurs in the train, it is displayed as a text message, along with unit identification information on the driver's display. The unit identification information points out which unit that has reported the fault.

Each Sub system has its own chapter in this document where all faults are listed with accompanying fault finding instructions.

All Sub Systems used in this project for the propulsion scope of supply are shown in Table 2 below.

Sub System	Sub System short name	Process id	Comment
Auxiliary Converter Module	ACM	24, 25	
Motor Converter Module	MCM	20, 21, 22, 23	

*Table 2 Fault code number series*



## 2 Safety

Before commencing testing/fault finding activities the user must read the safety warnings contained in Section 2 of document Fault finding Overview, PPC Scope of Supply 3EST000235-5963.

Any maintenance activities performed on the equipment as a result of fault finding activities (changing of components etc) must be performed in accordance with the safety regulations contained in the maintenance documentation.

## 3 ACM faults

### 3.1 0001 - Status DC-link overvoltage

Detected fault: DC-link voltage is above the overvoltage level.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_S\_OvUDcLk

Causes	Location	Item des.
1. High line voltage.	N.A.	N.A.
2. Faulty DC link voltage measurement	N.A.	N.A.

#### Check/inspect

1. Check if any of the other DCUs also have registered high line voltage.
2. See fault 0041 (ACM).

### 3.2 0002 - Status Overcurrent phase 1

Detected fault: Over current in phase 1.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_S\_OvIPh1

Causes	Location	Item des.
1. Overload or short-circuit in the three phase system outside the ACM	N.A.	N.A.
2. Faulty GDU	ACM	.A40
3. Faulty phase current measurement	N.A.	N.A.
4. Faulty cables in the three phase system inside the ACM	ACM	N.A.
5. Faulty three phase filter capacitor	PA Box	.2
6. Faulty three phase transformer	PA Box	.3.2
7. Arc-through in an IGBT	ACM	.A10

### Check/inspect

1. Disconnect all loads and reconnect them one by one to identify a faulty load. Check other fault messages received to see if these are related to this fault. These may provide a more precise indication of the location of the overcurrent.
2. Make a visual inspection in the ACM to check for IGBT arc-trough fault.
3. Check cables inside the ACM
4. To check the GDUs, the phase current sensor, IGBTs, capacitors, inductors and transformer Perform Load test. See Routine Test Instruction.
5. See fault 0069 (ACM) regarding the current measurement.

### 3.3 0003 - Status Overcurrent phase 2

Detected fault: Over current in phase 2.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_S\_OvIPh2

Causes	Location	Item des.
1. Overload or short-circuit in the three phase system outside the ACM	N.A.	N.A.
2. Faulty GDU	ACM	.A40
3. Faulty phase current measurement	N.A.	N.A.
4. Faulty cables in the three phase system inside the ACM	ACM	N.A.
5. Faulty three phase filter capacitor	PA Box	.2
6. Faulty three phase transformer	PA Box	.3.2
7. Arc-through in an IGBT	ACM	.A10

### Check/inspect

1. See fault 0002 (ACM).

### 3.4 0004 - Status Overcurrent phase 3

Detected fault: Over current in phase 3.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_S\_OvIPh3

Causes	Location	Item des.
1. Overload or short-circuit in the three phase system outside the ACM	N.A.	N.A.
2. Faulty GDU	ACM	.A40
3. Faulty phase current measurement	N.A.	N.A.
4. Faulty three phase filter inductor	PA Box	.3.1
5. Faulty three phase filter capacitor	PA Box	.2
6. Faulty three phase transformer	PA Box	.3.2
7. Arc-through in an IGBT	ACM	.A10

#### Check/inspect

1. See fault 0002 (ACM).

### 3.5 0009 - Status External Hardware Shutdown from FPGA1

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Protective shutdown

Local signal: HSTIMA\_S\_ExtHwSd

Causes	Location	Item des.
1. Intermittent disturbance	N.A.	N.A.
2. Faulty cabling between power supply and DCU/A, or between power supply and GDU boards.	ACM	N.A.
3. Faulty Power Supply.	ACM	.A50.A53
4. Faulty DCU/A, if fault is persistent	ACM	.A50.A51

#### Check/inspect

1. Turn off DCU and then restart converter, to see if fault is intermittent or recurring.
2. Check cabling between power supply and DCU/A, and between power supply and GDU boards.
3. Check output voltages, with and without connections to driven units.
4. If the fault remains, the DCU/A could be faulty.

### 3.6 0017 - OVP resistor overtemperature

Detected fault: Too high estimated temperature in OVP resistor.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.  
Local signal: HSTIMA\_B\_OvpRsTpFl

Causes	Location	Item des.
1. Line overvoltage	N.A.	N.A.
2. Faulty voltage measurement		

#### Check/inspect

1. Check if other units (ACM or MCM) are reporting similar faults.
2. See fault 0041 (ACM).

### 3.7 0023 - Unknown trigger of DSP PrSd PCL

Detected fault: Transient recorder has been triggered by unknown reason.  
Fault effect: None  
Local signal: Unkown\_TrigPrSd

Causes	Location	Item des.
1. TBD		

#### Check/inspect

1. TBD

### 3.8 0030 - DSP overload failure

Detected fault: Hardware fault or intermittent disturbance in the DCU.  
Fault effect: Fast shutdown  
High fault frequency will cause ACM isolation.  
Local signal: HSTIMA\_B\_DspOvLdFl

Causes	Location	Item des.
1. See fault 0009(ACM)		

#### Check/inspect

1. See fault 0009(ACM)

### 3.9 0031 - DSP-FPGA communication failure

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Fast shutdown  
High fault frequency will cause ACM isolation.  
Local signal: HSTIMA\_S\_DspFpgaComFl

Causes	Location	Item des.
--------	----------	-----------

1. See fault 0009(ACM)

#### Check/inspect

1. See fault 0009(ACM)

### 3.10 0032 - DSP stack supervision failure

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Fast shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_DspStkSvFl

Causes	Location	Item des.
--------	----------	-----------

1. See fault 0009(ACM)

#### Check/inspect

1. See fault 0009(ACM)

### 3.11 0033 - FPGA failure

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Fast shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMZ\_S\_FpgaFl

Causes	Location	Item des.
--------	----------	-----------

1. See fault 0009(ACM)

#### Check/inspect

1. See fault 0009(ACM)

### 3.12 0035 - Unknown trigger of DSP FsSd PCL

Detected fault: Transient recorder has been triggered by unknown reason.

Fault effect: None

Local signal: Unkown\_TrigFsSd

Causes	Location	Item des.
--------	----------	-----------

1. TBD

#### Check/inspect

1. TBD

### 3.13 0041 - DC-link voltage measurement failure

Detected fault: Invalid DC-link voltage measurement.

Fault effect: Soft shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_UDcLkMmFl

Related SW signals	I/O-unit	Signal description
UDC	DCU/A: X12:B22 (signal) X12:Z22 (+24V) X12:D22 (-24V)	DC link voltage

Causes	Location	Item des.
--------	----------	-----------

1. Faulty cables between sensor and DCU/A ACM N.A.
2. Faulty voltage sensor ACM -A40-U11
3. Faulty DCU/A ACM -A50-A51

#### Check/inspect

1. Check cables.
2. 1. Activate the train (if possible) and check that the voltage measurement of the DC-link is functioning correctly in all the converter modules by comparing the logged DC-link voltage (Signal name = UDC, 1=1V) from the different converters (ACM and MCM).  
2. If not possible to activate the train check the voltages from the sensors in discharged state. Voltage should be about 15-20V.  
3. If no faults are found and the fault is reoccurring replace the voltage sensor.
3. If the sensor has been replaced and the fault is still reoccurring replace the DCU/A.

### 3.14 0045 - A/D-converter failure, soft shutdown

Detected fault: Hardware fault in the DCU

Fault effect: Soft shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_AdcMmFl\_SfSd

Causes	Location	Item des.
1. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Replace DCU/A

### 3.15 0046 - DC-link overvoltage, level high4, soft shutdown

Detected fault: DC-link voltage is above the overvoltage level.

Fault effect: Soft shutdown  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_OvUDcLkLvHgh4SS

Causes	Location	Item des.
1. See fault 0067 (ACM).		

#### Check/inspect

1. See fault 0067 (ACM).

### 3.16 0049 - Unknown trigger of DSP SfSd PCL

Detected fault: Trainsient recorder has been triggered by unknown reason.

Fault effect: None

Local signal: Unkown\_TrigSfSd

Causes	Location	Item des.
1. TBD		

#### Check/inspect

1. TBD

### 3.17 0057 - DC-link overvoltage, level high4, protective blocking

Detected fault: Too low DC-link voltage.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_OvUDcLkLvHgh4PB



Causes	Location	Item des.
1. High line voltage.	N.A.	N.A.
2. Faulty DC link voltage measurement	ACM	N.A.

#### Check/inspect

1. Check if any of the other DCUs also have registered high line voltage.
2. See fault 0041 (ACM).

### 3.18 0059 - Phase current 1 measurement failure

Detected fault: Invalid phase 1 measurement.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_IPh1MmFl

Causes	Location	Item des.
1. Faulty cables between sensor and DCU/A	ACM	See ACM circuit diagram.
2. Faulty current sensor	ACM	-A32-U12
3. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Check cabling between sensor and DCU/A
2. Perform load test to test the phase current sensor. See Routine Test Instruction.

### 3.19 0060 - Phase current 2 measurement failure

Detected fault: Invalid phase 2 measurement.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_IPh2MmFl

Causes	Location	Item des.
1. Faulty cables between sensor and DCU/A	ACM	See ACM circuit diagram.
2. Faulty current sensor	ACM	-A32-U13
3. Faulty DCU/A	ACM	-A50-A51

### Check/inspect

1. See fault 0070 (ACM).

## 3.20 0061 - 3-phase output load voltage measurement failure

Detected fault: Invalid 3-phase voltage measurement.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_U3PhMmFl

Related SW signals	I/O-unit	Signal description
ULD	DCU/A: X21:B12 X21:D12	Three phase voltage

Causes	Location	Item des.
1. Tripped miniature circuit breaker.	PA Box	.5.1.5
2. Faulty cables between sensor and DCU/A.	See circuit diagram.	N.A.
3. Faulty auxiliary voltage transformer.	PA Box	.5.1.6
4. Faulty DCU/A	ACM	-A50-A51

### Check/inspect

1. Check if miniature circuit breaker has tripped.
2. Check cables and transformer.
3. Apply external three phase voltage. Check the measured value in DCU/A against external measurement. The difference should be less than +/-10%.
4. If the fault is still reoccurring replace the DCU/A.

## 3.21 0064 - Too many phase current SPB in time window 1

Detected fault: Phase current limited to often

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_IPhTmWnd1Fl

Causes	Location	Item des.
1. Overload or short-circuit in the three phase system outside the ACM	N.A.	N.A.
2. Faulty phase current measurement	N.A.	N.A.
3. Faulty cables in the three phase system inside the ACM	ACM	See ACM circuit diagram
4. Faulty three phase filter capacitor	PA Box	.2
5. Faulty three phase transformer	PA Box	.3.2
6. Arc-through in an IGBT	ACM	.A10
7. Faulty GDU	ACM	.A40

Check/inspect
1. Disconnect the loads and reconnect them one by one and try to locate the faulty load.
2. See fault 0069 (ACM) and 0070 (ACM).
3. Check cables.
4. Measure the three phase filter capacitor for short circuit.
5. Measure the three phase transformer for short circuit.

### 3.22 0065 - Too many phase current SPB time window 1 in time window 2

Detected fault:	Phase current limited to often
Fault effect:	Protective blocking High fault frequency will cause ACM isolation.
Local signal:	HSTIMA_B_IPhTmWnd2Fl

Causes	Location	Item des.
1. See fault 0074 (ACM).		

Check/inspect
1. See fault 0074 (ACM).

### 3.23 0068 - IGBT switching frequency failure POA, command

Detected fault:	Hardware fault in the DCU
Fault effect:	Protective blocking High fault frequency will cause ACM isolation.
Local signal:	HSTIMA_B_IgbtFSgPoaFl

Causes	Location	Item des.
1. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Replace DCU/A

### 3.24 0069 - IGBT switching frequency failure POA, feedback

Detected fault: Hardware fault in the DCU

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_GduFSgPoaFl

Causes	Location	Item des.
1. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Replace DCU/A

### 3.25 0073 - A/D-converter failure, protective blocking

Detected fault: Hardware fault in the DCU

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HSTIMA\_B\_AdcMmFl\_PrBc

Causes	Location	Item des.
1. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Replace DCU/A

### 3.26 0076 - Unknown trigger of DSP PrBc PCL

Detected fault: Transient recorder has been triggered by unknown reason.

Fault effect: None

Local signal: Unkown\_TrigPrBc

Causes	Location	Item des.
--------	----------	-----------

1. TBD

#### Check/inspect

1. TBD

### 3.27 0080 - Protective shutdown request charging contactor off-failure

Detected fault: Charging contactor does not open at order.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: CFSUMA\_B\_RqPrSd\_ChCt

Related SW signals	I/O-unit	Signal description
CFSUMA_C_CdChCt	X11:B28	Charging contactor close order
DIGIMA_A_CdChCt	X11:D30	Charging contactor closed

Causes	Location	Item des.
--------	----------	-----------

1. See fault 0120 (ACM).

#### Check/inspect

1. See fault 0120 (ACM).

### 3.28 0081 - Protective shutdown request separation contactor off-failure

Detected fault: Separation contactor does not open at order.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: CFSUMA\_B\_RqPrSd\_SrCt

Related SW signals	I/O-unit	Signal description
CFSUMA_C_CdSrCt	X11:B24	Separation contactor 1 (positive pole) close order
DIGIMA_A_CdSrCt	X11:B30	Separation contactor 1 (positive pole) closed

Causes	Location	Item des.
--------	----------	-----------

1. See fault 0121 (ACM).

#### Check/inspect

1. See fault 0121 (ACM).

### 3.29 0082 - Request Protective shutdown DC-link charging failure

Detected fault: DC-link voltage does not rise correctly at charge :

Fault effect: Protective shutdown

Local signal: DCCSMA\_B\_RqPrSd

Causes	Location	Item des.
--------	----------	-----------

- |  |      |      |
|--|------|------|
| 1. Too many charging sequences have been made within a short time and the charging resistor is overheated. | N.A. | N.A. |
| 2. No line voltage present or line voltage distributed   | N.A. | N.A. |
| 3. Faulty charging contactor control or supervision.   | ACM  | N.A. |
| 4. Faulty separation contactor (positive pole) control or supervision.                                     | ACM  | N.A. |
| 5. Faulty DC link voltage measurement  | ACM  | N.A. |
| 6. Short circuit in the DC-link  | ACM  | N.A. |
| 7. Faulty charging resistor.   | ACM  | .32  |

#### Check/inspect

1. Too many charging attempts has been made if fault 0017 (ACM) is received.
2. Check if other units (ACM or MCM) is reporting similar faults.
3. See fault 0120 (ACM) regarding the charging contactor.
4. See fault 0121 (ACM) regarding the separation contactor.
5. See fault 0041 (ACM) regarding the DC-link voltage measurement.
6.
  1. Check visually for signs of short circuit in the DC link.
  2. Check if the DC link is short circuited by measuring the voltage over DC+ and DC-. Measure with a DMM when the converter is discharged and supplied with battery voltage. The voltage should be 24V DC. If the voltage is below 10V DC there is a short circuit.
7. Measure the resistance of the charging resistor when the charging contactor is open. It should be 50 Ohm +/- 5% (hot/cold).

### 3.30 0083 - Request Protective shutdown DC-link discharging failure

Detected fault: DC-link voltage does not fall correctly at discharge.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: DCDSMA\_B\_RqPrSd

Causes	Location	Item des.
1. Faulty OVP function	ACM	N.A.
2. Faulty charging contactor control or supervision.	ACM	N.A.
3. Faulty separation contactor control or supervision.	ACM	N.A.
4. Faulty DC link voltage measurement	ACM	N.A.

#### Check/inspect

1. See fault 0121 (ACM) regarding the OVP.
2. See fault 0120 (ACM) regarding the charging contactor.
3. See fault 0121 (ACM) regarding the separation contactor.
4. See fault 0041 (ACM) for actions regarding the DC link voltage measurement.

### 3.31 0084 - Request Protective shutdown high contactor current

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: ISCSMA\_B\_RqPrSd

Causes	Location	Item des.
1. Short circuit in DC link	ACM	N.A.
2. Current sensor	ACM	A31-U10
3. DCU	ACM	.A50-A51

#### Check/inspect

1. TBD

### 3.32 0085 - Request Protective shutdown OVP test failure

Detected fault: DC-link voltage does not fall correctly at discharge.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: OVPTMA\_B\_RqPrSd

Causes	Location	Item des.
1. Faulty OVP resistor	ACM	-A10-R11 -A10-R12
2. Faulty OVP resistor cables.	ACM	N.A.
3. See fault 0007 (ACM).		

#### Check/inspect

1. Check that the resistance of the 2 OVP resistors are (each):  
20hm +/-10% (hot/cold)
2. Check the cables on the DC-link and attach cable lugs and screw connections if necessary.
3. Check that the opto cables are tightened.
4. Perform a chopper test according to the Routine Test Instruction

### 3.33 0090 - Soft shutdown request charging contactor on-failure

Detected fault: Charging contactor does not close at order.

Fault effect: Soft shutdown  
High fault frequency will cause ACM isolation.

Local signal: CFSUMA\_B\_RqSfSd\_ChCt

Related SW signals	I/O-unit	Signal description
CFSUMA_C_CdChCt	X11:B28	Charging contactor close order
DIGIMA_A_CdChCt	X11:D30	Charging contactor closed

Causes	Location	Item des.
1. Faulty control or feedback cables.	PA Box	See circuit diagram.
2. Faulty contactor.	PA Box	.5.1.2
3. Faulty voltage supply to DCU/A IO-module.	ACM	N.A.
4. Faulty DCU/A.	ACM	-A50-A51

#### Check/inspect

1. Check cabling
2. By visual inspection check that the charging contactor is not welded or stuck position.
3. Perform digital output test according to the Routine Test Instruction



### 3.34 0091 - Soft shutdown request separation contactor on-failure

Detected fault: Separation contactor does not close at order.

Fault effect: Soft shutdown  
High fault frequency will cause ACM isolation.

Local signal: CFSUMA\_B\_RqSfSd\_SrCt

Related SW signals	I/O-unit	Signal description
CFSUMA_C_CdSrCt	X11:B24	Separation contactor 1 (positive pole) close order
DIGIMA_A_CdSrCt	X11:B30	Separation contactor 1 (positive pole) closed

Causes	Location	Item des.
1. Faulty control or feedback cables.	PA Box	See circuit diagram.
2. Faulty contactor.	PA Box	.5.1.1
3. Faulty voltage supply to DCU/A IO-module.	ACM	N.A.
4. Faulty DCU/A.	ACM	-A50-A51

#### Check/inspect

1. Check cabling
2. By visual inspection check that the separation contactor is not welded or stuck position.
3. Perform digital output test according to the Routine Test Instruction

### 3.35 0096 - Request protective blocking DC-link overvoltage

Detected fault: DC-link voltage is above the overvoltage level.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: DOVPMA\_B\_RqPrBc

Causes	Location	Item des.
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1. See fault 0067 (ACM).

#### Check/inspect

1. See fault 0067 (ACM).

### 3.36 0099 - Request protective blocking measurement failure

Detected fault: Invalid phase current or 3-phase voltage measurement.

Fault effect: Protective blocking

Local signal: MEMSMA\_B\_RqPrBc

Causes	Location	Item des.
1. See related fault.		

#### Check/inspect

1. See related fault.

### 3.37 0100 - Protective blocking request high DC component in phase currents

Detected fault: Too high DC component in phase currents.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HDCCMA\_B\_RqPrBc

Causes	Location	Item des.
1. Faulty current measurement phase 1.	ACM	N.A.
2. Faulty current measurement phase 2.	ACM	N.A.
3. Faulty transformer	ACM	N.A.

#### Check/inspect

1. See fault 0069 (ACM).
2. See fault 0070 (ACM).
3. Perform a load test according to routine test instruction.

### 3.38 0101 - Protective blocking request phase current balance failure

Detected fault: Too high unbalance in phase currents.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: IBALMA\_B\_RqPrBc

Causes	Location	Item des.
1. Unbalanced load outside the ACM, e.g. too high load on a single phase	N.A.	N.A.
2. Faulty current measurement, phase 1.	ACM	N.A.
3. Faulty current measurement, phase 2.	ACM	N.A.

#### Check/inspect

1. Disconnect the loads and reconnect them one by one and try to locate the faulty load.
2. See faults 0018 (ACM).
3. See faults 0019 (ACM).

### 3.39 0102 - Protective blocking request AC current limitation time-out failure

Detected fault: Phase current limited to long time

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: ACLSMA\_B\_RqPrBc

Causes	Location	Item des.
1. See fault 0074 (ACM).		

#### Check/inspect

1. See fault 0074 (ACM).

### 3.40 0103 - Request protective blocking 3-phase output load overvoltage

Detected fault: Overvoltage in 3-phase.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: PHOVMA\_B\_RqPrBc

Causes	Location	Item des.
1. Faulty voltage measurement	ACM	N.A.

#### Check/inspect

1. See fault 0071 (ACM).

### 3.41 0114 - Request soft shutdown calibration failure

Detected fault: The calibration of DC-link voltage sensor or the phase current sensors failed.

Fault effect: Protective shutdown

Local signal: CALIMA\_B\_RqSfSd

Causes	Location	Item des.
1. Faulty voltage measurement	ACM	N.A.
2. Faulty current measurement	ACM	N.A.

#### Check/inspect

1. See fault 0071 (ACM).
2. See fault 0069 (ACM) and 0070 (ACM).

### 3.42 0116 - Request SfSd and converter isolation from external fan supervision

Detected fault: Fan contactor control failure while invalid heatsink temperature.

Fault effect: Soft shutdown  
High fault frequency will cause ACM isolation.

Local signal: EFANMA\_B\_ExtFnSvRqCvSlT

Causes	Location	Item des.
1. Faulty set or tripped motor protection breakers	PA Box	.1.4.2 (Half speed) .1.4.1 (Full speed)
2. Faulty cabling between DCU and contactors	PA Box	See circuit diagram
3. Faulty contactors	PA Box	.1.4.8 (Half speed) .1.4.6 (Full speed) .1.4.7 (Full speed)
4. Faulty temperature measurement	ACM	N.A.
5. Faulty fan	PA Box	.4

#### Check/inspect

1. Check setting of fan motor protection breakers or reset it if they have tripped.
2. Perform digital output test according to routine test instruction without 400V present and check that:
  - the DCU generator control voltage on D02 (Half speed) and D01 (Full speed).
  - check that feedback signals are received on DI5 (Half speed) and DI4 (Full speed)
  - that the fan contactor closes.
3. Perform digital output test according to routine test instruction with 400V present and check that:
  - the fan rotates correctly
4. Check cabling.
5. Perform an I/O test according to routine test instruction to check the heating temperature measurement.
6. If no faults can be found and the protection breakers trip again the fan or protection breakers might be faulty.

### 3.43 0130 - Digital output failure (HwFI)

Detected fault: Hardware fault in the DCU.

Fault effect: Soft shutdown  
High fault frequency will cause ACM isolation.

Local signal: DHSSMG\_B\_DiOutFl

Causes	Location	Item des.
1. Power supply to DI/DO missing.	ACM	See circuit diagram.
2. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Check cabling to DI/DO.
2. Perform I/O test according to routine test instruction.

### 3.44 0131 - DSP Version failure

Fault effect: Fast shutdown

Local signal: DHSSMG\_B\_DspVerCodFl

Causes	Location	Item des.
1. Check DSP version.		

#### Check/inspect

1. Download correct DSP version.

### 3.45 0132 - FPGA2 Verison failure

Fault effect: Fast shutdown  
High fault frequency will cause ACM isolation.

Local signal: DHSSMG\_B\_Fpga2VerCodFl

Causes	Location	Item des.
1. Check FPGA2 version.	ACM	-A50-A51

#### Check/inspect

1. Download correct DSP version.

### 3.46 0133 - Line trip relay closing failure(Warning)

Detected fault: Hardware fault in the DCU.

Fault effect: None

Local signal: DHSSMG\_B\_LtrCdFl

Causes	Location	Item des.
1. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Replace DCU/A.

### 3.47 0134 - Line trip opening delayed (HW 512 ms)

Detected fault: Hardware fault in the DCU.

Fault effect: Protective shutdown

Local signal: DHSSMG\_B\_LtrOpDly

Causes	Location	Item des.
1. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Replace DCU/A.

### 3.48 0135 - Line trip relay opening failure (HwFl)

Detected fault: Hardware fault in the DCU.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: DHSSMG\_B\_LtrHwOpFl

Causes	Location	Item des.
1. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Replace DCU/A.

### 3.49 0136 - DSP error

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Protective shutdown  
High fault frequency will cause ACM isolation.

Local signal: DHSSMG\_S\_DspFl

Causes	Location	Item des.
1. See fault 0009(ACM)		

#### Check/inspect

1. See fault 0009(ACM)

### 3.50 0137 - DCU Hardware failure

Detected fault: Hardware fault in the DCU.

Fault effect: Depends on which failure is active.

Local signal: DHSSMG\_S\_HwFl

Causes	Location	Item des.
1. Power supply to DI/DO missing.	ACM	See circuit diagram
2. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Check cabling to DI/DO.
2. Connect a PC to the DCU/A. Turn the LCB to the ACM on and off and check which fault texts appear at start up. If the faults indicate a problem with DI/DO, perform I/O test according to the Routine Test Instruction.
3. If no other faults can be found.

### 3.51 0138 - Warning, Board-temperature high (HwFI)

Detected fault: High DCU control board temperature.

Fault effect: Soft shutdown

Local signal: DOTSMG\_B\_RqSfSd

Causes	Location	Item des.
1. See fault 0164 (ACM).		

#### Check/inspect

1. See fault 0164 (ACM).

### 3.52 0139 - Board-temperature (HwFI, Power off)

Detected fault: High DCU control board temperature.

Fault effect: Soft shutdown

Local signal: DOTSMG\_B\_PowOf\_DcuBdTpFI

Causes	Location	Item des.
1. Converter cooling missing	N.A.	N.A.
2. Faulty temperature measurement	N.A.	N.A.

#### Check/inspect

1. See fault 0171 (ACM).
2. Perform an I/O test according to routine test instruction to check the board temperature measurement.

### 3.53 0140 - DCU hardware failure Warning

Detected fault: Hardware fault in the DCU.

Fault effect: None

Local signal: PRASMG\_B\_DgMsg



Causes	Location	Item des.
1. Power supply to DI/DO missing.	ACM	261-1 262-1
2. Faulty DCU/A	ACM	-A50-A51

#### Check/inspect

1. Check cabling to DI/DO.
2. Connect a PC to the DCU/A. Turn the LCB to the ACM on and off and check which fault texts appear at start up. If the faults indicate a problem with DI/DO, perform I/O test according to the Routine Test Instruction.
3. If no other faults can be found.

### 3.54 0141 - System change failed

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Blocking  
High fault frequency will cause ACM isolation.

Local signal: SYSCMG\_B\_SyChgFl

Causes	Location	Item des.
1. See fault 0009(ACM)		

#### Check/inspect

1. See fault 0009(ACM)

### 3.55 0151 - Request protective blocking heatsink temperature supervision

Detected fault: Too high heatsink temperature or too high phase current in relation to actual heatsink temperature.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: HCOTMA\_B\_RqPrBc

Causes	Location	Item des.
1. High ambient temperature	N.A.	N.A.
2. Inlet and/or outlet for the converter module's external air is blocked	N.A.	N.A.
3. Dirty heat sink.	N.A.	N.A.
4. Missing 3-phase 400V to external fan.	See vehicle circuit diagram.	N.A.
5. Faulty external fan function.	PA Box	N.A.
6. Faulty internal fan	PA Box	.5.3.1
7. Faulty cables between internal fan and Power Supply Unit	ACM/PA Box	See circuit diagram
8. Faulty Supply Unit	ACM	-A50-A52
9. Overload	N.A.	N.A.
10. Faulty temperature measurement	N.A.	N.A.

#### Check/inspect

1. Check the air inlet and outlet of the module. Clean air inlet and outlet if necessary.
2. Check the heat sink of the module. Clean the heat sink if necessary.
3. Check the 3-phase 400V supply.
4. See fault 0146 (ACM) regarding the external fan function.
5. Make sure that the internal fan is running and that it is rotating in the correct direction. (According to arrow.)
6. Check cables to internal fan.
7. Check that the Power Supply Unit supplies +/- 24VDC to the fan.
8. Check that the unit not has been running under abnormal conditions.
9. Perform an I/O test according to routine test instruction to check the heatsink temperature measurement.

### 3.56 0153 - Request protective blocking long-term overload protection

Detected fault: 3-phase overload.

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: LOTPMA\_B\_RqPrBc

Causes	Location	Item des.
1. See fault 0074 (ACM).		

### Check/inspect

1. See fault 0074 (ACM).

### 3.57 0156 - Request protective blocking internal air overtemperature, level max

Detected fault: Overtemperature in converter

Fault effect: Protective blocking  
High fault frequency will cause ACM isolation.

Local signal: IAOTMA\_B\_RqPrBc

Related SW signals	I/O-unit	Signal description
TEMPAIR	DCU/A: X12:D10 (0V / signal +) X12:D8 (2.5mA / signal -)	Converter internal air temperature

Causes	Location	Item des.
1. Faulty internal fan	PA Box	.5.3.1
2. Faulty cables between internal fan and Power Supply Unit	ACM/PA Box	See circuit diagram
3. Faulty Power Supply.	ACM	-A50-A52
4. Faulty temperature measurement	ACM	N.A.
5. Faulty external cooling	PA Box	N.A.

### Check/inspect

1. Check that the internal fan is rotating and rotating in the correct direction when the converter is supplied with battery voltage.
2. Check cables.
3. Check that the Power Supply unit supplies +/- 24VDC to the fan.
4. Perform an I/O test according to routine test instruction to check the air temperature measurement.
5. See fault 171 (ACM) regarding the external cooling.

### 3.58 0170 - Too high auxiliary power

Detected fault: Too high auxiliary load

Fault effect: None

Local signal: HiAy\_S\_AyPowToHgh

Causes	Location	Item des.
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1. See fault 0074 (ACM).

#### Check/inspect

1. See fault 0074 (ACM).

### 3.59 0171 - MVB Communication Disturbed

Detected fault: MVB watchdog wrap-around counter not updated after 3 samples.

Fault effect: The vehicle has reduced 3-phase power.  
(If the counter has not changed for 30 samples a protective shutdown sequence is initiated.)

Local signal: XHgV\_S\_MvbComDist

Causes	Location	Item des.
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1. Faulty MVB cabling or connectors
2. Faulty MVB termination
3. Redundant VCU problem
4. Faulty redundant VCU

### 3.60 0172 - DX44 communication error

Detected fault: Failure or disturbance in MVB communication

Fault effect: None

Local signal: CI\_E\_DX44com

Causes	Location	Item des.
--------	----------	-----------

- |                                   |      |      |
|-----------------------------------|------|------|
| 1. Faulty MVB communication       | N.A. | N.A. |
| 2. Faulty DX unit addressing      | N.A. | N.A. |
| 3. Faulty power supply to DX unit | N.A. | N.A. |
| 4. Faulty DX unit                 | N.A. | DX44 |

#### Check/inspect

1. Check power supply to I/O unit.
2. Check MVB cables and connections.
3. Check I/O unit device address.
4. If no faults are found the I/O unit is faulty.

### 3.61 0173 - Error in DX44

Detected fault: Hardware fault in the DX unit.

Fault effect: None

Local signal: CI\_E\_DX44

Causes	Location	Item des.
1. Faulty power supply to I/O unit	See vehicle circuit diagram	N.A.
2. Faulty I/O unit	See vehicle circuit diagram	DX44

#### Check/inspect

1. Check power supply to I/O unit.
2. If no faults are found the DX unit is faulty.

### 3.62 0174 - DX30 communication error

Detected fault: Failure or disturbance in MVB communication

Fault effect: Protective shutdown

Local signal: CI\_E\_DX30com

Causes	Location	Item des.
1. Faulty MVB communication	N.A.	N.A.
2. Faulty DX unit addressing	PH Box	N.A.
3. Faulty power supply to DX unit	PH Box	N.A.
4. Faulty DX unit	PH Box	5.2.1 (For MCM in PH Box) 5.2.2 (For MCM in PX Box)

#### Check/inspect

1. Check power supply to I/O unit.
2. Check MVB cables and connections.
3. Check I/O unit device address.
4. If no faults are found the I/O unit is faulty.

### 3.63 0175 - Error in DX30

Detected fault: Hardware fault in the DX unit.

Fault effect: Protective shutdown

Local signal: CI\_E\_DX30

Causes	Location	Item des.
1. Faulty power supply to I/O unit	PH Box	N.A.
2. Faulty I/O unit	PH Box	DX30

#### Check/inspect

1. Check power supply to I/O unit.
2. If no faults are found the DX unit is faulty.

## 4 MCM faults

### 4.1 0001 - FPGA PrSd error: details see 'Z\_ErrDePS'

Detected fault: Summary fault.

Fault effect: Protective shutdown

Local signal: EC\_PS\_FPGA

Causes	Location	Item des.
1. Several integrated causes. Further analysis is required.	N.A.	N.A.

#### Check/Inspect

1. Compress the following data into a zip-file and e-mail it to your Bombardier contact person in Västerås, Sweden:
  - ODBS-data
  - Data recorders: (transient\_dr\_1, transient\_dr\_2, transient\_dr\_3, trend\_dr\_1)
  - System Information from DCU, generated by the commands in the file: Faulttracing\_with\_DCU\_reset\_V22.txtFor information of how to collect the data see Chapter 5 in 3EST000216-7698\_B\_en\_FFI\_overview.doc

### 4.2 0002 - DC link overvoltage trip (M01)

Detected fault: DC link voltage is above the overvoltage level.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: PS\_ADC\_TRIPUDC

Related SW signals	I/O-unit	Signal description
UDC	DCU/M: X12:B22 X12:Z22 (+24V) X12:D22 (-24V)	DC link voltage

Causes	Location	Item des.
1. High line voltage.	N.A.	N.A.
2. Faulty DC link voltage measurement	MCM	N.A.

### Check/Inspect

1. Check if any of the other DCUs also have registered high line voltage.
2. See fault 0028 (MCM).

### 4.3 0004 - internal short circuit (M65)

Detected fault: Short circuit is indicated by the DC link input current sensor.

Fault effect: Protective shutdown

Local signal: EC\_INTERN\_SHORT

Causes	Location	Item des.
1. Another fault in the propulsion system has generated an overcurrent.	N.A.	N.A.
2. Short circuit somewhere in the DC-link outside the MCM	N.A.	N.A.
3. Short circuit in the DC-link inside the MCM	MCM	N.A.
4. Faulty DC link input current measurement	N.A.	N.A.

### Check/Inspect

1. Check other fault messages related to faults that can have generated an overcurrent.
2. Check if the DC link is short circuited by performing a load test according to the Routine Test Instruction.
3. See fault 0011 (MCM) regarding the DC link input current measurement.

### 4.4 0006 - earth fault (M66)

Detected fault: Earth fault is indicated by the differential current sensor:

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_EARTH\_FAULT



Causes	Location	Item des.
1. Earth fault in the Traction Motors	See vehicle circuit diagram.	N.A.
2. Earth fault in the cables to the Traction Motors	See vehicle circuit diagram.	N.A.
3. Earth fault in the OVP resistor	See vehicle circuit diagram.	N.A.
4. Earth fault in the cables to the OVP resistor	MCM	N.A.
5. Earth fault in the MCM	MCM	N.A.
6. Faulty differential current sensor	Px Box	.1.1.3
7. Faulty cables between differential current sensor and DCU/M	MCM	See circuit diagram.
8. Faulty DCU/M	MCM	.1.21

Check/Inspect
<ol style="list-style-type: none"> <li>1. If the earth fault detection is active even when the DC-link is discharged, disconnect cables between differential current sensor and DCU/M. If the earth fault still remains active replace the DCU/M. If the earth fault deactivates, check the cables between the sensor and the DCU/M. Replace the current sensor if no faults are found on the cables.</li> <li>2. Disconnect the DC+ and the DC- cables from the MCM. Connect DC+ to DC- and measure the resistance between this point and earth. The resistance should be in the range of M Ohm. If not, try to locate the earth fault by disconnecting different parts of the system.</li> <li>3. Disconnect the Traction Motor cables from the MCM and measure the resistance between the phases and earth. The resistance should be &gt; 5 M Ohm.</li> <li>4. Disconnect the OVP resistor cables from the MCM and measure the resistance between the phases and earth. The resistance should be &gt; 5 M Ohm.</li> </ol>

#### 4.5 0007 - OVC phase1 feedback failure (M09A)

Detected fault:	OVC GDU phase 1 feedback indication is faulty. Order and feedback do not correspond. The MCM is blocked immediately.
Fault effect:	Protective shutdown High fault frequency will cause MCM isolation.
Local signal:	EC_OVCPH1FBFL

Causes	Location	Item des.
1. Faulty GDU	MCM	.7.C1
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	183 184
4. Dirty optic cables.	MCM	183 184
5. Faulty cables between IGBT and GDU	MCM	175 176 177
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.C1

#### Check/Inspect

1. See fault 0041 (MCM).

### 4.6 0008 - OVC phase2 feedback failure (M09A)

Detected fault: OVC GDU phase 1 feedback indication is faulty. Order and feedback do not correspond. The MCM is blocked immediately.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_OVCPH2FBFL

Causes	Location	Item des.
1. Faulty GDU	MCM	.7.C2
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	185 186
4. Dirty optic cables.	MCM	185 186
5. Faulty cables between IGBT and GDU	MCM	187 188 189
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.C2

#### Check/Inspect

1. See fault 0041 (MCM).

#### 4.7 0009 - OVC phase1 feedback failure FPGA(M09A)

Detected fault: OVC GDU phase 1 feedback indication is faulty. Order and feedback do not correspond. The MCM is blocked immediately.

Fault effect: Protective shutdown

Local signal: PS\_OVCPH1\_FBFL

Causes	Location	Item des.
1. Faulty GDU	MCM	.7.C1
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	183 184
4. Dirty optic cables.	MCM	183 184
5. Faulty cables between IGBT and GDU	MCM	175 176 177
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.C1

#### Check/Inspect

1. See fault 0041 (MCM).

#### 4.8 0010 - OVC phase2 feedback failure FPGA(M09A)

Detected fault: OVC GDU phase 1 feedback indication is faulty. Order and feedback do not correspond. The MCM is blocked immediately.

Fault effect: Protective shutdown

Local signal: PS\_OVCPH2\_FBFL

Causes	Location	Item des.
1. Faulty GDU	MCM	.7.C2
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	185 186
4. Dirty optic cables.	MCM	185 186
5. Faulty cables between IGBT and GDU	MCM	187 188 189
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.C2

#### Check/Inspect

1. See fault 0041 (MCM).

### 4.9 0011 - plausibility failure IDcLine (M83)

Detected fault: Invalid DC-link current measurement.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_IDCLNPLYFL

Related SW signals	I/O-unit	Signal description
IDC	DCU/M: X12:B20 (signal) X12:Z20 (+24V) X12:D20 (-24V)	DC link input current

Causes	Location	Item des.
1. Faulty cables between sensor and DCU/M	MCM	199/1-2,2-2,3-2,SC-2
2. Faulty current sensor	MCM	.9.13
3. Faulty DCU/M	MCM	.1.21

### Check/Inspect

1. Check cables between sensor and DCU/M
2. 1. Check the current sensor with a DMM by measuring the resistance between the connections. Pull out the connector .9.X14 and check that the multimeter shows several Mohm resistance between the following contacts:  
+ probe to contact 1, - probe to contact 2  
+ probe to contact 3, - probe to contact 2  
+ probe to contact 1, - probe to contact 3  
With changed polarity of the multimeter probes, the result must be open circuit. If the result is different, the current sensor is faulty and has to be replaced.  
2. If the fault appears intermittently replace the current sensor.
3. If the sensor has been replaced and the fault is still reoccurring replace the DCU/M.

#### 4.10 0014 - VSI ON without command (S01)

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Protective shutdown

Local signal: EC\_PS\_VSION\_SAFETY

Causes	Location	Item des.
1. Intermittent disturbance		
2. Power supply to DCU/M missing	MCM	
3. Faulty DCU/M	MCM	

### Check/Inspect

1. Turn off DCU and then restart converter, to see if fault is intermittent or recurring.
2. See fault 0021(MCM)
3. If the fault remains, the DCU/M could be faulty.

#### 4.11 0015 - DSP PrSd error: details see 'Z\_ErrCoPS'

Detected fault: Summary fault.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_PS\_DSP

Causes	Location	Item des.
1. See fault 0001 (MCM)		

#### Check/Inspect

1. See fault 0001 (MCM)

### 4.12 0020 - FPGA FsSd error: details see 'Z\_ErrDeFS'

Detected fault: Summary fault.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_FS\_FPGA

Causes	Location	Item des.
1. See fault 0001 (MCM)		

#### Check/Inspect

1. See fault 0001 (MCM)

### 4.13 0021 - PowerFail DCU supply unit (M93)

Detected fault: The supply unit has been detected to be faulty.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: FS\_PF\_DCU

Causes	Location	Item des.
1. Faulty cabling between power supply and DCU/M.	MCM	20
2. Faulty power supply unit.	MCM	.1.22
3. Faulty DCU/M.	MCM	.1.21

#### Check/Inspect

1. Check cabling.
2. Check input voltages to DCU/M according to document FFI for Routine test instruction. If the input voltages to the DCU/M are not ok, replace the power supply unit.
3. If the cabling and voltages are correct and the fault is remaining, replace the DCU/M.

### 4.14 0022 - Internal power fail 6V or +/-15V (H24)

Detected fault: The DCU internal power has been detected to be faulty.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: FS\_PF\_INTERNAL

Causes	Location	Item des.
1. Faulty DCU/M.	MCM	.1.21

#### Check/Inspect

1. Replace DCU/M

### 4.15 0023 - watchdog alarm (H18)

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: FS\_WDALARM

Causes	Location	Item des.
1. See fault 0014(MCM)		

#### Check/Inspect

1. See fault 0014(MCM)

### 4.16 0024 - 25MHz clock lost (H16)

Detected fault: Hardware fault in the DCU.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: FS\_CLK25M

Causes	Location	Item des.
1. Faulty DCU/M.	MCM	.1.21

#### Check/Inspect

1. Replace DCU/M

### 4.17 0025 - hardware fast shutdown

Detected fault: Hardware fault in the DCU.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: FS\_HWFS

Causes	Location	Item des.
1. Faulty DCU/M.	MCM	.1.21

#### Check/Inspect

1. Replace DCU/M

### 4.18 0026 - deviation between ADC's UDC (H19)

Detected fault: Hardware fault in the DCU.

Fault effect: Fast shutdown

Local signal: EC\_UDCLK\_PRDV

Causes	Location	Item des.
1. Faulty DCU/M.	MCM	.1.21

#### Check/Inspect

1. Replace DCU/M

### 4.19 0027 - deviation between ADC's IDCLN (H19)

Detected fault: Hardware fault in the DCU.

Fault effect: Fast shutdown

Local signal: EC\_IDCLN\_PRDV

Causes	Location	Item des.
1. Faulty DCU/M.	MCM	.1.21

#### Check/Inspect

1. Replace DCU/M

### 4.20 0028 - plausibility failure UDc (M80A)

Detected fault: Invalid DC-link voltage measurement.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_UDCLKPLYFL



Related SW signals	I/O-unit	Signal description
UDC	DCU/M: X12:B22 (signal) X12:Z22 (+24V) X12:D22 (-24V)	DC link voltage

Causes	Location	Item des.
1. Faulty cables between sensor and DCU/M	MCM	198/1-1,2-1,3-1,SC-1
2. Faulty voltage sensor	MCM	.7.63
3. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Check cables.
2.
  1. Activate the train (if possible) and check that the voltage measurement of the DC-link is functioning correctly in all the converter modules by comparing the logged DC-link voltage (Signal name = UDC, 1=1V) from the different converters (MCM and ACM).
  2. If not possible to activate the train check the voltages from the sensors in discharged state. Voltage should be about 15-20V.
  3. If no faults are found and the fault is reoccurring replace the voltage sensor.
3. If the sensor has been replaced and the fault is still reoccurring replace the DCU/M.

### 4.21 0029 - average DSP overload (H08)

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Fast shutdown

Local signal: EC\_DSPOVLOAD

Causes	Location	Item des.
1. See fault 0014(MCM)		

#### Check/Inspect

1. See fault 0014(MCM)

### 4.22 0030 - wrong FPGA revision code (H13)

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_FPGAREVCO

Causes	Location	Item des.
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1. Check FPGA revision

#### Check/Inspect

1. Download correct FPGA

### 4.23 0031 - DSP FPGA communication failure (H13)

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Fast shutdown

Local signal: EC\_DSPFPGACOM

Causes	Location	Item des.
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1. See fault 0014(MCM)

#### Check/Inspect

1. See fault 0014(MCM)

### 4.24 0032 - MCU DSP communication failure (H06)

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Fast shutdown

Local signal: EC\_MCU DSPCOM

Causes	Location	Item des.
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1. See fault 0014(MCM)

#### Check/Inspect

1. See fault 0014(MCM)

### 4.25 0033 - OVC phase 1 frequency failure (M20C)

Detected fault: The switching frequency of the IGBT in OVC phase 1 is faulty.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_OVCPH1FREQFL

Causes	Location	Item des.
1. Faulty brake resistor cables.	Vehicle	See circuit diagram
2. Faulty brake resistor.	Vehicle	See circuit diagram
3. Faulty DC link capacitor.	MCM	.9

#### Check/Inspect

1. Check brake resistor cables.
2. Measure the resistance of the brake resistor. Both circuits should be between 2.8Ohm (cold) and 3.5Ohm (hot).

### 4.26 0034 - OVC phase 2 frequency failure (M20C)

Detected fault: The switching frequency of the IGBT in OVC phase 2 is faulty.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_OVCPH2FREQFL

Causes	Location	Item des.
1. See fault 0033 (MCM).		

#### Check/Inspect

1. See fault 0033 (MCM).

### 4.27 0035 - DSP FsSd error: details see 'Z\_ErrCoFS'

Detected fault: Summary fault.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: EC\_FS\_DSP

Causes	Location	Item des.
1. See fault 0001 (MCM)		

#### Check/Inspect

1. See fault 0001 (MCM)

#### 4.28 0040 - FPGA PrBc error: details see 'Z\_ErrDePB'

Detected fault: Summary fault.

Fault effect: Protective blocking

Local signal: EC\_PB\_FPGA

Causes	Location	Item des.
1. See fault 0001 (MCM)		

##### Check/Inspect

1. See fault 0001 (MCM)

#### 4.29 0041 - IGBT1 feedback fault (M05B)

Detected fault: IGBT 1 feedback indication is faulty. Order and feedback do not correspond.

Fault effect: Protective blocking

Local signal: PB\_VSI\_FBFUZZYFL\_FI1

Causes	Location	Item des.
1. Faulty GDU	MCM	.7.UU
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables.	MCM	138 139
4. Dirty optic cables.	MCM	138 139
5. Fault in cables between IGBT and GDU	MCM	See circuit diagram
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.UU

##### Check/Inspect

1. Check the cables on the DC-link and attach cable lugs and screw connections if necessary.
2. Check that the opto cables are tightened.
3. Perform an opto cable and an opto cable feedback test according to the Routine Test Instruction.

#### 4.30 0042 - IGBT2 feedback fault (M05B)

Detected fault: IGBT 2 feedback indication is faulty. Order and feedback do not correspond.

Fault effect: Protective blocking  
 Local signal: PB\_VSI\_FBFUZZYFL\_FI2

Causes	Location	Item des.
1. Faulty GDU	MCM	.7UL
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	140 141
4. Dirty optic cables.	MCM	140
5. Faulty cables between IGBT and GDU	MCM	141
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.UL

#### Check/Inspect

1. See fault 0041 (MCM).

### 4.31 0043 - IGBT3 feedback fault (M05B)

Detected fault: IGBT 3 feedback indication is faulty. Order and feedback do not correspond.

Fault effect: Protective blocking  
 Local signal: PB\_VSI\_FBFUZZYFL\_FI3

Causes	Location	Item des.
1. Faulty GDU	MCM	.7:VU
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	153 154
4. Dirty optic cables.	MCM	153 154
5. Faulty cables between IGBT and GDU	MCM	
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.VU

#### Check/Inspect

1. See fault 0041 (MCM).

#### 4.32 0044 - IGBT4 feedback fault (M05B)

Detected fault: IGBT 4 feedback indication is faulty. Order and feedback do not correspond.

Fault effect: Protective blocking

Local signal: PB\_VSI\_FBFUZZYFL\_FI4

Causes	Location	Item des.
1. Faulty GDU	MCM	.7.VL
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	155 156
4. Dirty optic cables.	MCM	155 156
5. Faulty cables between IGBT and GDU	MCM	See circuit diagram
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.VL

#### Check/Inspect

1. See fault 0041 (MCM).

#### 4.33 0045 - IGBT5 feedback fault (M05B)

Detected fault: IGBT 5 feedback indication is faulty. Order and feedback do not correspond.

Fault effect: Protective blocking

Local signal: PB\_VSI\_FBFUZZYFL\_FI5

Causes	Location	Item des.
1. Faulty GDU	MCM	.7.WU
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	168 169
4. Dirty optic cables.	MCM	168 169
5. Faulty cables between IGBT and GDU	MCM	See circuit diagram
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.WU

### Check/Inspect

1. See fault 0041 (MCM).

#### 4.34 0046 - IGBT6 feedback fault (M05B)

Detected fault: IGBT 6 feedback indication is faulty. Order and feedback do not correspond.

Fault effect: Protective blocking

Local signal: PB\_VSI\_FBFUZZYFL\_FI6

Causes	Location	Item des.
1. Faulty GDU	MCM	.7.WL
2. Faulty Power Supply.	MCM	.1.22
3. Faulty optic cables	MCM	170 171
4. Dirty optic cables.	MCM	170 171
5. Faulty cables between IGBT and GDU	MCM	See circuit diagram
6. Faulty DCU/M	MCM	.1.21
7. Faulty IGBT	MCM	.2.WL

### Check/Inspect

1. See fault 0041 (MCM).

#### 4.35 0047 - overcurrent phase 1 (M10A)

Detected fault: Overcurrent in phase 1

Fault effect: Protective blocking

Local signal: PB\_ADC\_TRIPOCPH1

Causes	Location	Item des.
1. Line voltage transient.	N.A.	N.A.
2. Disturbance during entering or exit of neutral track section.	N.A.	N.A.
3. Disturbance, for example jammed brake on the wheel axle	N.A.	N.A.
4. Faulty GDU	MCM	.7.UU, .7.UL
5. Faulty phase current measurement	MCM	N.A.
6. Arc-through in an IGBT	MCM	.2.UU, .2.UL
7. Short circuit in motor cables	See vehicle circuit diagram	N.A.
8. Short circuit in motor	See vehicle circuit diagram	N.A.
9. Faulty speed measurement	N.A.	N.A.

#### Check/Inspect

1. Check if a line voltage transient has occurred.
2. Check other fault messages received to see if these are related to this fault. These may provide a more precise indication of the location of the overcurrent.
3. Make a visual inspection in the MCM to check for IGBT arc-trough fault.
4. See fault 0202 (MCM) for actions regarding speed measurement.
5. To check the GDU, the phase current sensor and the IGBTs perform a load test. See Routine Test Instruction.
6. If no fault in the MCM can be found, check the motor cabling and the motor resistance values.
7. If the fault appears intermittently replace the current sensor .
8. If the fault is still reoccurring replace the DCU/M.

### 4.36 0048 - overcurrent phase 2 (M10A)

Detected fault: Overcurrent in phase 2

Fault effect: Protective blocking

Local signal: PB\_ADC\_TRIPOCPH2



Causes	Location	Item des.
1. Line voltage transient.	N.A.	N.A.
2. Disturbance during entering or exit of neutral track section.	N.A.	N.A.
3. Disturbance, for example jammed brake on the wheel axle	N.A.	N.A.
4. Faulty GDU	MCM	.7.VU, .7.VL
5. Faulty phase current measurement	MCM	N.A.
6. Arc-through in an IGBT	MCM	.2.VU, .2.VL
7. Short circuit in motor cables	See vehicle circuit diagram	N.A.
8. Short circuit in motor	See vehicle circuit diagram	N.A.
9. Faulty speed measurement	N.A.	N.A.

#### Check/Inspect

1. See fault 0047 (MCM).

### 4.37 0049 - overcurrent phase 3 (M10A)

Detected fault: Overcurrent in phase 3

Fault effect: Protective blocking

Local signal: PB\_ADC\_TRIOPCPH3

Causes	Location	Item des.
1. Line voltage transient.	N.A.	N.A.
2. Disturbance during entering or exit of neutral track section.	N.A.	N.A.
3. Disturbance, for example jammed brake on the wheel axle	N.A.	N.A.
4. Faulty GDU	MCM	7.WU, .7.WL
5. Faulty phase current measurement phase 1.	MCM	N.A.
6. Faulty phase current measurement phase 2.	MCM	N.A.
7. Arc-through in an IGBT	MCM	.2.WU, .2.WL
8. Short circuit in motor cables	See vehicle circuit diagram	N.A.
9. Short circuit in motor	See vehicle circuit diagram	N.A.
10. Faulty speed measurement	N.A.	N.A.

#### Check/Inspect

1. See fault 0047 (MCM).

### 4.38 0050 - Phase current unbalance superv. (M12)

Detected fault: Too high unbalance in phase currents.

Fault effect: Protective blocking

Local signal: EC\_IPHBAL\_SUP\_FL

Causes	Location	Item des.
1. Faulty current measurement		
2. Faulty motor	See vehicle circuit diagram	N.A.

#### Check/Inspect

1. See fault 0062 (MCM)

### 4.39 0051 - No current supervision Ph1 (M12)

Detected fault: The current sensor does not indicate any phase current even if motors are magnetized.

Fault effect: Protective blocking

Local signal: EC\_IPH1\_NOCURSUP\_FL

Causes	Location	Item des.
1. Faulty current measurement.		

#### Check/Inspect

1. See fault 0062 (MCM).

### 4.40 0053 - No current supervision Ph3 (M12)

Detected fault: The current sensor does not indicate any phase current even if motors are magnetized.

Fault effect: Protective blocking

Local signal: EC\_IPH3\_NOCURSUP\_FL

Causes	Location	Item des.
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1. Faulty current measurement.

#### Check/Inspect

1. See fault 0064 (MCM).

### 4.41 0054 - dev. meas./est. current phase 1 (M13)

Detected fault: The deviation between measured and estimated motor current is too high during motor magnetization.

Fault effect: Protective blocking

Local signal: ED\_DVIPH1

Causes	Location	Item des.
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1. Faulty current measurement.

#### Check/Inspect

1. See fault 0062 (MCM).

### 4.42 0056 - dev. meas./est. current phase 3 (M13)

Detected fault: The deviation between measured and estimated motor current is too high during motor magnetization.

Fault effect: Protective blocking

Local signal: ED\_DVIPH3

Causes	Location	Item des.
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1. Faulty current measurement.

#### Check/Inspect

1. See fault 0064 (MCM).

### 4.43 0057 - too high DC-comp., phase currents (M15)

Detected fault: Too high unbalance in phase currents.

Fault effect: Protective blocking

Local signal: EC\_IDCLIMFL

Causes	Location	Item des.
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1. Faulty current sensor
2. Faulty motor

#### Check/Inspect

1. Perform a load test according to routine test instruction.

### 4.44 0061 - no speedsensor valid (M41)

Detected fault: MVB speed is indicated but none of the speed sensors are indicating speed.

Fault effect: Protective blocking

Local signal: EC\_NOSPEEDSEN\_VALID

Causes	Location	Item des.
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1. Faulty cabling.

#### Check/Inspect

1. Check speed sensor cabling.

### 4.45 0062 - plausibility failure Iconv\_ph1 (M81A)

Detected fault: Invalid phase 1 measurement.

Fault effect: Protective blocking

Local signal: EC\_ICVPH1PLYFL

Related SW signals	I/O-unit	Signal description
PCTS1MZ_XI_Ph1	DCU/M: X12:B26 X12:Z26 (+24V) X12:D26 (-24V)	Current phase 1

Causes	Location	Item des.
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1. Faulty cables between sensor and DCU/M  
MCM  
See MCM circuit diagram
2. Faulty current sensor  
MCM  
.6.64
3. Faulty DCU/M  
MCM  
.1.21

#### Check/Inspect

1. Check cabling between sensor and DCU/M
2. Perform load test to test the phase current sensor. See Routine Test Instruction.

#### 4.46 0064 - plausibility failure Iconv\_ph3 (M81A)

Detected fault: Invalid phase 3 measurement.

Fault effect: Protective blocking

Local signal: EC\_ICVPH3PLYFL

Related SW signals	I/O-unit	Signal description
PCTS1MZ_XI_Ph3	DCU/M: X12:B24 X12:Z24 (+24V) X12:D24 (-24V)	Current phase 3

Causes	Location	Item des.
1. Faulty cables between sensor and DCU/M	MCM	See MCM circuit diagram
2. Faulty current sensor	MCM	.6.65
3. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. See fault 0062 (MCM).

#### 4.47 0065 - plausibility failure UDcLine (M80C)

Fault effect: Protective blocking

Local signal: EC\_UDCLNPLYFL

Causes	Location	Item des.
1. TBD		

#### Check/Inspect

1. TBD

#### 4.48 0066 - too many cv. fastblock. lph\_high4 (M97A)

Detected fault: MCM has been blocked to often due to high phase current.

Fault effect: Protective blocking  
Local signal: EC\_ICV\_HIGH4

Causes	Location	Item des.
1. See fault 0047(MCM)		
2. See fault 0048(MCM)		
3. See fault 0049(MCM)		

#### Check/Inspect

1. See fault 0047(MCM)
2. See fault 0048(MCM)
3. See fault 0049(MCM)

### 4.49 0068 - deviation between ADC's IPH1 (H19)

Detected fault: Hardware fault in the DCU.

Fault effect: Protective blocking  
Local signal: EC\_ICVPH1\_PRDV

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Replace DCU/M

### 4.50 0069 - deviation between ADC's IPH2 or 3 (H19)

Detected fault: Hardware fault in the DCU.

Fault effect: Protective blocking  
Local signal: EC\_ICVPHX\_PRDV

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Replace DCU/M

#### 4.51 0070 - EOC failure Iconv\_ph1/x (H38)

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Protective blocking

Local signal: EC\_ICVPH1XEOC\_FL

Causes	Location	Item des.
1. Intermittent disturbance		
2. Faulty DCU/M if fault is persistent		

##### Check/Inspect

1. TBD

#### 4.52 0071 - EOC failure UDcLink/IDcLine (H38)

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Protective blocking

Local signal: EC\_UDCLKIDCLNEOC\_FL

Causes	Location	Item des.
1. Intermittent disturbance	N.A.	N.A.
2. Faulty DCU/M if fault is persistent	MCM	.1.21

##### Check/Inspect

1. TBD

#### 4.53 0072 - EOC failure UDcLine (H38)

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Protective blocking

Local signal: EC\_UDCLNEOC\_FL

Causes	Location	Item des.
1. TBD		

##### Check/Inspect

1. TBD

#### 4.54 0073 - DSP PrBc error: details see 'Z\_ErrCoPB'

Detected fault: Summary fault.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: EC\_PB\_DSP

Causes	Location	Item des.
1. See fault 0001 (MCM)		

##### Check/Inspect

1. See fault 0001 (MCM)

#### 4.55 0080 - Calibration failure

Detected fault: The calibration of DC-link voltage sensor or the phase current sensors failed.

Fault effect: Soft shutdown

Local signal: CALIMM\_B\_RqSfSd

Causes	Location	Item des.
1. Disturbance during calibration.	N,A.	N.A.
2. Faulty DC-link voltage measurement.	MCM	N.A.
3. Faulty DC-link current measurement.	MCM	N.A.
4. Faulty phase current measurement.	MCM	N.A.
5. Faulty OVP function	MCM	N.A.

##### Check/Inspect

1. See fault 0028(MCM).
2. See fault 0011(MCM).
3. See fault 0062(MCM) and 0064(MCM).
4. See fault 0105 (MCM).

#### 4.56 0081 - Internal cooling problem

Fault effect: None

Local signal: IFANMM\_B\_RqSfSd



#### 4.57 0082 - External fan failure

Detected fault: Fan contactor control failure while invalid heatsink temperature.

Fault effect: Isolation  
High fault frequency will cause MCM isolation.

Local signal: EFANMM\_B\_ExtFnSvRqCvSlt

Causes	Location	Item des.
1. Faulty set or tripped motor protection breakers	Px Box	.1.4.2 (Half speed) .1.4.1 (Full speed)
2. Faulty cabling between DCU and contactors	Px Box	See circuit diagram
3. Faulty contactors	Px Box	.1.4.8 (Half speed) .1.4.6 (Full speed) .1.4.7 (Full speed)
4. Faulty temperature measurement	MCM	N.A.
5. Faulty fan	Px Box	.4

#### Check/Inspect

1. Check setting of fan motor protection breakers or reset it if they have tripped.
2. Perform digital output test according to routine test instruction without 400V present and check that:
  - the DCU generator control voltage on D02 (Half speed) and D01 (Full speed).
  - check that feedback signals are received on DI5 (Half speed) and DI4 (Full speed)
  - that the fan contactor closes.
3. Perform digital output test according to routine test instruction with 400V present and check that:
  - the fan rotates correctly
4. Check cabling.
5. Perform an I/O test according to routine test instruction to check the heatsink temperature measurement.
6. If no faults can be found and the protection breakers tripped again the fan or protection breakers might be faulty.

#### 4.58 0083 - Slip/Slide failure

Detected fault: The slip speed limit has been exceeded for too long time.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: SSSPMM\_B\_SfSd

Causes	Location	Item des.
1. Mechanical brake problems	N.A.	N.A.
2. Faulty speed measurement	N.A.	N.A.

#### Check/Inspect

1. Check mechanical brakes. When the speed has decreased until achieved tractive effort corresponds to the reference, the indication disappears.
2. See fault 0110 (MCM) regarding the speed measurement.

### 4.59 0084 - Mechanical fault

Detected fault: The deviation between measured and estimated motor current is too high.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: MFPRMM\_B\_RqPrBc

Causes	Location	Item des.
1. Faulty motor cable connections.	See vehicle circuit diagram	N.A.
2. Mechanically locked motor or gear.	N.A.	N.A.
3. Broken shrinkage fit/coupling.	N.A.	N.A.

#### Check/Inspect

1. Check phase sequence on motor cables.
2. Check cable connections
2. 1. Check that axle rotates freely by moving the train very slow while supervising the axle rotation from the side of the train.  
2. Remove coupling between motor and gear. If the axle then rotates the motor is faulty, if not the gear is faulty.

### 4.60 0085 - Traction/braking plausibility fault

Detected fault: Both traction and braking status is set or tractive effort reference during braking status or braking effort reference during traction status.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: TBPCMM\_B\_RqPrBc

Related SW signals	I/O-unit	Signal description
TBD		

Causes	Location	Item des.
1. VCU problem if MVB is functional (not backup mode)		
2. Trainlines in backup mode		

Check/Inspect
1. Check for related VCU faults.
2. Check trainlines to DCU/M.

#### 4.61 0087 - DC-Link discharging failure (M91)

Detected fault: DC-link voltage does not fall correctly at discharge.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: BRCPMM\_B\_RqPrSd

Causes	Location	Item des.
1. Faulty OVP function.	N.A.	N.A.
2. Faulty charging contactor control or supervision.	MCM	N.A.
3. Faulty separation contactor control or supervision.	MCM	N.A.
4. Faulty DC link voltage measurement	MCM	N.A.

Check/Inspect
1. See fault 0105 regarding the OVP.
2. See fault 0106 (MCM) regarding the charging contactor.
3. See fault 0107 (MCM) regarding the separation contactor.
4. See fault 0028 (MCM) for actions regarding the DC link voltage measurement.

#### 4.62 0088 - contactor current check failure (M92)

Detected fault: DC link current sensor indicates too high current to open the separation contactor.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: ISCSMM\_B\_RqPrSd

Causes	Location	Item des.
1. Short circuit in DC link		
2. HSCB should have opened but did not open		
3. Current sensor measurement failure		
4. DCU fault		

Check/Inspect
1. TBD

#### 4.63 0089 - DC-link charging failure (M90/M95)

Detected fault: DC-link voltage does not rise correctly at charge.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: DCCSMM\_B\_RqPrSd

Causes	Location	Item des.
1. Too many charging sequences have been made within a short time and the charging resistor is overheated.	N.A.	N.A.
2. No line voltage present or line voltage distributed	N.A.	N.A.
3. Faulty charging contactor control or supervision.	MCM	N.A.
4. Faulty separation contactor control or supervision.	MCM	N.A.
5. Faulty DC link voltage measurement	MCM	N.A.
6. Short circuit in the DC-link	MCM	N.A.
7. Faulty charging resistor.	Px Box	.1.10

Check/Inspect
1. Too many charging attempts has been made if fault 0093 (MCM) is received.
2. Check if other units (ACM or MCM) is reporting similar faults.
3. See fault 0106 (MCM) regarding the charging contactor.
4. See fault 0107 (MCM) regarding the separation contactor.
5. See fault 0028 (MCM) regarding the DC-link voltage measurement.
6. 1. Check visually for signs of short circuit in the DC link. 2. Check if the DC link is short circuited by measuring the voltage over the DC+ and DC-. Measure with a DMM when the converter is discharged and supplied with battery voltage. The voltage should be 24V DC. If the voltage is below 10V DC there is a short circuit.
7. Measure the resistance of the charging resistor when the charging contactor is open. It should be 50 Ohm +/- 5% (hot/cold).

#### 4.64 0090 - Charging contactor off failure (M63)

Detected fault: Charging contactor does not open at order.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: CFSUMM\_B\_RqPrSd\_ChCt

Related SW signals	I/O-unit	Signal description
CFSUMM_C_CdChCt	X11:B26 X11:D26	Charging contactor close order
DIGIMM_A_CdChCt	X11:D30	Charging contactor closed

Causes	Location	Item des.
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1. See fault 0106 (MCM).

#### Check/Inspect

1. See fault 0106 (MCM).

#### 4.65 0091 - Separation contactor off failure (M64)

Detected fault: Separation contactor does not open at order.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: CFSUMM\_B\_RqPrSd\_SrCt

Related SW signals	I/O-unit	Signal description
CFSUMM_C_CdSrC	X11:B24 X11:D24	Separation contactor 1 (positive pole) close order
DIGIMM_A_CdSrCt	X11:B30	Separation contactor 1 (positive pole) closed

Causes	Location	Item des.
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1. See fault 0107 (MCM).

#### Check/Inspect

1. See fault 0107 (MCM).

#### 4.66 0092 - MVB communication failure (M719)

Detected fault: Failure or disturbance in MVB communication

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: MVBSMZ\_B\_RqPrSd

Causes	Location	Item des.
1. A unit on the local Traction MVB is turned off	N.A.	N.A.
2. Fault somewhere along the Traction MVB cables	N.A.	N.A.
3. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Check if there is a unit that is turned off.
2. Check MVB cables.
3. Check for fault messages indicating other faulty units. If only this DCU/M indicates an MVB fault it is likely that the fault is within this DCU/M.

### 4.67 0093 - Brake resistor over temperature (M32)

Detected fault: Too high estimated temperature in brake resistor.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: BRTSMM\_B\_RqFsSd

Causes	Location	Item des.
1. See fault 0124(MCM)		

#### Check/Inspect

1. See fault 0124(MCM)

### 4.68 0094 - power balance failure (M61)

Detected fault: The input power dissipation in the brake resistor is too high in traction mode.

Fault effect: Fast shutdown  
High fault frequency will cause MCM isolation.

Local signal: PBALMM\_B\_RqFsSd

Causes	Location	Item des.
1. Faulty DC link voltage measurement.	MCM	N.A.
2. Short circuit in the DC-link	MCM	N.A.
3. Faulty motor phase current 1 measurement.	MCM	N.A.
4. Faulty motor phase current 2 measurement.	MCM	N.A.
5. Faulty cables to the brake resistor	See vehicle circuit diagram	N.A.
6. Faulty cables to the traction motors	See vehicle circuit diagram	N.A.
7. Faulty brake resistor	See vehicle circuit diagram	N.A.

#### Check/Inspect

1. Check for fault messages regarding listed measurements.
2. Check cabling to the brake resistor
3. Check cabling to the traction motors
4. Measure the resistance of the brake resistor. Both circuits should be between 2.8Ohm (cold) and 3.5Ohm (hot).

### 4.69 0095 - Motor overspeed (M43)

Detected fault: Too high motor speed is indicated.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: MOSPMM\_B\_RqPrBc

Causes	Location	Item des.
1. The unit has been running too fast	N.A.	N.A.

#### Check/Inspect

1. Check if the unit has been running too fast.

### 4.70 0096 - direction selection failure

Detected fault: Both forward and reverse command is set at the same time.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: DIRSMM\_B\_RqPrBcDrSIFl

Causes	Location	Item des.
1. PCU has ordered both forward and backward directions	N.A.	N.A.

#### Check/Inspect

1. See other fault messages for actions.

### 4.71 0098 - wheel diameter axle 1 failure

Detected fault: The wheel diameter is above 840 or below 760 mm.

Fault effect: 50% torque reduction

Local signal: WDCSMM\_S\_WhDm1Fl

Causes	Location	Item des.
1. The actual wheel diameter is smaller or bigger than the allowed.	N.A.	N.A.
2. Faulty speed measurement	N.A.	N.A.

#### Check/Inspect

1. Perform a new wheel diameter calibration by coasting above 40 km/h for more than 30 seconds on a level track.
2. Check for other fault messages regarding speed or calibration problems.
3. If the fault remains, check the actual wheel diameter of the wheels in the motored bogie.

### 4.72 0099 - wheel diameter axle 2 failure

Detected fault: The wheel diameter is above 840 or below 760 mm.

Fault effect: 50% torque reduction

Local signal: WDCSMM\_S\_WhDm2Fl

Causes	Location	Item des.
1. The actual wheel diameter is smaller or bigger than the allowed.	N.A.	N.A.
2. Faulty speed measurement	N.A.	N.A.



#### Check/Inspect

1. Perform a new wheel diameter calibration by coasting above 40 km/h for more than 30 seconds on a level track.
2. Check for other fault messages regarding speed or calibration problems.
3. If the fault remains, check the actual wheel diameter of the wheels in the motored bogie.

### 4.73 0100 - wheel diameter axle 3 failure

Detected fault: The wheel diameter is above 840 or below 760 mm.

Fault effect: 50% torque reduction

Local signal: WDCSMM\_S\_WhDm3Fl

Causes	Location	Item des.
1. The actual wheel diameter is smaller or bigger than the allowed.	N.A.	N.A.
2. Faulty speed measurement	N.A.	N.A.

#### Check/Inspect

1. Perform a new wheel diameter calibration by coasting above 40 km/h for more than 30 seconds on a level track.
2. Check for other fault messages regarding speed or calibration problems.
3. If the fault remains, check the actual wheel diameter of the wheels in the motored bogie.

### 4.74 0101 - wheel diameter axle 4 failure

Detected fault: The wheel diameter is above 840 or below 760 mm.

Fault effect: 50% torque reduction

Local signal: WDCSMM\_S\_WhDm4Fl

Causes	Location	Item des.
1. The actual wheel diameter is smaller or bigger than the allowed.	N.A.	N.A.
2. Faulty speed measurement	N.A.	N.A.

#### Check/Inspect

1. Perform a new wheel diameter calibration by coasting above 40 km/h for more than 30 seconds on a level track.
2. Check for other fault messages regarding speed or calibration problems.
3. If the fault remains, check the actual wheel diameter of the wheels in the motored bogie.

#### 4.75 0102 - wheel diameter difference high 1 failure

Detected fault: The wheel diameter difference within the MCM is above 7,5 mm.

Fault effect: torque reduction

Local signal: WDCSMM\_S\_WhDmDfHgh1Fl

Causes	Location	Item des.
1. The wheel diameter difference between axle 1 to 4 is too big.	N.A.	N.A.

#### Check/Inspect

1. Make a new calibration by coasting the train unit above 40 km/h for more than 30 seconds on a level track.
2. If the fault remains, check the actual wheel diameters.
3. Turn the wheels.

#### 4.76 0103 - No valid wheel diameter failure (M44)

Detected fault: The wheel diameter is above 840 or below 760 mm for all axels or the wheel diameter difference within the MCM is above 11 mm.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: WDCSMM\_B\_RqPrBc

Causes	Location	Item des.
1. Wheel axles	Vehicle	N.A.
2. Calibration fault	Vehicle	N.A.

#### 4.77 0104 - Filter inductor over temperature (M58)

Detected fault: Too high estimated temperature in filter inductor.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: FITSMM\_B\_RqPrBc

Causes	Location	Item des.
1. High load.	N.A.	N.A.
2. Faulty or high ambient temperature	N.A.	N.A.
3. Low line voltage	N.A.	N.A.

#### Check/Inspect

1. Check if the unit has been running under abnormal conditions.
2. Check if the ambient temperature has been unusually high or faulty.
3. Check if the line voltage has been unusually low.

### 4.78 0105 - OVP self test failure (M30)

Detected fault: DC-link voltage does not fall correctly during OVP test in charge sequence.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: BCTCMM\_B\_RqSfSd

Causes	Location	Item des.
1. Faulty brake resistor module.	See vehicle circuit diagram	N.A.
2. Faulty cables between brake resistor and MCM.	See vehicle circuit diagram	N.A.
3. See fault 0007 (MCM).		

#### Check/Inspect

1. Check cabling to the brake resistor
2. Measure the resistance of the brake resistor. Both circuits should be between 2.8Ohm (cold) and 3.5Ohm (hot).
3. Check the cables on the DC-link and attach cable lugs and screw connections if necessary.
4. Check that the opto cables are tightened.
5. Perform a chopper test according to the Routine Test Instruction

### 4.79 0106 - Charging contactor on failure (M59)

Detected fault: Charging contactor does not close at order.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: CFSUMM\_B\_RqSfSd\_ChCt

Related SW signals	I/O-unit	Signal description
CFSUMM_C_CdChCt	X11:B26 X11:D26	Charging contactor close order
DIGIMM_A_CdChCt	X11:D30	Charging contactor closed

Causes	Location	Item des.
1. Faulty charging contactor	MCM front section	.1.1.2
2. Faulty cabling between the DX unit and the charging contactor	MCM front section	See circuit diagram
3. Faulty DX unit	MCM	

#### Check/Inspect

1. Check cabling
2. By visual inspection check that the charging contactor is not welded or stuck position.
3. Perform digital output test according to the Routine Test Instruction

### 4.80 0107 - Separation contactor on failure (M60)

Detected fault: Separation contactor does not close at order.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: CFSUMM\_B\_RqSfSd\_SrCt

Related SW signals	I/O-unit	Signal description
CFSUMM_C_CdSrC	X11:B24 X11:D24	Separation contactor 1 (positive pole) close order
DIGIMM_A_CdSrCt	X11:B30	Separation contactor 1 (positive pole) closed

Causes	Location	Item des.
1. Faulty Separation contactor	MCM front section	.1.1.1
2. Faulty cabling between the DX unit and the separation contactor	MCM front section	See circuit diagram
3. Faulty DX unit	MCM	1.21

#### Check/Inspect

1. Check cabling
2. By visual inspection check that the separation contactor is not welded or stuck position.
3. Perform digital output test according to the Routine Test Instruction

### 4.81 0108 - charging failure, resistor overtemp.(M62)

Detected fault: Too high temperature in charging resistor.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: DCCHMM\_B\_RqSfSd

Causes	Location	Item des.
1. Too many charging attempts has been made within a too short period of time.	N.A.	N.A.

#### Check/Inspect

1. Check other fault messages received to find the reason to the repeated charging attempts.

## 4.82 0110 - Speed Sensor Channel 1A Failure

Detected fault: Invalid speed sensor channel 1A.

Fault effect: None

Local signal: SSSUMM\_B\_SpeCh1AEnFl

Causes	Location	Item des.
1. Faulty cabling between sensor and DCU/M	See vehicle circuit diagram	N.A.
2. Disturbances due to faulty motor- or grounding cables.	See vehicle circuit diagram	N.A.
3. Faulty speed sensor.	Motor	N.A.
4. Faulty DCU/M	MCM	.1.21
5. Damaged tooth wheel.	Motor	N.A.

### Check/Inspect

1. Rotate the axles at low speed by moving the train.  
Log the following signals:  
SpeSnChNoVdLvA Error signal channel 1A, speed sensor 1  
SpeSnChNoVdLvB Error signal channel 1B, speed sensor 1  
B\_ChAVdMCU Valid bit channel 1A, speed sensor 1  
B\_ChBVdMCU Valid bit channel 1B, speed sensor 1  
Check that the valid bits for both channels are “1”. If not there is probably a cable break or a faulty sensor.
2. Check the direction indication of the sensor by comparing the following signals and parameters:  
HSTIMM\_B\_Dr\_Ax1 with parameter PARTMP\_B\_RefDr\_Ax1 (speed sensor 1)  
HSTIMM\_B\_Dr\_Ax2 with parameter PARTMP\_B\_RefDr\_Ax2 (speed sensor 1)  
HSTIMM\_B\_Dr\_Ax3 with parameter PARTMP\_B\_RefDr\_Ax3 (speed sensor 1)  
HSTIMM\_B\_Dr\_Ax4 with parameter PARTMP\_B\_RefDr\_Ax4 (speed sensor 1)  
When the train is moved forwards (from the actual train section point of view) the signal and the parameter shall have the same value.  
When the train is moved backwards (from the actual train section point of view) signal and the parameter shall have opposite value.  
If the above conditions are not fulfilled for a sensor, the sensor is probably wrongly connected.
3. Rotate the axle, at low speed, either by moving the train or by lifting and rotating the relevant axle. All signals should show the same value with the same sign.  
Note that a sensor, that is detected faulty by the DCU/M, will give zero speed.
4. Check the error signals of the sensors. If they have a noisy behavior, i.e. fluctuating values, the problem is probably due to disturbances. This problem could be more obvious during maximum traction or electrical braking.
5. Check the tooth wheel if it is mounted in an exposed position.
6. If the problem persists replace the DCU/M.

## 4.83 0111 - Speed Sensor Channel 1B Failure

Detected fault: Invalid speed sensor channel 1B.

Fault effect: None

Local signal: SSSUMM\_B\_SpeCh1BEnFl

Causes	Location	Item des.
1. See fault 0110 (MCM).		

### Check/Inspect

1. See fault 0110 (MCM).

#### 4.84 0112 - Speed Sensor Channel 2A Failure

Detected fault: Invalid speed sensor channel 2A.

Fault effect: None

Local signal: SSSUMM\_B\_SpeCh2AEnFl

Causes	Location	Item des.
1. See fault 0110 (MCM).		

##### Check/Inspect

1. See fault 0110 (MCM).

#### 4.85 0113 - Speed Sensor Channel 2B Failure

Detected fault: Invalid speed sensor channel 2B.

Fault effect: None

Local signal: SSSUMM\_B\_SpeCh2BEnFl

Causes	Location	Item des.
1. See fault 0110 (MCM).		

##### Check/Inspect

1. See fault 0110 (MCM).

#### 4.86 0114 - Speed Sensor Channel 3A Failure

Detected fault: Invalid speed sensor channel 3A.

Fault effect: None

Local signal: SSSUMM\_B\_SpeCh3AEnFl

Causes	Location	Item des.
1. See fault 0110 (MCM).		

##### Check/Inspect

1. See fault 0110 (MCM).

#### 4.87 0115 - Speed Sensor Channel 3B Failure

Detected fault: Invalid speed sensor channel 3B.

Fault effect: None  
Local signal: SSSUMM\_B\_SpeCh3BEnFl

Causes	Location	Item des.
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1. See fault 0110 (MCM).

#### Check/Inspect

1. See fault 0110 (MCM).

### 4.88 0116 - Speed Sensor Channel 4A Failure

Detected fault: Invalid speed sensor channel 4A.

Fault effect: None  
Local signal: SSSUMM\_B\_SpeCh4AEnFl

Causes	Location	Item des.
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1. See fault 0110 (MCM).

#### Check/Inspect

1. See fault 0110 (MCM).

### 4.89 0117 - Speed Sensor Channel 4B Failure

Detected fault: Invalid speed sensor channel 4B.

Fault effect: None  
Local signal: SSSUMM\_B\_SpeCh4BEnFl

Causes	Location	Item des.
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1. See fault 0110 (MCM).

#### Check/Inspect

1. See fault 0110 (MCM).

### 4.90 0118 - Feedback failure GDU 1 (M05A/M08)

Detected fault: The GDU feedback indicates IGBT-ON when MCM is charged but not in operation.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.



Local signal: SFPAMM\_S\_Gdu1FbFl

Causes	Location	Item des.
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1. See fault 0041 (MCM).

#### Check/Inspect

1. See fault 0041 (MCM).

### 4.91 0119 - Feedback failure GDU 2 (M05A/M08)

Detected fault: The GDU feedback indicates IGBT-ON when MCM is charged but not in operation.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: SFPAMM\_S\_Gdu2FbFl

Causes	Location	Item des.
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1. See fault 0042 (MCM).

#### Check/Inspect

1. See fault 0041 (MCM).

### 4.92 0120 - Feedback failure GDU 3 (M05A/M08)

Detected fault: The GDU feedback indicates IGBT-ON when MCM is charged but not in operation.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: SFPAMM\_S\_Gdu3FbFl

Causes	Location	Item des.
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1. See fault 0043 (MCM).

#### Check/Inspect

1. See fault 0041 (MCM).

### 4.93 0121 - Feedback failure GDU 4 (M05A/M08)

Detected fault: The GDU feedback indicates IGBT-ON when MCM is charged but not in operation.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: SFPAMM\_S\_Gdu4FbFl

Causes	Location	Item des.
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1. See fault 0044 (MCM).

#### Check/Inspect

1. See fault 0041 (MCM).

### 4.94 0122 - Feedback failure GDU 5 (M05A/M08)

Detected fault: The GDU feedback indicates IGBT-ON when MCM is charged but not in operation.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: SFPAMM\_S\_Gdu5FbFl

Causes	Location	Item des.
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1. See fault 0045 (MCM).

#### Check/Inspect

1. See fault 0041 (MCM).

### 4.95 0123 - Feedback failure GDU 6 (M05A/M08)

Detected fault: The GDU feedback indicates IGBT-ON when MCM is charged but not in operation.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: SFPAMM\_S\_Gdu6FbFl

Causes	Location	Item des.
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1. See fault 0046 (MCM).

#### Check/Inspect

1. See fault 0041 (MCM).

#### 4.96 0124 - Brake resistor over temperature (M33)

Detected fault: Too high estimated temperature in brake resistor.

Fault effect: Soft blocking  
High fault frequency will cause MCM isolation.

Local signal: BRTSMM\_B\_RqSfBc

Related SW signals	I/O-unit	Signal description
UDC	DCU/M: X12:B22 X12:Z22 (+24V) X12:D22 (-24V)	DC link voltage

Causes	Location	Item des.
1. Excessive rheostatic braking, due to e.g. loss of mechanical brake or loss of motor converters.	N.A.	N.A.
2. Repeated powerful DC link overvoltage in combination with excessive rheostatic braking	N.A.	N.A.
3. Faulty DC link voltage measurement	N.A.	N.A.

##### Check/Inspect

1. Check status on MCMs and mechanical brakes.
2. Check if other units (MCM) is reporting similar faults.
3. See fault 0014 (MCM) regarding the voltage measurement.

#### 4.97 0125 - PrBc: traction safe supervision (M72)

Detected fault: The DCU internal HW feedback of the traction safe signal is lost during operation.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: TRSSMM\_B\_RqPrBc

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

##### Check/Inspect

1. Replace DCU/M.

#### 4.98 0126 - undemanded tq sup. blocked conv. (S01)

Detected fault: The DCU internal start feedback indicates converter in operation even if start command is not set.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: VOFSMM\_B\_RqPrSd

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

##### Check/Inspect

1. Replace DCU/M.

#### 4.99 0127 - undemanded torque sup. Standstill (S02)

Detected fault: Tractive effort is indicated at stand still even if no reference is applied.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: UTQSMM\_B\_RqPrSd

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

##### Check/Inspect

1. Replace DCU/M.

#### 4.100 0128 - NO Speed sensor supply OK

Detected fault: Faulty voltage supply to the speed sensors.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation.

Local signal: SSSUMM\_B\_RqPrBc

Causes	Location	Item des.
1. Faulty voltage supply to the speed sensors.	MCM	See circuit diagram

#### Check/Inspect

1. See fault 0021 (MCM) regarding the power supply.

#### 4.101 0129 - DSP parameter calculation failure

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: None

Local signal: DIAGMM\_B\_ParadFl

Causes	Location	Item des.
1. See fault 0014(MCM)		

#### Check/Inspect

1. See fault 0014(MCM)

#### 4.102 0130 - MCU parameter calculation failure

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: None

Local signal: DIAGMM\_B\_ParamFl

Causes	Location	Item des.
1. See fault 0014(MCM)		

#### Check/Inspect

1. See fault 0014(MCM)

#### 4.103 0131 - DSP/FPGA PrSd failure, MCU trigger

Detected fault: Trig signal for DSP recorder.

Fault effect: None

Local signal: DIAGMM\_B\_TrigDiagPrSdM

Causes	Location	Item des.
1. Fault 0001 (MCM) to 0015 (MCM) fault has occurred.		

#### Check/Inspect

1. See related fault.

#### 4.104 0132 - DSP/FPGA FsSd failure, MCU trigger

Detected fault: Trig signal for DSP recorder.  
Fault effect: None  
Local signal: DIAGMM\_B\_TrigDiagFsSdM

Causes	Location	Item des.
1. Fault 0020 (MCM) to 0035 (MCM) fault has occurred.		

#### Check/Inspect

1. See related fault.

#### 4.105 0133 - DSP/FPGA PrBc failure, MCU trigger

Detected fault: Trig signal for DSP recorder.  
Fault effect: None  
Local signal: DIAGMM\_B\_TrigDiagPrBcM

Causes	Location	Item des.
1. Fault 0040 (MCM) to 0073 (MCM) fault has occurred.		

#### Check/Inspect

1. See related fault.

#### 4.106 0140 - Digital output failure (HwFI)

Detected fault: Hardware fault in the DCU.  
  
Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.  
Local signal: DHSSMG\_B\_DiOutFI

Causes	Location	Item des.
1. Power supply to DCU/M IO-module missing.	MCM	See circuit diagram
2. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Check cabling to DI/DO.
2. Perform I/O test according to the Routine Test Instruction
3. Replace the DCU/M.

### 4.107 0141 - DSP Verison failure

Fault effect: Fast shutdown

Local signal: DHSSMG\_B\_DspVerCodFl

Causes	Location	Item des.
1. Check DSP version.		

#### Check/Inspect

1. Download correct DSP version.

### 4.108 0142 - FPGA2 Verison failure

Fault effect: Fast shutdown

High fault frequency will cause MCM isolation.

Local signal: DHSSMG\_B\_Fpga2VerCodFl

Causes	Location	Item des.
1. Check FPGA2 version.		

#### Check/Inspect

1. Download correct DSP version.

### 4.109 0143 - Line trip relay closing failure(Warning)

Detected fault: Hardware fault in the DCU.

Fault effect: None

Local signal: DHSSMG\_B\_LtrCdFl

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Replace DCU/M.

#### 4.110 0144 - Line trip opening delayed (HW 512 ms)

Detected fault: Hardware fault in the DCU.

Fault effect: Protective shutdown

Local signal: DHSSMG\_B\_LtrOpDly

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

##### Check/Inspect

1. Replace DCU/M.

#### 4.111 0145 - Line trip relay opening failure (HwFI)

Detected fault: Hardware fault in the DCU.

Fault effect: Protective shutdown  
High fault frequency will cause MCM isolation.

Local signal: DHSSMG\_B\_LtrHwOpFI

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

##### Check/Inspect

1. Replace DCU/M.

#### 4.112 0146 - DSP error

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Reinit  
High fault frequency will cause MCM isolation.

Local signal: DHSSMG\_S\_DspFI

Causes	Location	Item des.
1. See fault 0014(MCM)		

##### Check/Inspect

1. See fault 0014(MCM)



#### 4.113 0147 - DCU Hardware failure

Detected fault: Hardware fault in the DCU.

Fault effect: Depends on active fault

Local signal: DHSSMG\_S\_HwFl

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

##### Check/Inspect

1. Replace DCU/M.

#### 4.114 0148 - Warning, Board-temperature high (HwFl)

Detected fault: High DCU control board temperature.

Fault effect: Soft shutdown

Local signal: DOTSMG\_B\_RqSfSd

Causes	Location	Item des.
1. See fault 0149 (MCM).		

##### Check/Inspect

1. See fault 0149 (MCM).

#### 4.115 0149 - Board-temperature high (HwFl, Power off)

Detected fault: High DCU control board temperature.

Fault effect: Power off

Local signal: DOTSMG\_B\_PowOf\_DcuBdTpFl

Causes	Location	Item des.
1. Converter cooling missing	N.A.	N.A.
2. Faulty temperature measurement	N.A.	N.A.

##### Check/Inspect

1. See fault 0113 (MCM).
2. See fault 0310 (MCM).

#### 4.116 0150 - DCU hardware failure Warning

Detected fault: Hardware fault in the DCU.

Fault effect: None

Local signal: PRASMG\_B\_DgMsg

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

##### Check/Inspect

1. If the fault remains the DCU/M is faulty.

#### 4.117 0151 - System change failed

Detected fault: Hardware fault or intermittent disturbance in the DCU.

Fault effect: Blocking

Local signal: SYSCMG\_B\_SyChgFl

Causes	Location	Item des.
1. See fault 0014(MCM)		

##### Check/Inspect

1. See fault 0014(MCM)

#### 4.118 0153 - Speed sensor supply 1 NOT OK

Detected fault: Faulty voltage supply to the speed sensor.

Fault effect: None

Local signal: DHSSMG\_B\_Sn1SpNOK

Causes	Location	Item des.
1. Cabling between power supply unit and DCU/M.	MCM	See circuit diagram
2. Power supply unit		.1.22
3. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Check cabling
2. Check supply voltages according to document FFI for RT.
3. Replace DCU/M if no faults can be found.

#### 4.119 0154 - Speed sensor supply 2 NOT OK

Detected fault: Faulty voltage supply to the speed sensor.

Fault effect: None

Local signal: DHSSMG\_B\_Sn2SpNOK

Causes	Location	Item des.
1. See fault 0153 (MCM).		

#### Check/Inspect

1. See fault 0153 (MCM).

#### 4.120 0155 - Speed sensor supply 3 NOT OK

Detected fault: Faulty voltage supply to the speed sensor.

Fault effect: None

Local signal: DHSSMG\_B\_Sn3SpNOK

Causes	Location	Item des.
1. See fault 0153 (MCM).		

#### Check/Inspect

1. See fault 0153 (MCM).

#### 4.121 0156 - Speed sensor supply 4 NOT OK

Detected fault: Faulty voltage supply to the speed sensor.

Fault effect: None

Local signal: DHSSMG\_B\_Sn4SpNOK

Causes	Location	Item des.
1. See fault 0153 (MCM).		

#### Check/Inspect

1. See fault 0153 (MCM).

### 4.122 0160 - DCU board temperature failure

Detected fault: Invalid DCU board temperature measurement.

Fault effect: None  
High fault frequency will cause MCM isolation.

Local signal: ANINMM\_S\_DcuBrdTpFl

Related SW signals	I/O-unit	Signal description
TEMPCB	N.A.	Control board temperature

Causes	Location	Item des.
1. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. If the fault remains the DCU/M is faulty.

### 4.123 0161 - Heat Sink temperature failure

Detected fault: Invalid heatsink temperature measurement.

Fault effect: None  
High fault frequency will cause MCM isolation.

Local signal: ANINMM\_S\_HtCoTpFl

Related SW signals	I/O-unit	Signal description
TEMPHS	DCU/M: X12:D14 (0V / signal +) X12:D12 (2.5mA / signal -)	Converter heat sink temperature

Causes	Location	Item des.
1. Faulty temperature sensor	MCM	.2.50
2. Faulty cables between sensor and DCU/M	MCM	266/1-1,1-2,2-1,2-2,SC-2
3. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Check cabling between sensor and DCU/M
2. Connect a reference Pt-100 temperature sensor at MCM connector X12:D12, D14.  
Log signal TEMPHS.  
If the signal shows ambient temperature the motor sensor is faulty. If the fault remains the DCU/M is faulty.

#### 4.124 0162 - Internal air temperature failure (M56)

Detected fault: Invalid air temperature measurement.

Fault effect: None  
High fault frequency will cause MCM isolation.

Local signal: ANINMM\_S\_NteArTpFl

Related SW signals	I/O-unit	Signal description
TEMPAIR	DCU/M: X12:D10 (0V / signal +) X12:D8 (2.5mA / signal -)	Converter internal air temperature

Causes	Location	Item des.
1. Faulty temperature sensor	MCM	.7.51
2. Faulty cables between sensor and DCU/M	MCM	265/1-1,1-2,2-1,2-2,SC-2
3. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Check cabling between sensor and DCU/M
2. Connect a reference Pt-100 temperature sensor at MCM connector X12:D10, D8.  
Log signal TEMPAIR.  
If the signal shows ambient temperature the motor sensor is faulty. If the fault remains the DCU/M is faulty.

#### 4.125 0163 - Status high Heatsink temperature

Detected fault: High heatsink temperature.

Fault effect: Torque reduction  
Local signal: HCOTMM\_S\_Tp\_Hgh

Related SW signals	I/O-unit	Signal description
TEMPHS	DCU/M: X12:D14 (0V / signal +) X12:D12 (2.5mA / signal -)	Converter heat sink temperature

Causes	Location	Item des.
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1. See fault 0170(MCM).

#### Check/Inspect

1. See fault 0170(MCM).

### 4.126 0164 - Heatsink over/under temperature (M50/52)

Detected fault: Heatsink temperature is below min or above max permitted.

Fault effect: Soft shutdown  
High fault frequency will cause MCM isolation.

Local signal: HCOTMM\_B\_RqSfSd

Related SW signals	I/O-unit	Signal description
TEMPHS	DCU/M: X12:D14 (0V / signal +) X12:D12 (2.5mA / signal -)	Converter heat sink temperature

Causes	Location	Item des.
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1. See fault 0170(MCM).

#### Check/Inspect

1. See fault 0170(MCM).

### 4.127 0165 - motor over temperature (M45)

Detected fault: Overtemperature in at least one motor

Fault effect: Soft blocking  
High fault frequency will cause MCM isolation.

Local signal: MOTSMM\_B\_RqSfBc

Related SW signals	I/O-unit	Signal description
TEMPM1	DCU/M: X12:Z14 (0V) X12:B14 (signal +) X12:B12 (signal -) X12:Z12 (2.5mA)	Motor 1 temperature
TEMPM2	DCU/M: X12:Z10 (0V) X12:B10 (signal +) X12:B8 (signal -) X12:Z8 (2.5mA)	Motor 2 temperature
TEMPM3	DCU/M: X12:B20 (0V) X12:D20 (signal +) X12:D18 (signal -) X12:B18 (2.5mA)	Motor 3 temperature
TEMPM4	DCU/M: X12:B16 (0V) X12:D16 (signal +) X12:D14 (signal -) X12:B14 (2.5mA)	Motor 4 temperature

Causes	Location	Item des.
1. Traction motor cooling missing	N.A.	N.A.
2. Traction motor overload	N.A.	N.A.
3. Faulty traction motor.	See vehicle circuit diagram	N.A.
4. Faulty temperature sensor	See vehicle circuit diagram	N.A.
5. Faulty cables between sensor and DCU/M	See vehicle circuit diagram	N.A.
6. Faulty DCU/M	MCM	.1.21

#### Check/Inspect

1. Check the cooling of the Traction Motors.
2. Check if the unit has been running under abnormal conditions.
3. Check if only one of the motors has indicated high temperature and the temperature measurement of this motor is functional. This could indicate a faulty motor.
4. Check cabling between sensor and DCU/M
5. Connect a reference Pt-100 temperature sensor at MCM connector.  
Log signal motor temperature.  
If the signal shows ambient temperature the motor sensor is faulty. If the fault remains the DCU/M is faulty.

### 4.128 0166 - Motor 1 high temperature

Detected fault: High temperature in motor 1

Fault effect: Torque reduction

Local signal: MOTSMM\_S\_Mt1\_Hgh

Causes	Location	Item des.
1. See fault 0165 (MCM).		

#### Check/Inspect

1. See fault 0165 (MCM).

### 4.129 0167 - Motor 2 high temperature

Detected fault: High temperature in motor 2

Fault effect: Torque reduction

Local signal: MOTSMM\_S\_Mt2\_Hgh

Causes	Location	Item des.
1. See fault 0165 (MCM).		

#### Check/Inspect

1. See fault 0165 (MCM).

### 4.130 0168 - Motor 3 high temperature

Detected fault: High temperature in motor 3

Fault effect: Torque reduction



Local signal: MOTSMM\_S\_Mt3\_Hgh

Causes	Location	Item des.
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1. See fault 0165 (MCM).

#### Check/Inspect

1. See fault 0165 (MCM).

### 4.131 0169 - Motor 4 high temperature

Detected fault: High temperature in motor 4

Fault effect: Torque reduction

Local signal: MOTSMM\_S\_Mt4\_Hgh

Causes	Location	Item des.
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1. See fault 0165 (MCM).

#### Check/Inspect

1. See fault 0165 (MCM).

### 4.132 0170 - SfBc Heatsink over temperature (M51)

Detected fault: High heatsink temperature.

Fault effect: Soft blocking  
High fault frequency will cause MCM isolation.

Local signal: HCOTMM\_B\_RqSfBc

Related SW signals	I/O-unit	Signal description
TEMPHS	DCU/M: X12:D14 (0V / signal +) X12:D12 (2.5mA / signal -)	Converter heat sink temperature

Causes	Location	Item des.
1. High ambient temperature	N.A.	N.A.
2. Inlet and/or outlet for the converter module's external air is blocked	N.A.	N.A.
3. Dirty heat sink.	N.A.	N.A.
4. Missing 3-phase 400V to external fan.	See vehicle circuit diagram.	N.A.
5. Faulty external fan function.	Px Box	N.A.
6. Faulty internal fan	Px Box	.1.3.1
7. Faulty cables between internal fan and Power Supply Unit	MCM/Px Box	See circuit diagram
8. Faulty Supply Unit	MCM	.1.22
9. Overload	N.A.	N.A.
10. Faulty temperature measurement	N.A.	N.A.

#### Check/Inspect

1. Check the air inlet and outlet of the module. Clean air inlet and outlet if necessary.
2. Check the heat sink of the module. Clean the heat sink if necessary.
3. Check the 3-phase 400V supply.
4. See fault 0082 (MCM) regarding the external fan function.
5. Make sure that the internal fan is running and that it is rotating in the correct direction. (According to arrow.)
6. Check cables to internal fan.
7. Check that the Power Supply Unit supplies +/- 24VDC to the fan.
8. Check that the unit not has been running under abnormal conditions.
9. See fault 0161 (MCM) regarding the temperature measurement.

### 4.133 0171 - Internal Air over temperature

Detected fault: High heatsink temperature.

Fault effect: Soft blocking  
High fault frequency will cause MCM isolation.

Local signal: IAOTMM\_B\_RqSfBc

Causes	Location	Item des.
1. Faulty internal fan	Px Box	.1.3.1
2. Faulty cables between internal fan and Power Supply Unit	MCM/Px Box	See circuit diagram
3. Faulty Power Supply.	MCM	.1.22
4. Faulty temperature measurement	MCM	N.A.
5. Faulty external cooling	Px Box	N.A.

#### Check/Inspect

1. Check that the internal fan is rotating and rotating in the correct direction when the converter is supplied with battery voltage.
2. Check cables.
3. Check that the Power Supply unit supplies +/- 24VDC to the fan.
4. See fault 0162 (MCM) regarding the temperature measurement.
5. See fault 170 (MCM) regarding the external cooling.

### 4.134 0180 - Error in DX30

Detected fault: Hardware fault in the DX unit.

Fault effect: Protective shutdown

Local signal: CI\_E\_DX30

Causes	Location	Item des.
1. Faulty power supply to I/O unit	PH Box	N.A.
2. Faulty I/O unit	PH Box	DX30

#### Check/Inspect

1. Check power supply to I/O unit.
2. If no faults are found the DX unit is faulty.

### 4.135 0181 - Error in DX44

Detected fault: Hardware fault in the DX unit.

Fault effect: Protective shutdown

Local signal: CI\_E\_DX44

Causes	Location	Item des.
1. Faulty power supply to I/O unit	See vehicle circuit diagram	N.A.
2. Faulty I/O unit	See vehicle circuit diagram	DX44

Check/Inspect
1. Check power supply to I/O unit.
2. If no faults are found the DX unit is faulty.

#### 4.136 0182 - Hscb can not close

Detected fault: The HSCB does not close at order.

Fault effect: None

Local signal: HCV\_E04\_HscbNCI

Related SW signals	I/O-unit	Signal description
DX30_OUT1_S_HscbHd	DX30	Command: hold HSCB
DX30_IN1_S_HscbCd	DX30	Status: HSCB is closed
DX30_OUT2_S_HscbCd	DX30	Command: close HSCB

Causes	Location	Item des.
1. Faulty HSCB	PH Box	.5.4.1 (HSCB 1) .5.5.1 (HSCB 2)
2. Line trip chain is open outside PH Box.	See vehicle circuit diagram	N.A.
3. Line trip chain is open inside PH Box or PA Box (only HSCB 2).	PH Box	.1.1.2 (Charging contactor MCM PA Box) .1.1.1 (Separation contactor MCM PA Box) .1.1.2 (Charging contactor MCM PH Box) .1.1.1 (Separation contactor MCM PH Box) .5.2.2 (Emergency trip relay) .5.2.3 (Hold relay HSCB 1) .5.2.5 (Hold relay HSCB 2) .5.2.4 (Close relay HSCB 1) .5.2.6 (Close relay HSCB 2)
4. Faulty cabling between HSCB and DX unit.	PH Box	See circuit diagram
5. Faulty hold relay for HSCB.	PH Box	.5.2.2 (HSCB 1) .5.2.3 (HSCB 2)
6. Faulty close relay for HSCB.	PH Box	5.2.4 (HSCB 1) 5.2.6 (HSCB 2)
7. Faulty cabling between HSCB and DX unit.	PH Box	See circuit diagram
8. Faulty DX unit.	PH Box	.5.2.1 (HSCB 1) .5.2.2 (HSCB 2)

## Check/Inspect

1. Log related signals.  
Set HSCB close order from the drivers desk.  
Check if the HSCB closes.
  1. If it closes:
    - Check the cabling between the HSCB and the DX unit.
    - If the cabling is OK measure the voltage level at DX30:DI1. If the measured voltage is 110V DC and the signal is "0" the DX unit is faulty.
  2. If it does not close check the voltage on connectors:
    - U should be 110V DC
    - V should be 0V DC
    - If the voltages are as expected the HSCB is faulty.
    - If the voltages are not as expected the Line trip chain is open.
2. Set HSCB close order from the drivers desk.  
Check if the HSCB close relay closes momentarily.  
If it does not close:
  - Check that that close command is "1" and 110V DC is recieved at DX30:DO2 for a short time. If close command is "1" but no pulse is recieved at the DO, the DX unit is faulty.
  - Check cabling between the DX unit and the HSCB close relay.
3. Check the line trip chain outside the PH Box.
4. Check the line trip chain inside the PH Box (and PA Box if HSCB 2 is failing).
5. Set HSCB close order from the drivers desk.  
Check that the auxiliary contacts of hold relay for the HSCB closes.
6. Set HSCB close order from the drivers desk.  
Check that the auxiliary contacts of close relay for the HSCB closes.

### 4.137 0183 - Hscb can not open

Detected fault: The HSCB does not close at order.

Fault effect: Protective shutdown

Local signal: HCV\_E05\_HscbNOp

Related SW signals	I/O-unit	Signal description
DX30_OUT1_S_HscbHd	DX30	Command: hold HSCB
DX30_IN1_S_HscbCd	DX30	Status: HSCB is closed
DX30_OUT2_S_HscbCd	DX30	Command: close HSCB

Causes	Location	Item des.
1. Faulty (welded) HSCB	PH Box	.6
2. Line trip chain is faulty energized outside PH Box.	See vehicle circuit diagram	N.A.
3. Line trip chain is faulty energized inside PH Box.	PH Box	.1.1.2 (Charging contactor MCM PA Box) .1.1.1 (Separation contactor MCM PA Box) .1.1.2 (Charging contactor MCM PH Box) .1.1.1 (Separation contactor MCM PH Box) .5.2.2 (Emergency trip relay) .5.2.3 (Hold relay HSCB 1) .5.2.5 (Hold relay HSCB 2) .5.2.4 (Close relay HSCB 1) .5.2.6 (Close relay HSCB 2)
4. Faulty cabling between HSCB and DX unit.	PH Box	See circuit diagram
5. Faulty DX unit.	PH Box	.5.2.1 (HSCB 1) .5.2.2 (HSCB 2)

#### Check/Inspect

- Log related signals.  
Check if the HSCB is closed.
  - If it is not closed:
    - Check the cabling between the HSCB and the DX unit.
    - If the cabling is OK measure the voltage level at DX30:DI5. If the measured voltage is 0V DC and the signal is "1" the DX unit is faulty.
  - If it is not closed check the voltage on connectors:
    - U should be 0V DC
    - V should be 0V DC
    - If the voltages are as expected the HSCB is faulty (welded).
    - If the voltages are not as expected the Line trip chain is faulty energized.
- Check the line trip chain inside the PH Box (and PA Box if HSCB 2 is failing).
- Check the line trip chain outside the PH Box.

### 4.138 0184 - Hscb open without order

Detected fault: The HSCB has opened without order.





Causes	Location	Item des.
1. Faulty setting of or tripped fan motor protection breaker.	PH Box PA Box	.1.4.4
2. Faulty contactor.	PH Box PA Box	.1.4.5
3. Faulty cos-phi relay	PH Box PA Box	.1.4.3
4. Faulty control or feedback cables.	PH Box PA Box	See circuit diagram
5. Faulty voltage supply to DCU/M IO-module.	MCM	N.A.
6. Faulty DCU/M	MCM	.1.21
7. Faulty brake resistor fan 400V 3-phase cables	See vehicle circuit diagram.	N.A.
8. Faulty brake resistor fan	See vehicle circuit diagram	N.A.

Check/Inspect
1. Check setting of fan motor protection breaker or reset it if it has tripped.
2. Perform digital output test according to routine test instruction without 400V present and check that: - the DCU generator control voltage on D06. - that the fan contactor closes.
3. Perform digital output test according to routine test instruction with 400V present and check that: - the fan rotates correctly - cos phi relay closes
4. Check cabling.
5. If no faults can be found and the protection breaker trips again the fan or protection breaker might be faulty.

#### 4.140 0186 - Front Hatch not closed

Detected fault: The front hatch is indicated to be open.

Fault effect: Protective shutdown if speed > 5km/h

Local signal: S\_FtHaNotCd

Related SW signals	I/O-unit	Signal description
DX30_IN6_S_FtHaCd	DX30	Front hatch closed

Causes	Location	Item des.
1. Front hatch not closed	PH Box	N.A.
2. Faulty cabling	PH Box	See circuit diagram

#### Check/Inspect

1. If front hatch is closed and event is still set, check cabling.

### 4.141 0187 - Line voltage relay fault

Detected fault: Line voltage is not indicated from line voltage relay even if DCU/M is indicating DC link voltage.

Fault effect: None

Local signal: S\_LnVRIF1

Related SW signals	I/O-unit	Signal description
DX30_IN2_S_LnOk	DX30	Line voltage is detected

Causes	Location	Item des.
1. Faulty line voltage relay or faulty setting of line voltage relay.	PH Box	.5.6.1
2. Faulty voltage dividing resistor.	PH Box	.5.6.2 .5.6.3
3. Faulty cabling between line voltage relay and DX unit.	PH Box	See circuit diagram
4. Faulty cabling between line voltage input and line voltage relay.	PH Box	See circuit diagram
5. Faulty DX unit.	PH Box	5.2.1 (For MCM in PH Box) 5.2.2 (For MCM in PX Box)

#### Check/Inspect

1. Check the settings of line voltage relay.
2. Check that the upper LED of the relay indicates that 110V DC is supplied to the relay. If not the relay is faulty.
3. Check the cabling between line voltage relay and DX unit.
4. Measure the resistance of the resistors.
5. Check cabling between DC+ /DC- and line voltage relay.
6. Log signal:  
DX30\_IN2\_S\_LnOk  
Connect 110V DC to DI2 of the DX unit, if the signal is "0" the DX unit is faulty.
7. Log signal:  
DX30\_IN2\_S\_LnOk  
If the signal is "0" and line voltage is supplied the line voltage relay is faulty.

#### 4.142 0188 - MCM in operation and no 3-Phase voltage

Detected fault: The MCM is in operation but the ACM is not in operation.

Fault effect: None

Local signal: APSIMM\_S\_McmInOpandNo3ph

Causes	Location	Item des.
1. ACM has stopped running.	N.A.	N.A.

#### Check/Inspect

1. See related fault.

#### 4.143 0189 - Backup mode active

Detected fault: The propulsion system is in backup mode.

Fault effect: None

Local signal: DX44\_IN1\_C\_BpMo

Causes	Location	Item des.
1. Backup mode has been requested by the driver.	N.A.	N.A.

#### Check/Inspect

1. See related fault.

#### 4.144 0190 - DX30 communication error

Detected fault: Failure or disturbance in MVB communication

Fault effect: Protective shutdown

Local signal: CI\_E\_DX30com

Causes	Location	Item des.
1. Faulty MVB communication	N.A.	N.A.
2. Faulty DX unit addressing	PH Box	N.A.
3. Faulty power supply to DX unit	PH Box	N.A.
4. Faulty DX unit	PH Box	5.2.1 (For MCM in PH Box) 5.2.2 (For MCM in PX Box)

##### Check/Inspect

1. Check power supply to I/O unit.
2. Check MVB cables and connections.
3. Check I/O unit device address.
4. If no faults are found the I/O unit is faulty.

#### 4.145 0191 - DX44 communication error

Detected fault: Failure or disturbance in MVB communication

Fault effect: Protective shutdown

Local signal: CI\_E\_DX44com

Causes	Location	Item des.
1. Faulty MVB communication	N.A.	N.A.
2. Faulty DX unit addressing	N.A.	N.A.
3. Faulty power supply to DX unit	N.A.	N.A.
4. Faulty DX unit	N.A.	DX44

##### Check/Inspect

1. Check power supply to I/O unit.
2. Check MVB cables and connections.
3. Check I/O unit device address.
4. If no faults are found the I/O unit is faulty.

#### 4.146 0192 - Emergency braking active

Detected fault: Emergency braking is active.

Fault effect: None

Local signal: IUCLMM\_S\_EmBr

Causes	Location	Item des.
1. Indication only.	N.A.	N.A.

#### Check/Inspect

1. N.A.

#### 4.147 0193 - Possible locked rotor of motor 1

Detected fault: The rotor of motor 1 is indicated to be locked.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation Running the vehicle may cause damage to the drive system.

Local signal: MFPRMM\_S\_Rx1Lkd

Causes	Location	Item des.
1. The deviation between measured and estimated motor current is too high and no signal from the speed sensor.	N.A.	N.A.

#### Check/Inspect

1. N.A.

#### 4.148 0194 - Possible locked rotor of motor 2

Detected fault: The rotor of motor 2 is indicated to be locked.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation Running the vehicle may cause damage to the drive system.

Local signal: MFPRMM\_S\_Rx2Lkd

Causes	Location	Item des.
1. The deviation between measured and estimated motor current is too high and no signal from the speed sensor.	N.A.	N.A.

#### Check/Inspect

1. N.A.

### 4.149 0195 - Possible locked rotor of motor 3

Detected fault: The rotor of motor 2 is indicated to be locked.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation Running the vehicle may cause damage to the drive system.

Local signal: MFPRMM\_S\_Rx3Lkd

Causes	Location	Item des.
1. The deviation between measured and estimated motor current is too high and no signal from the speed sensor.	N.A.	N.A.

#### Check/Inspect

1. N.A.

### 4.150 0196 - Possible locked rotor of motor 4

Detected fault: The rotor of motor 2 is indicated to be locked.

Fault effect: Protective blocking  
High fault frequency will cause MCM isolation Running the vehicle may cause damage to the drive system.

Local signal: MFPRMM\_S\_Rx4Lkd

Causes	Location	Item des.
1. The deviation between measured and estimated motor current is too high and no signal from the speed sensor.	N.A.	N.A.

#### Check/Inspect

1. N.A.