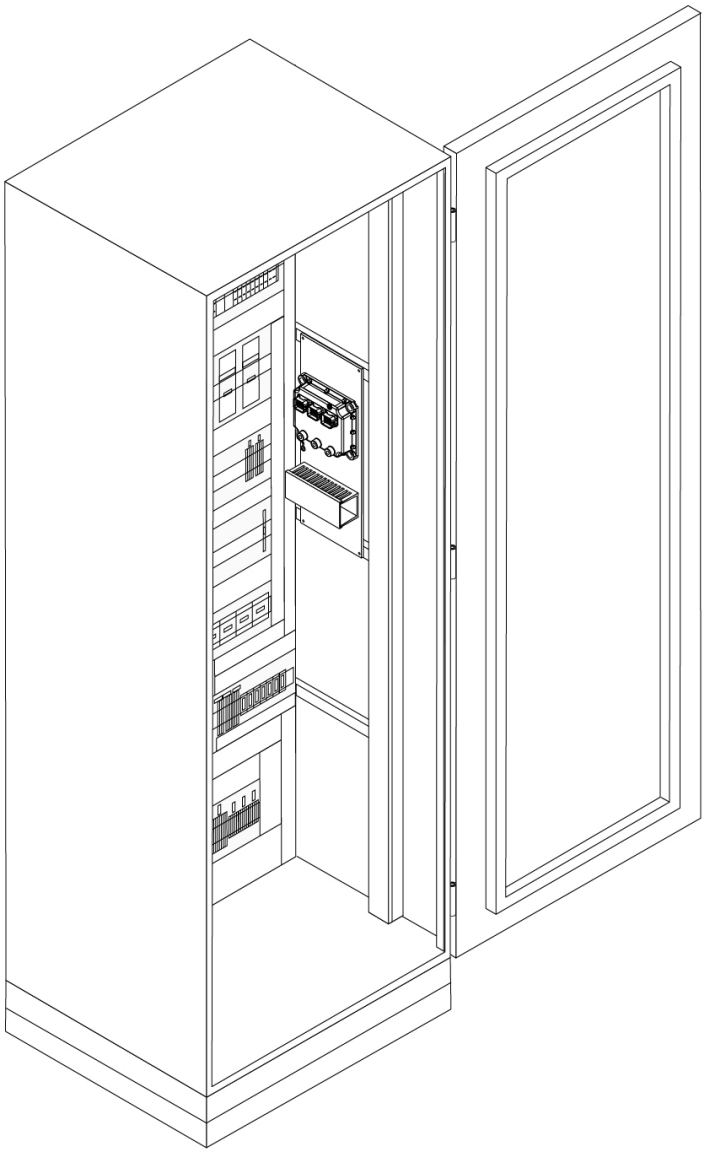
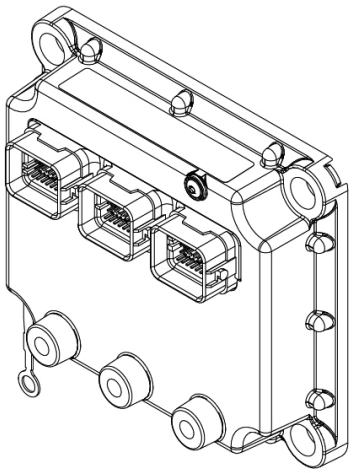
Product Link Elite (PLE) Retrofit Kit

Operating manual
12524292 for TPEM EN
Valid from Release 1.7.1
2024-09
Competence level CL 2





This document is a part of the operating manual in accordance with Machinery Directive 2006/42/EC.
This is a translation of the German original. All translations are based on the German original.

Technical modifications required to improve our products are reserved with regard to specification data and other technical information contained in the document. No parts of this document may be reproduced in any form or by any means without the written approval of the manufacturer.

The document contains information that is necessary for maintenance and repair work on the product. When carrying out the work listed in the maintenance schedule, only original parts or parts and operating media approved by the manufacturer may be used.

Masthead:
Caterpillar Energy Solutions GmbH
Servicedokumentation
Carl-Benz-Str. 1
68167 Mannheim
Germany
+49 621 384 0
+49 621 384 8800
www.caterpillar-energy-solutions.de

Table of contents

1 Information about this manual

Table of contents

1.1 Introduction

1.1.1 Target group

The document is aimed at authorized specialist personnel with the competence level 2 (CL2). Only authorized specialist personnel may perform the described activities.

1.1.2 Validity

The document is drafted in German. In other languages, the document is a translation of the original manual.

1.1.3 Handling

The notes and descriptions given in the document enable safe and efficient handling of the product. Observe and comply with all warnings, safety notes and instructions for handling in order to work safely on the product.

In the document, illustrations assist in basic understanding and may deviate from the actual design.

1.1.4 Operator obligations

The operator must observe and ensure the following points so that the product functions without impairment:

- Have all activities on the product performed in accordance with the applicable standards and specifications
- Determine the responsibilities for operation, servicing and troubleshooting
- Inform the authorized specialist personnel of possible dangers that may arise from handling the product
- Ensure that the authorized specialist personnel have read and understood the operating manual

1.1.5 Symbols used

Symbols are used in this document so that the authorized specialist personnel can quickly recognize issues and clearly categorize them. Warnings are marked with symbols.

1.1.6 Conventions of terminology

Asset: this document uses the term asset to refer to a telematics-capable industrial power generation plant with a genset as the central assembly. In this context, a genset consists of a base frame with a gas engine, coupling, generator and switch cabinet for the control. Since various programs and portals use the term asset, this term is preferred and supplemented with genset in parentheses: asset (genset).

RAM: the application CAT Remote Asset Monitoring (RAM) along with its systems and components for online communication with an asset (genset) is simply called RAM.

Product Link: the comprehensive telematics hardware TPEM Product Link™ is simply called Product Link.

Network Manager: the device CAT® Product Link™ Elite (PLE) of the type PLE702 Network Manager is simply called Network Manager.

Cellphone radio: the device CAT® Product Link™ Elite (PLE) of the type PL243 mobile is simply called cellphone radio.

TPEM system: The Total Plant and Energy Management (TPEM) control system for the asset (genset) is simply called TPEM system.

Cable: the term cable is used for all cable-like electrical connections, regardless of where they are installed (underground or above ground).

For further information on the system layout and the terms, see chapter 4 Structure and function 31.

1.2 Legal notes

1.2.1 Limitations of liability

In this document, all information and notes have been compiled taking the relevant standards and specifications for the product and the state of the art technology into account.

The manufacturer assumes no liability for damage resulting from the following causes:

- Non-observance of the operating manual
- Non-intended use
- Deployment of unauthorized specialist personnel
- Unauthorized conversions
- Technical alterations
- Use of unapproved spare parts or attachments
- Use of unapproved operating media

The actual scope of delivery may differ under the following conditions:

- Special versions
- Utilization of additional order options
- Due to the latest technical modifications

The regulations apply in the following order:

1. Obligations agreed in the delivery agreement
2. Terms and conditions of the manufacturer for the sales and delivery of new engines, new plants and original parts in the current version
3. Legal provisions valid when the contract was concluded

The right for the manufacturer to undertake technical alterations to improve the performance characteristics and further development is reserved.

1.2.2 Copyright

1.3 Feedback on documentation

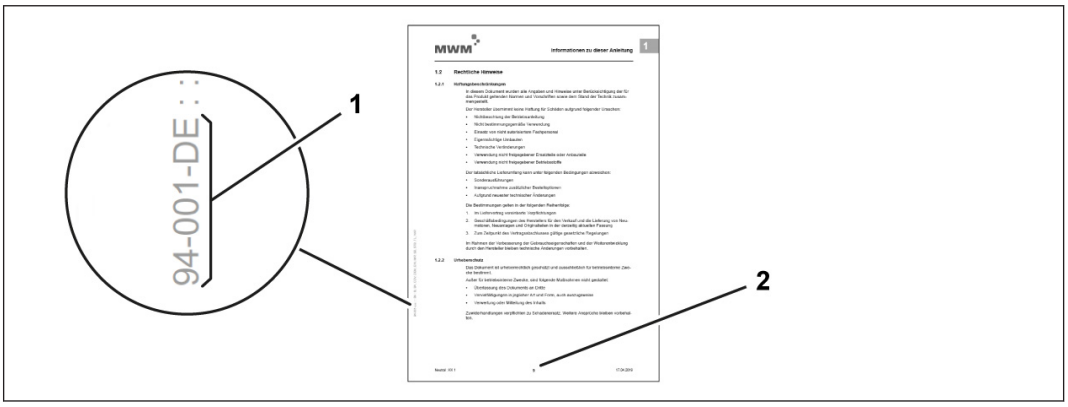
Do you have any praise, criticism or suggestions for improvement for this document?

Send an e-mail to techred@mwm.net.

Describe your request as precisely as possible.

So that we can allocate your feedback, please also provide the following information:

- Document number (1)
- Page number (2)
- Contact data (name, email) for potential further enquiries



72239-002

Thank you for your support. We read all feedback carefully.

We look forward to hearing from you!

2 Safety

Table of contents

2.1 Safety regulations

Observe the applicable safety regulations for operation, maintenance and servicing. Observe and comply with all instructions for handling and safety notes given in this document. Otherwise, substantial hazards may arise.

The product is used in the commercial sector. The operator is subject to the legal obligations for health and safety at work.

The operator must comply with the following for the product's and overall plant's area of application:

- Safety notes in this document
- Safety regulations
- Accident prevention regulations
- Environmental protection specifications
- General rules on health and safety at work
- Risk assessment of the operator
- Directives and ordinances on operational safety

Directives, ordinances and regulations are available from trade associations or specialist dealers.

For necessary information on the safety regulations, see

- Operating Manual ⇒ General ⇒ Safety regulations
  - Safety and Product Information Specification

2.2 Intended use

The Network Manager and its accessories are hardware components to be installed in an asset (genset) from the manufacturer: Caterpillar Energy Solutions GmbH. The Network Manager is only suitable for a control system of the type TPEM with the appropriate hardware and operating system. Older TPEM systems must be converted. For further information on the technical requirements, see chapter 3.1.1 System requirements 20.

The main task of the Network Manager is to collect and exchange data via an online connection of the TPEM system to a global RAM application. The online connection is preferably established via a local area network (LAN) of the operator with an internet connection. If this option is not viable, a connection can be established via mobile radio using the optional cellphone radio (accessory).

RAM applications offer operators, dealers/service partners and the manufacturer different online services, for example remote monitoring of telematics data. The manufacturer specifies the type, scope and destination of the telematics data to be transmitted. Extensions are possible upon agreement and after technical inspection.

Operation of the Network Manager and its accessories is allowed only when the following requirements are met:

- Fully functional and maintained device
- Mobile connection with GPS functionality through the optional cellphone radio, if necessary
- Use in accordance with technical specifications and technical data
- Proper electrical and electronic connection
- Configuration and parameterization according to the operating site
- Suitable network and appropriate IT security measures
- Use of the recorded data in accordance with the regional specifications for data protection

Any other use of the Network Manager and its accessories beyond the intended use of the TPEM system and beyond the purpose of RAM and Product Link is not permitted. The operator is liable for any damage resulting from such improper use.

2.3 Work on the product; Operation

All work done on the product (assembly, commissioning, troubleshooting, maintenance and dismantling) must be carried out by an authorized and qualified specialist (in the area of electrical engineering, additionally trained for SCR systems). Relevant regional safety regulations and environmental regulations must be observed. The product must be integrated into the overall system in accordance with the manufacturer's technical specifications and existing technical rules.

The following general information always applies. These must be supplemented in accordance with the regional specifications, recognized technical rules, job assignment and situation on site.

- If a problem occurs, do not open the product. Instead, contact the responsible dealer or service partner
- If the product has an unusual odor or makes unusual noises, disconnect the product from the mains immediately. Contact the responsible dealer or service partner
- Keep the product away from liquids
- Disconnect the product from the mains before any maintenance work

2.4 Emissions

The Network Manager sends out radio signals in conjunction with the cellphone radio (optional). These can cause interference with other electronic components and medical devices.

The operator must carry out their own assessment of the suitability of the mobile device in accordance with the technical data and regional regulations, as they know the specific operating conditions on site.

Since the Network Manager can be used universally with the cellphone radio, an adhesive label for the cellphone radio's use in vehicles is included in its scope of delivery. This warning is primarily for malfunctions in mining applications, in order to avoid operation of the mobile device with its electromagnetic radiation near highly sensitive blasting equipment. This will not be the case with the standard use of the assets (gensets) described in this document.

74939-001 Adhesive label for cellphone radio (optional)

If there is any doubt about the suitability of the cellphone radio for the local situation, the connection cable between the Network Manager and the cellphone radio must be disconnected or remain disconnected at the plug-in connection.

To avoid interactions with the human body or medical devices, the cellphone radio must be installed at a sufficient distance from the relevant personnel. Even during assembly and commissioning, a switched-on cellphone radio must not come too close to the human body.

The minimum distances to be observed vary according to regional regulations. These do not apply unconditionally, but must be adapted to the personnel concerned. At the time of this document's creation, for example, a distance of 20 cm or more fulfilled the requirements of the Federal Communications Commission (FCC) regulation.

For necessary information on the interactions and required minimum distances, see

- Responsible dealer or service partner and responsible doctor

2.5 Batteries and accumulators

The mobile device contains lithium batteries. These are not serviceable.

An exploding battery can cause injuries. There is especially a risk with batteries of the wrong type.

Only change batteries with personal protective equipment (face protection, gloves) and be careful when doing so.

Never throw batteries into fire. The battery can explode and release caustic chemicals.

Dispose of used batteries in accordance with local regulations.

3 Technical data and rating plates

Table of contents

3.1 Network Manager

3.1.1 System requirements

Description	Value
Available control system	TPEM system
TPEM hardware	from Release 1.2 b
TPEM software	from Release 1.7

3.1.2 Ambient conditions

Description	Value
Installation site	Interior, fixed location
Height above sea level	max. 6000 m
Operating temperature	–40 °C to 85 °C
Vibrations	9.8 ^{g}rms

3.1.3 Integrated safety

Description	Value
Protection class	IP 68

3.1.4 Power supply and connections

Description	Value
Power supply	9 V_{DC} to 32 V_{DC}
Protection	Reverse polarity protection
Jump start	32 V_{DC} to 48 V_{DC}
Connections	Three 44-pin connections for: • Power supply • Communication systems • Cellphone radio (optional) Equipotential bonding
Cable lengths	Use the provided connecting cables

3.1.5 Approvals and guidelines

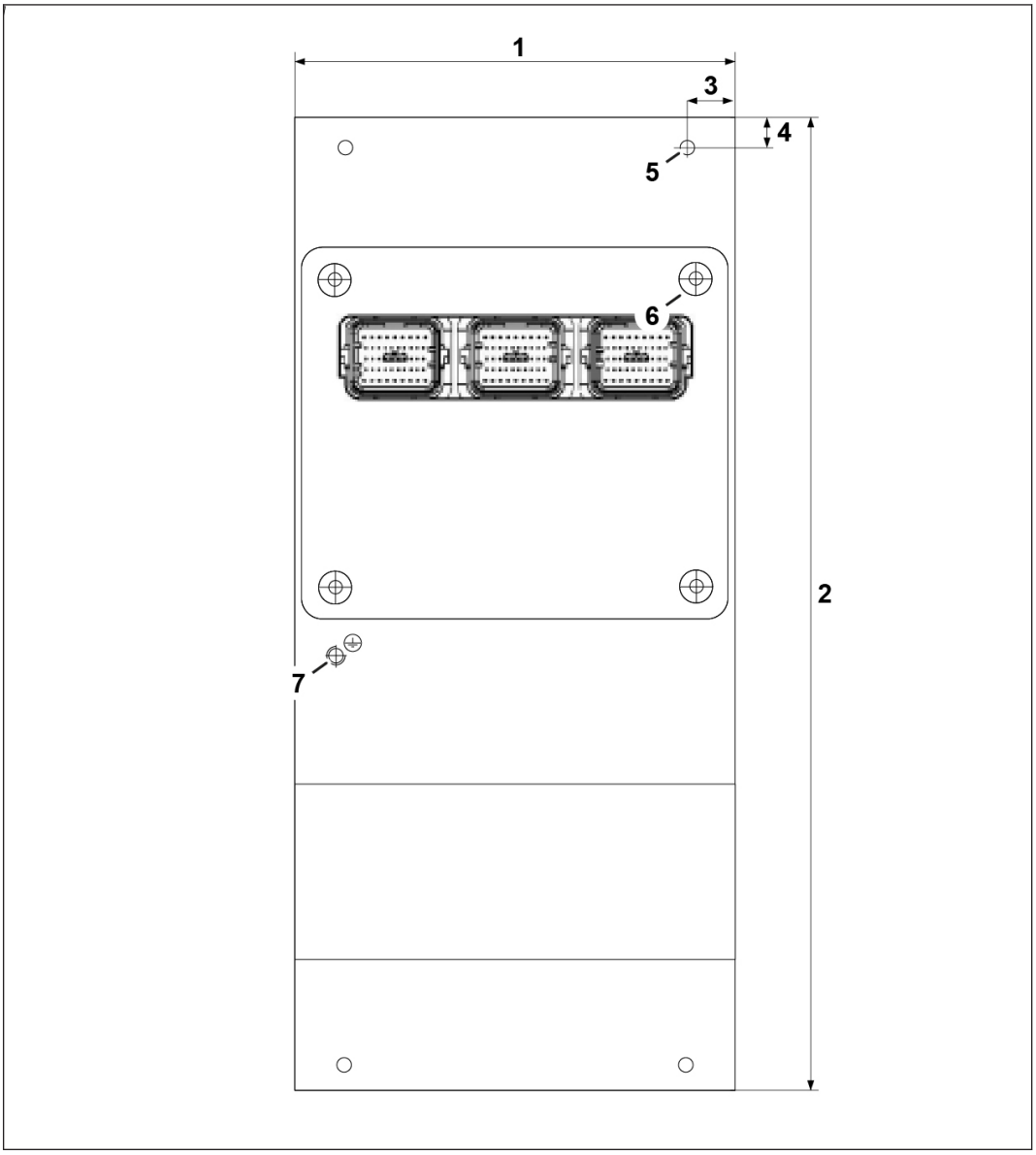
Description	Value
Certifications[1]	• Restriction of Hazardous Substances (RoHS) • Waste of Electrical and Electronic Equipment (WEEE) • Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) • UL Information Technology Equipment - Safety - Part 1: General Requirements (UL 60950-1) • Federal Communications Commission (FCC): Part 15 • European Union (CE) • Industry Canada (IC) • Australia (ACMA) • Eurasian Economic Union (EAC) • Pending Marine (DNV/GL, BV, LR, ABS, RINA, CCS, RS) • CSA / ATEX certifiable

[1] For current information, see labeling on the device or contact the responsible dealer or service partner

3.1.6 Housing

Description	Value
Type	Aluminum (Network Manager)
Dimensions (W × H × D)	194.5 × 169.6 × 63.1 mm (Network Manager) 200 × 445 × 3 mm (mounting plate)
Fastening	4× 15.3 mm (Network Manager)
Weight	1.125 kg (Network Manager)

3.1.7 Mounting plate



74166-001

1 Width: 200 mm

2 Height: 445 mm

3 Fastening hole, right and left: 25 mm

4 Fastening hole, top and bottom: 10 mm

5 Mounting plate fastening: 4 bores D = 6 mm

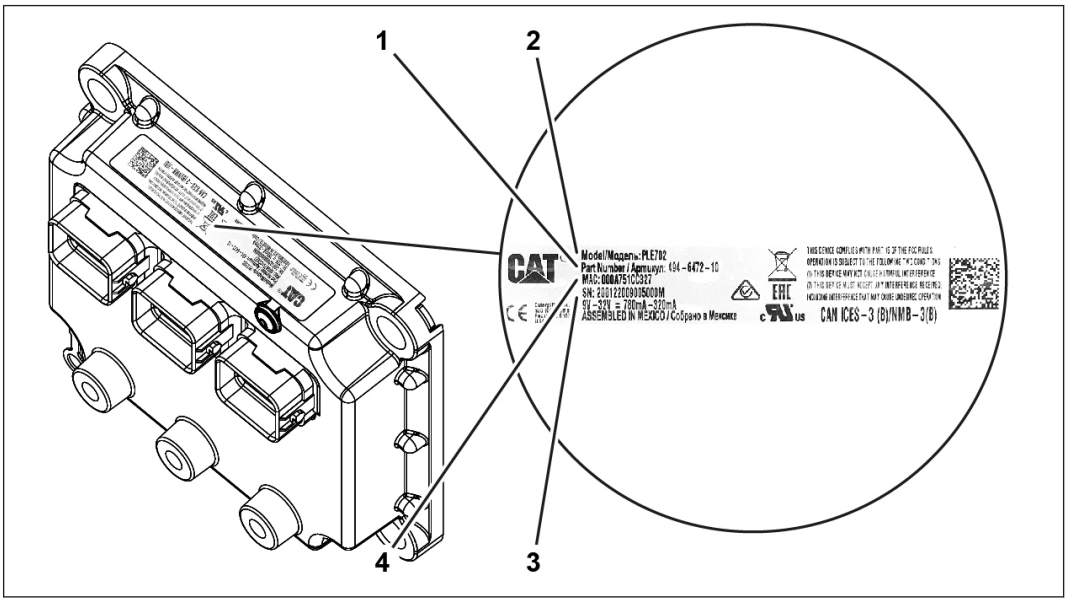
6 Network Manager fastening: 4× M6 for elastic fastening set. When the Network Manager is replaced, the elastic fastening provided must be used. Tightening torque: 12 Nm

7 Equipotential bonding connection (PE): M8

3.1.8 Rating plate

The rating plate is on the top. The information must be observed.

The information presented is important should you have questions for the manufacturer.



74167-001

1 Part number

2 Device type (model)

3 MAC address (MAC)

4 Serial number (SN)

3.2 Cellphone radio (optional)

3.2.1 Ambient conditions

Description	Value
Installation site	Outdoors possible, no direct sunlight; horizontal, fixed location
Height above sea level	max. 6000 m (TPEM CC)
Operating temperature	−40 °C to 70 °C, to 85 °C reduced power
Vibrations	4.41 ^{g}rms

3.2.2 Integrated safety

Description	Value
Protection class	IP 66

3.2.3 Power supply and connections

Description	Value
Power supply	9 VDC to 32 VDC
Protection	Reverse polarity protection
Jump start	32 VDC to 48 VDC
Non-destructive voltage range	−32 VDC to 180 VDC
Internal battery	Voltage: 3.6 VDC Type: rechargeable, NiMH Capacity: 500 mAh
External battery connection for backup (only if required)	9 to 14.5 VDC
Connections	Power supply • Mains • External battery (only if required) Communication • Ethernet
Cable lengths	Use the provided connecting cable Ethernet connecting cable maximum 90 m

3.2.4 Interfaces of communication systems

Ethernet

Description	Value
Ethernet socket	4-wire IEEE 802.3 Full-duplex for 10 & 100 Mb/s
Autonegotiation	10 Mb/s

3.2.5 Radio connection

Description	Value
Radio standard	Quad-band GSM
4G LTE Cat 1	1, 2, 3, 4, 5, 7, 8, 12 (17), 18, 19, 20, 28
3G	1, 2, 4, 5, 8, 9, 19
2G	Quad-bands – 850 / 900 / 1800 / 1900 MHz
Transmission power	0.5 W normally; 2 W maximum
Antenna	Internal

3.2.6 Position determination

Description	Value
Receiver	GPS / QZSS / GLONASS
Tracking channels	50
Update	≤1 Hz
Accuracy	< 5 m with 95 % certainty
Sensitivity	−162 dBm tracking
Antenna	Internal

3.2.7 Approvals

Description	Value
Certifications[1]	• Federal Communications Commission (FCC): Parts 15, 22, 24 and 27 • Industry Canada (IC) • European Union (CE) • Restriction of Hazardous Substances (RoHS) • Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) • Information technology equipment - Safety - Part 1: General requirements (IEC 60950-1)

[1] For current information, see labeling on the device or contact the responsible dealer or service partner

3.2.8 Housing

Description	Value
Type	UV stabilized polycarbonate (PC), flame-retardant
Dimensions (W × H × D)	205 × 30 × 100 mm
Fastening	Self-adhesive
Weight	0.65 kg
LEDs	Orange: GNSS Yellow: radio connection Blue: Ethernet

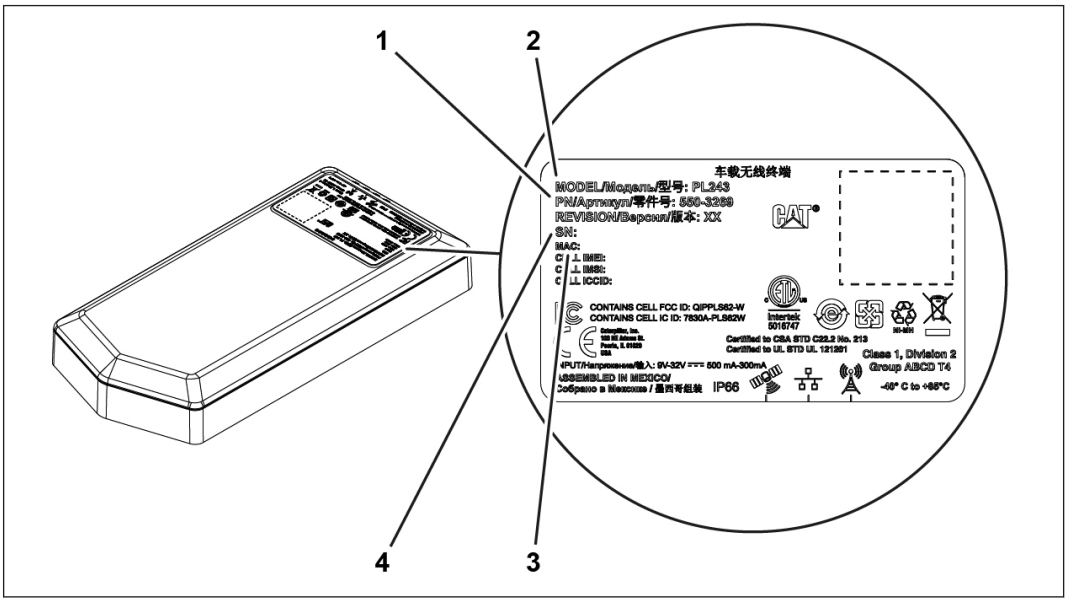
3.2.9 Other data

Description	Value
Real-time clock	Battery-backed Accuracy: ≤ ±3 s/day
Genset running	Voltage range of input signal: −1 to +32 V Frequency range of input: DC to 10000 Hz

3.2.10 Rating plate

The rating plate is on the top. The information must be observed. Further information can be found on the adhesive label on the underside.

For questions for the manufacturer, the information presented is important.



74168-001

1 Part number

2 Device type (model)

3 MAC address (MAC)

4 Serial number (SN)

3.3 Network administration of operator network

For communication, different ports must be enabled for the individual applications in the operator's network. Depending on the network, these must be parameterized manually by the network administrator.

All connections are outbound connections.

Main server IP

Currently:

- Target 104.214.119.85
  - via TCP port 443
  - via TCP port 5012

In the future:

- Target 18.216.73.179
  - via TCP port 443
  - via TCP port 5012
  - via UDP port 123 (NTP)

Backup server IP

This server is the redundancy of the main server.

Currently:

- Target 23.96.237.118
  - via TCP port 443
  - via TCP port 5012

In the future:

- Target 18.219.80.244
  - via TCP port 443
  - via TCP port 5012
  - via UDP port 123 (NTP)

RAM server

This connection is actively used only when RAM is enabled on the Network Manager and is sending data.

Currently:

- Target 66.22.7.61
  - via TCP port 443

Previously:

- Target 165.26.255.37

DNS resolution

This connection is actively used only when RAM is enabled on the Network Manager and is sending data.

If necessary, the DNS service from Google can be used. Otherwise, an internal DNS server must be used.

- Target 8.8.8.8
  - via TCP port 53
  - via UDP port 53
- Target 8.8.4.4
  - via TCP port 53
  - via UDP port 53

3.4 TPEM system network information

3.4.1 Service computer

Service computer IP

- Static IP address: 165.26.78.2
- Subnet mask: 255.255.254.0

3.4.2 Network Manager

Port 10 Modbus and WAN port

- IP address: 10.0.0.66
- Subnet mask: 255.255.255.240

3.4.3 Cellphone radio

Port 7 Radio Module

- MAC address: see rating plate
- Subnet mask: see rating plate

Port 10 Modbus

- IP address: 10.0.0.66
- Subnet mask: 255.255.255.240

3.4.4 TPEM IPC

The Modbus is enabled for communication with the IP address 10.0.0.66 via port TCP/502.

3.4.5 TPEM RPG

- WAN/Modbus GateWay: br1
- IPv4 address: 10.0.0.65
- Subnet mask: 255.255.255.240

4 Structure and function

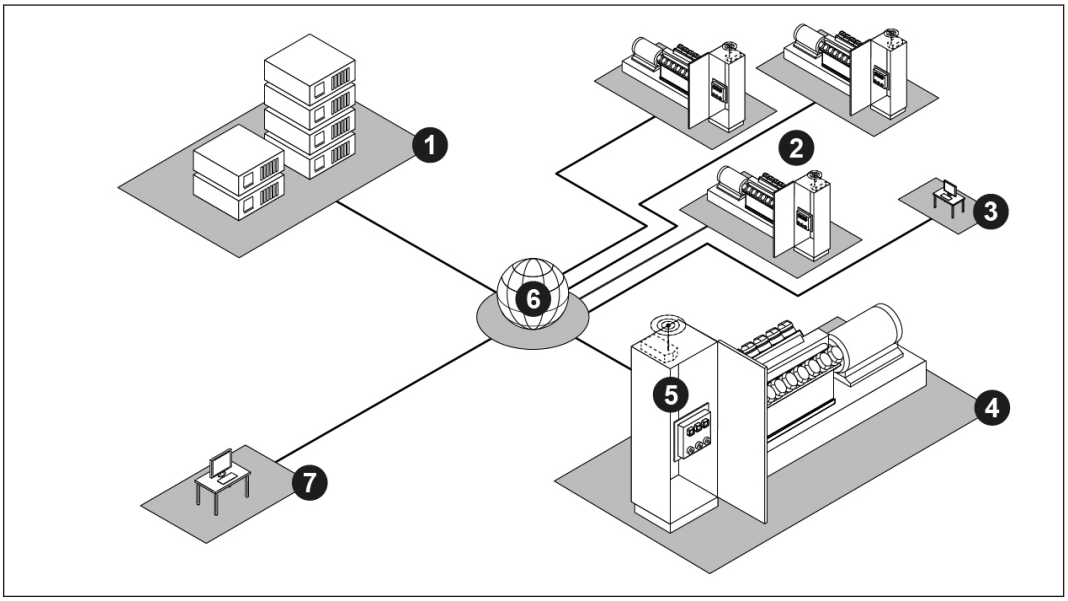
Table of contents

4.1 Remote Asset Monitoring (RAM) for CES products

4.1.1 Technology and Services

Caterpillar Energy Solutions GmbH provides **RAM** as a complete system. RAM includes various technologies and services for optimized use and remote monitoring of assets (gensets). To do this, RAM networks the local assets (gensets) with the RAM infrastructure (servers and databases) via the internet.

The RAM hardware components installed in an asset (genset) read out appropriate electronic telematics data from the control systems in real time and transmit it to the RAM infrastructure with the RAM servers and RAM applications. They process the telematics data and provide visualized online access via monitoring tools.



74924-001 Simplified structure for Remote Asset Monitoring (RAM) of assets (gensets)

1 RAM infrastructure with servers, databases, and applications

2 Multiple assets (gensets) or operators for which one service partner is responsible

3 Remote access by the service partner via RAM applications

4 Individual asset of an operator

5 Product Link hardware for online access

6 Data exchange via the internet

7 Remote access by the operator via RAM applications

Technology

RAM provides the necessary technology for the global online connection of an asset (genset). Installing and configuring the corresponding hardware components of **Product Link** makes an asset (genset) quickly available for online access.

As part of Product Link, the **Network Manager** is integrated into the control for connection to RAM, thereby accessing relevant telematics data. Here, the term telematics data refers to electronically accessible operating data of the asset (genset) that is exchanged via suitable systems such as Modbus or CAN bus.

At the same time, regular data exchange takes place within the RAM infrastructure via the Network Manager, through which, e.g., the telematics data is processed and visually displayed for the user or the device firmware is updated.

Services

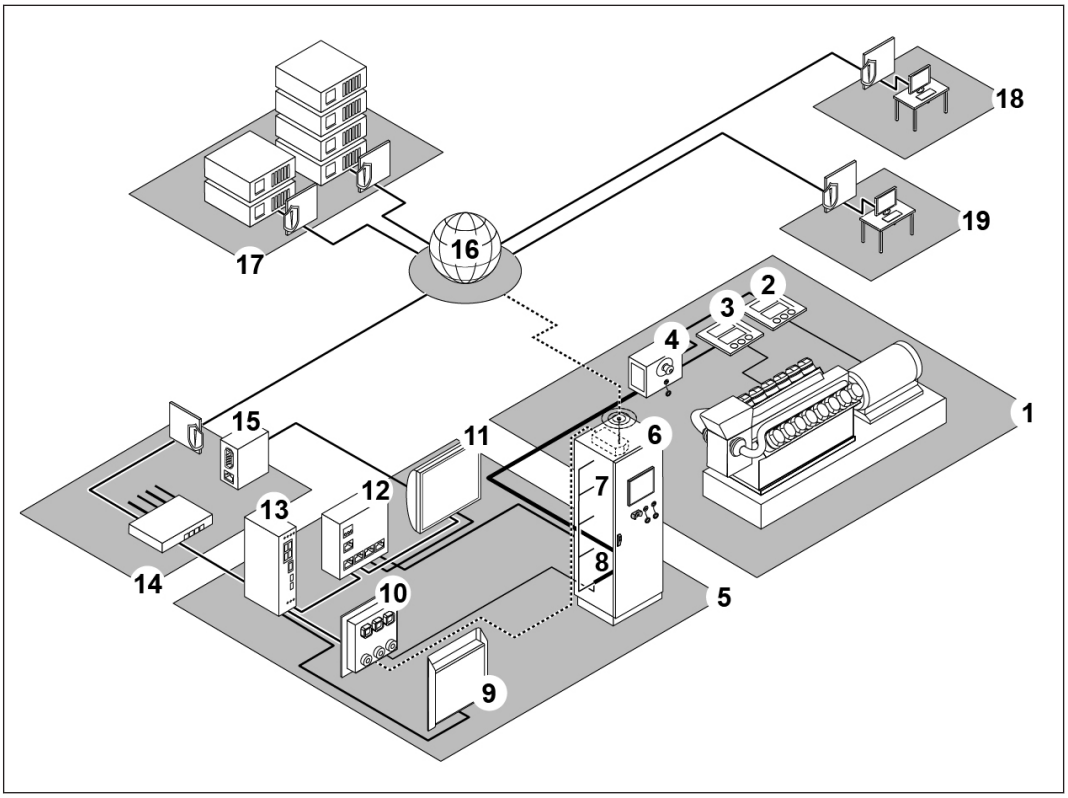
Central processing of telematics data with intelligent monitoring technology within the RAM infrastructure makes various user-related scenarios possible. These range from general visualization of operating data for the user to targeted monitoring of components and situation-specific maintenance by the dealers or service partners.

4.1.2 RAM product family

RAM Overall system with respective technologies and services Allows remote monitoring of a compatible asset (genset) by exchanging, evaluating, and visualizing data		
⇩	⇩	⇩
RAM infrastructure	**Product Link hardware**	**Software or portals**
Provides the technology for processing telematics data and enables scalable monitoring services for users	**Product Link Elite (PLE)** Caterpillar telematics hardware that reads telematics data from the asset (genset) and transmits it via a network to a RAM application in real time ⇨ **Network Manager**: Router on the machine that records and stores machine data and sends it to the RAM server via an internet connection (WAN) ⇨ **Cellphone radio** (optional): Modem with GPS functionality that sends Network Manager data to the RAM infrastructure via mobile radio	**Product Link Web** Web portal with general information on the management of an asset (genset) with Product Link **RAM user interface or RAM website or ram.cat.com** Web portal for visualization of the telematics data provided by the RAM infrastructure and management of all assets (gensets) **Dealer Service Portal** Web portal for dealers and service partners for monitoring and administering customer assets (gensets)

4.2 RAM and TPEM system

The TPEM system is connected to RAM via the Network Manager (10) in the switch cabinet TPEM Control Cabinet (TPEM CC) (5) and its networking with the various electronic systems or components (9, 11-13). Depending on the situation, data exchange with RAM is done via connection to the local LAN (14) or via the optional TPEM PLE cellphone radio (6).



74649-001

1 Asset (genset)
2 Generator controller
3 TPEM Control Unit (TPEM CU)
4 TPEM Connection Box (TPEM CB)
5 TPEM Control Cabinet (TPEM CC), important installations are shown on the left
6 TPEM PLE cellphone radio (optional)
7 TPEM Modbus connection
8 TPEM CAN bus connection
9 TPEM Multifunction Relay (TPEM MFR)
10 TPEM PLE Network Manager
11 TPEM Touch Panel (TPEM TP) with operating computer
12 TPEM Switch
13 TPEM Remote Plant Gateway (TPEM RPG)
14 Operator-side network with firewall and internet connection
15 Operator-side Modbus connection
16 Wide Area Network (WAN)

17 RAM infrastructure with firewall and internet connection

18 RAM access for the service partner

19 RAM access for the operator

(1) Asset (genset)

An asset (genset) consists of a genset with a base frame, gas engine, generator and the installed or mounted sensors, actuators, controls/controllers. The exchange of signals between the various electronic components and systems is preferably done via bus systems with the switch cabinet TPEM Control Cabinet (TPEM CC) as the central control unit.

Depending on the task and the design of the asset (genset), the standard equipment on sensors and actuators is sufficient for collecting RAM-compatible telematics data.

Examples of telematics data on the genset:

- Lube oil temperature
- Genset power
- Ignition timing

Examples of telematics data on the generator:

- Voltage

For further information on extending the telematics data displayed, see

- Manufacturer CES ⇒ Product area RAM

(2) Generator controller

The generator controller regulates the voltage values to its internal desired values. The internal desired values are specified in combination with the TPEM Multifunction Relay.

(3) TPEM Control Unit (TPEM CU)

The TPEM Control Unit comprises the components for controlling and regulating the gas engine. The Network Manager reads out selected measured variables of the gas engine available in real time from the TPEM Control Unit and transmits them to RAM as telematics data. These can then be processed and visualized via the RAM infrastructure.

(4) TPEM Connection Box (TPEM CB)

The TPEM Connection Box is the interface between the TPEM Control Unit, the TPEM Control Cabinet and the gas valves. A network connection for service personnel is available.

(5) TPEM Control Cabinet (TPEM CC) with installations

The switch cabinet TPEM Control Cabinet is the central control unit for the exchange of signals between the engine control devices of the TPEM Control Unit and the control of the generator and auxiliary drives.

The most important installations for the networking of the Network Manager and the collection of telematics data are: TPEM Multifunction Relay, TPEM Modbus, TPEM CAN bus, TPEM Touch Panel, TPEM Remote Plant Gateway and TPEM Switch. Optionally, a TPEM PLE cellphone radio can be installed.

A network connection for service personnel is available.

(6) TPEM PLE cellphone radio (optional) (TPEM PLE)

If the TPEM Remote Plant Gateway does not have an internet connection or if the bandwidth of the internet connection is insufficient, the optional cellphone radio transmits the data to the RAM infrastructure via mobile radio.

(7) TPEM Modbus connection

The TPEM Modbus connection allows access to different operating data of the power generation plant.

(8) TPEM CAN bus connection

The TPEM CAN bus connection allows access to different operating data of the engine control TPEM Control Unit.

(9) TPEM Multifunction Relay (TPEM MFR)

The TPEM Multifunction Relay collects the current operating data of the power generated, determines the control deviation and generates the necessary control signal for the correction of the engine control units of the TPEM Control Unit. In mains parallel mode, the TPEM MFR controls and regulates the synchronization of the generator.

The TPEM PLE Network Manager accesses the TPEM MFR data via the TPEM Modbus and the TPEM Touch Panel.

(10) TPEM PLE Network Manager (TPEM PLE)

The Network Manager accesses the various signals and data via the TPEM Modbus and sends them to the RAM infrastructure.

(11) TPEM Touch Panel (TPEM TP)

The TPEM Touch Panel with integrated operating computer and data storage media is located in the switch cabinet TPEM Control Cabinet. Many clients (components) communicate with each other via the operating computer as the server, for example the Network Manager with the TPEM Modbus.

(12) TPEM Switch

The TPEM switch allows multiple network devices to communicate.

(13) TPEM Remote Plant Gateway (TPEM RPG)

The TPEM Remote Plant Gateway as a router transmits the data between the operator-side network connection and the network of the asset (genset).

The Network Manager is connected to the TPEM Remote Plant Gateway in the network of the asset (genset).

(14) Operator-side network with internet connection and firewall

The connection to the WAN is established via an operator-side node. The operator is responsible for provision, maintenance and IT security (firewall, etc.).

For necessary information on the network connection, see chapter 7.2 Network administration (only if required) 73.

(15) Operator-side Modbus connection on the TPEM Touch Panel (TPEM TP)

An operator-side Modbus connection is possible after prior configuration on the TPEM Touch Panel.

For further information on the Modbus connection, see

- Manufacturer Caterpillar Energy Solutions GmbH ⇒ Product area Product Link Elite (PLE)

(16) Wide Area Network (WAN)

The WAN is a network that, like the internet, covers a large geographic area and connects multiple local networks.

(17) RAM infrastructure

The RAM infrastructure, consisting of the main server, backup server and RAM server, administers the connected Network Managers, stores the transmitted data, ensures the necessary IT security measures, manages the users and makes the customer applications available. Redundancies are provided for precautionary reasons.

(18) Dealer Service Portal for dealers and service partners

Portal for the dealer or service partner for administering the RAM application assigned to them.

(19) RAM for the operator

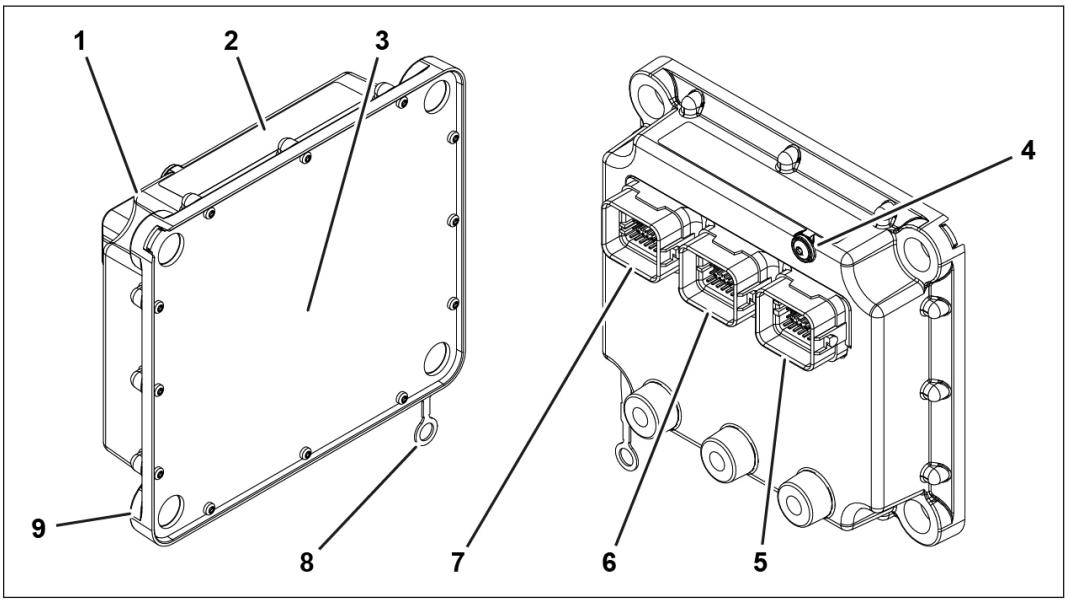
Portal for the operator for the visualization and evaluation of their RAM telematics data.

4.3 Network Manager

4.3.1 Hardware and Technology

The Network Manager is a router for controlling the incoming and outgoing data streams. It has three connections for the internal power supply and data exchange of the connected systems as well as buffer memory to buffer data. Depending on the local situation, it connects the asset (genset) to the RAM infrastructure via cable or via the optional cellphone radio.

The Network Manager consists of a housing with a cover plate. The cover plate must not be loosened. For integration in the TPEM system, assembly in the switch cabinet TPEM Control Cabinet is expected. The Network Manager is already pre-installed on a mounting plate for this purpose. Any direct fastening deviating from this must be clarified with the manufacturer.



74175-001

1 Housing
2 Rating plate
3 Rear side with cover plate
4 Additional potential equalizer (not used)
5 44-pin connection for Modbus wiring harness, symbol circle (●)
6 44-pin connection for main harness, symbol triangle (▲)
7 44-pin connection for main harness, symbol square (■)
8 Potential equalizer
9 Bore for fastening

4.3.2 Signals

Status messages and fault messages can be read out via the network interface or a connected service computer.

The Network Manager itself has no signal devices on the device.

4.3.3 Software

Firmware

The software on the Network Manager is proprietary firmware. This allows configuration of the Network Manager for communication of the asset (genset) with the RAM infrastructure. Access is restricted by rights and roles so that unauthorized system changes are prevented.

The most important tasks of the firmware are:

- Starting up and shutting down the Network Manager
- Handling the configuration files
- Converting signals
- Buffering data in the internal storage

Risk of destruction of components

Faults due to incorrect firmware

- Only authorized service personnel are allowed make manual changes in connection with the firmware.

Configuration file

The configuration file adjusts the functionality of the Network Manager to the asset (genset) on site.

Software and portals

Different portals and web applications are available for the display and evaluation of the telematics data. The scope and visualization of the telematics data are determined in coordination with the responsible dealer or service partner.

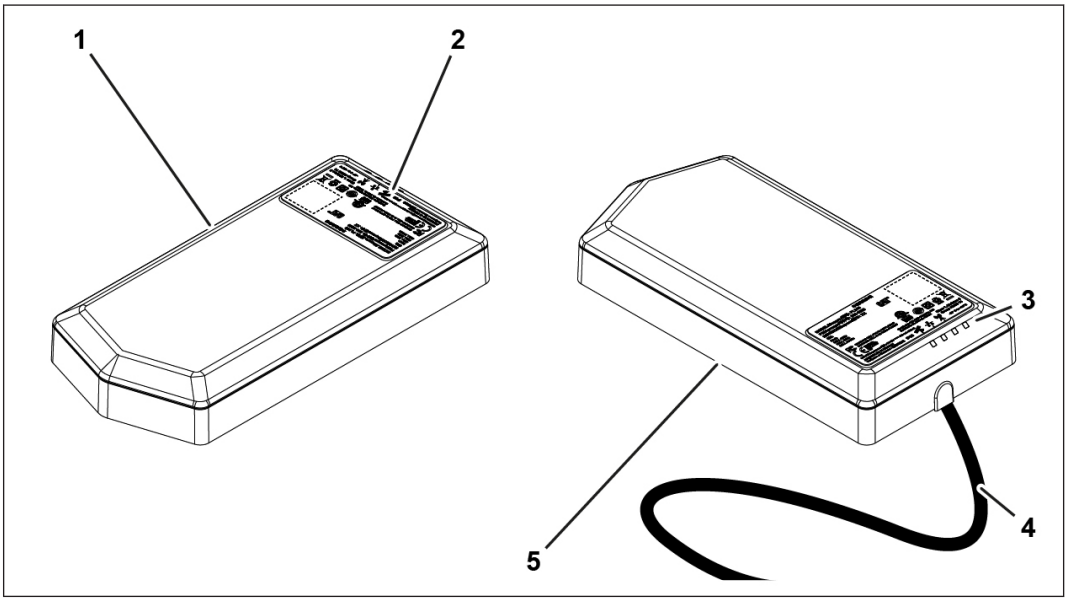
4.4 Cellphone radio (optional)

4.4.1 Hardware

If no suitable operator network is available, the Network Manager can be connected to the RAM infrastructure via a mobile network.

The cellphone radio optionally provided for this has an internal antenna for transmitting mobile data. Mobile data is processed via a 4G LTE-capable radio communication system. If a 4G signal is not available, the cellphone radio automatically searches for 3G or 2G signals. In addition, the cellphone radio contains a GNSS receiver that also receives GPS positioning signals via an internal antenna.

Integration into the TPEM system is achieved by installing it near the TPEM CC control cabinet. Assembly is also possible outdoors in compliance with the technical data.



74650-001

1 Housing
2 Rating plate
3 LEDs
4 Wiring harness
5 Underside with adhesive tape

For further information on the currently available mobile standards, see

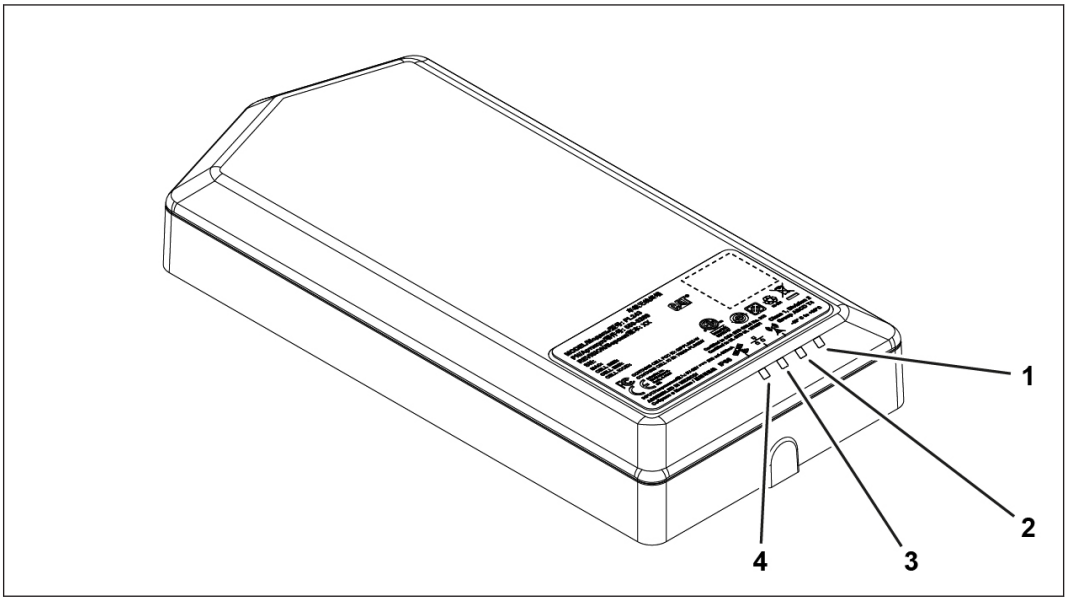
- Responsible dealer or service partner

A ventilation opening and an adhesive film for assembly are located on the underside.

The power supply and communication with the Network Manager are established via the wiring harness. The cellphone radio contains a lithium battery for short-term bridging of power failures.

Data may be lost in the event of a signal transmission failure.

4.4.2 Signals



74651-001

1 Not used

2 Mobile connection (LED yellow)

3 Ethernet connection (LED blue)

4 GNSS connection (LED orange)

4.4.3 Software

Firmware

The software on the cellphone radio is proprietary firmware. This enables communication of the asset (genset) with the RAM infrastructure. The firmware can be updated. Access to the firmware is restricted by rights and roles so that unauthorized system changes are prevented.

Risk of destruction of components

Faults due to incorrect firmware

- Only authorized service personnel are allowed make manual changes in connection with the firmware.

4.5 IT security

4.5.1 Operator-side network and TPEM

The operator is responsible for the security of the operator-provided network connections, especially the connections to the internet. The current standard for industrial network protection applies.

Pay particular attention to:

- Appropriate and updated firewalls, especially for interfaces to the internet
- Approving only absolutely necessary ports on the firewall
- Current firmware on all operator-side routers
- Current security updates must be accessible via the update servers
- Only use secure cloud functions
- **Only** the TPEM Remote Plant Gateway (TPEM RPG) may be connected to the customer-side internet connection via a LAN cable
- All other network components, such as switches and routers, must not be accessible via the internet
- If possible, deactivate USB interfaces and unnecessary network interfaces
- Only use TPEM USB tokens approved by CES in the USB interfaces in the TPEM system

For necessary information on IT security, see

- Operator IT contact person

4.5.2 Cellphone radio

The cellphone radio complies with the IT security regulations valid at the time of manufacture.

4.6 Machine safety

The Network Manager is designed to monitor operating data as provided by the process control systems of the asset (genset).

The safety circuits (TPEM Safety chain) must remain separate from the Network Manager and the RAM components. There must be no direct connection. If this is not the case, malfunctions in the machine network can affect the safety functions (emergency shutdowns, etc.).

Risk of destruction of components

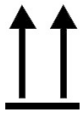
Control impairment due to Network Manager malfunctions

- If complications occur with the Network Manager during operation, disconnect it from the network immediately and contact the operator and the responsible dealer or service partner

5 Preservation, packaging, transport and storage

Table of contents

5.1 Symbols on the packaging

	**Top** Shows the correct upright position of the package. Only transport and store the packages in an upright position.
	**Protect from moisture** Protect packages from moisture and store in a dry place.
	**Fragile** Indicates packages with fragile or damageable contents. Treat packages with care, do not throw and be careful not to knock or bump them.

5.2 Removing from transport

Immediately check the delivery for completeness and transport damage upon receipt.

In the event of visible transport damage on the outside, proceed as follows:

1. Do not accept the delivery or only accept under reserve
2. Note the extent of the damage on the transport documents or on the hauler's delivery note
3. Lodge complaint

Note

Make a claim for each fault as soon as it is detected. Claims for damage may only be made within the legal and contractually agreed claim deadlines.

5.3 Information on packaging

The individual packages are packed according to the transport conditions to be expected.

Note

For required information on packaging, see

- Operating Manual ⇒ General ⇒ Operating media regulations
  - Technical Bulletin (TR) 2169 Specification for preservation, packaging, transport and storage

The packaging should protect the individual components up to assembly. Therefore, do not destroy the packaging and only remove it directly before assembly.

Handling packaging materials

Danger to the environment

Incorrect disposal of packaging materials may cause environmental damage.

- Dispose of packaging material according to the respectively applicable legal regulations and local specifications.
- Pass recyclable packaging material on to be recycled
- Commission a specialist company if necessary

6 Assembly

Table of contents

6.1 Safety notes

WARNING!

Electric shock if live components are touched

This can lead to severe injuries and even death.

- Only authorized specialist personnel may work on the electrical system.
- Turn off electrical power supply and secure against restarting:
  - Disconnect electrical system.
  - Secure against reconnection.
  - Check that equipment is de-energized.
  - Ground and short-circuit the electrical system.
  - Cover or cordon off adjacent components which are electrically live.

The disconnection of the plant also includes the measuring lines. Since individual measuring lines are connected upstream of the generator circuit breaker (GCB), they can carry mains voltage even when the genset is stopped and the power supply of the switch cabinet TPEM Control Cabinet (TPEM CC) is disconnected.

WARNING!

Injury due to improper installation

This can lead to severe injuries and even death.

- Ensure sufficient installation space.
- Handle sharp-edged components carefully.
- Ensure tidiness and cleanliness in the workplace.
  - Do not leave tools lying around.
  - Components left lying around and on top of one another are causes of accidents.
- Assemble components properly.
  - Observe specified tightening torques.
- Secure components from being knocked over or falling down.

WARNING!

Injury due to improper installation

This can lead to severe injuries and even death.

- Only qualified specialist personnel may work on the electrical system.
- Only qualified specialist personnel are permitted to work on the fuel gas system.

Risk of destruction of components

Electrostatic charging of the assembly personnel or their tools can damage sensitive components or restrict their function.

- Observe handling regulations for components subject to electrostatic hazards

6.2 General

6.2.1 Guidelines

All components must be assembled and connected properly. Depending on the region, additional requirements may apply or acceptance testing may be required.

Tightening

Observe specified tightening torques for electrical operating equipment, housing, etc.

Electrical connections

The cable routing and connections to electrical operating equipment must comply with the following general guidelines:

- Follow the wiring diagram of the switch cabinet TPEM Control Cabinet and the wiring diagram supplement for retrofit installation
- Adhere to the specified cable routing in the switch cabinet. Route cables in the existing lateral cable ducts to the levels with the operating equipment such that they are free from tension. Comply with permissible bending radii. Secure cables with suitable fastening means
- Protect cables to be laid outside switch cabinets from damage and secure with suitable fastening means. Options for protecting cables include rigid or flexible conduits made of metal or plastic, cable ducts, or the use of cut-resistant cables. Comply with permissible bending radii.
- Properly install and close or seal feedthroughs for electrical connections in switch cabinets, etc.
- Cover open cable ends with a protective cap as a safeguard before installation
- Establish the connections and cable connections such that they cannot come loose during operation
- Secure the connections and cable connections such that they cannot be loosened easily by persons. The method of securing or loosening should require a tool
- Label the unlabeled cables or wires according to the wiring diagram
- Adapt technical documentation accordingly

6.2.2 Local situation and documents

This document describes the assembly and connection as realistically as possible according to the standard situation. If adjustments are to be made or if there are any queries, contact the responsible service partner.

The wiring diagram supplied always applies.

- Before assembly, compare the local situation with this manual and the wiring diagram

6.2.3 Power supply timing

To avoid possible registration problems, do not supply current to the system until all hardware is installed and all electrical connections are established.

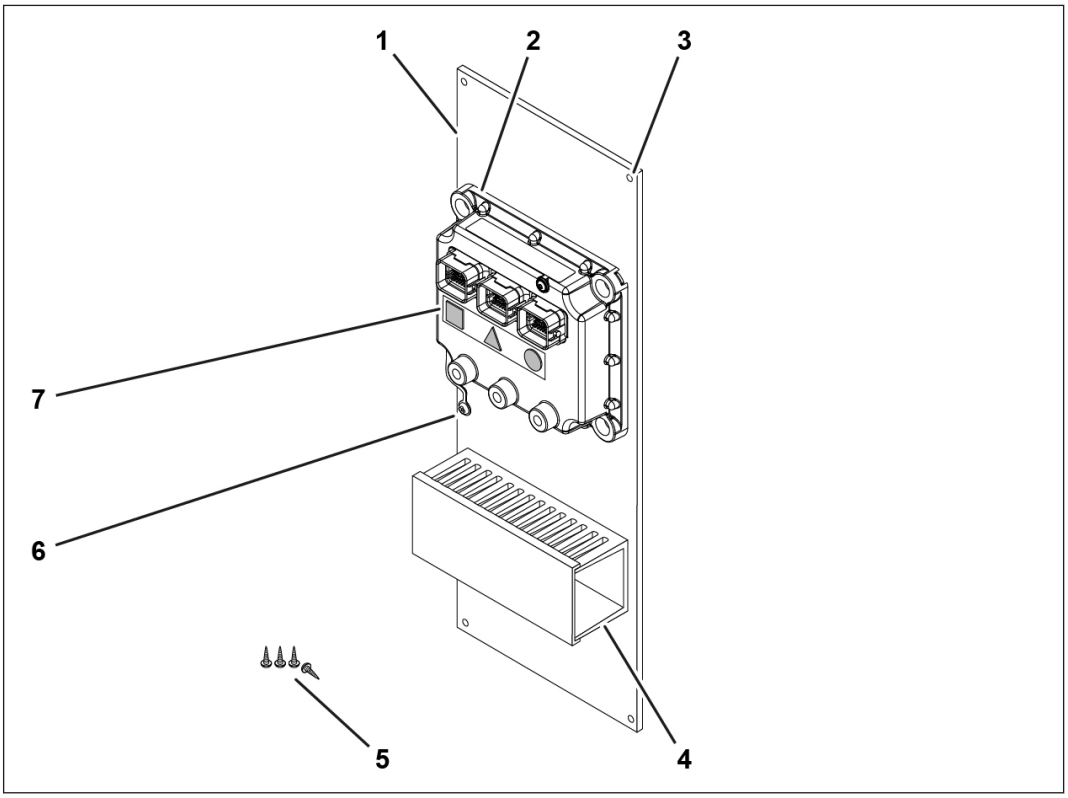
6.3 Scope of delivery

6.3.1 Network Manager

Mounting plate

The Network Manager (2) is pre-installed on a mounting plate (1). On the mounting plate (1) there is a cable duct (4) for laying the connecting cables and for storing unused connections (for example, RJ45 Ethernet connection for service computer).

Depending on the situation and delivery, the wiring harnesses may already be connected to the Network Manager.

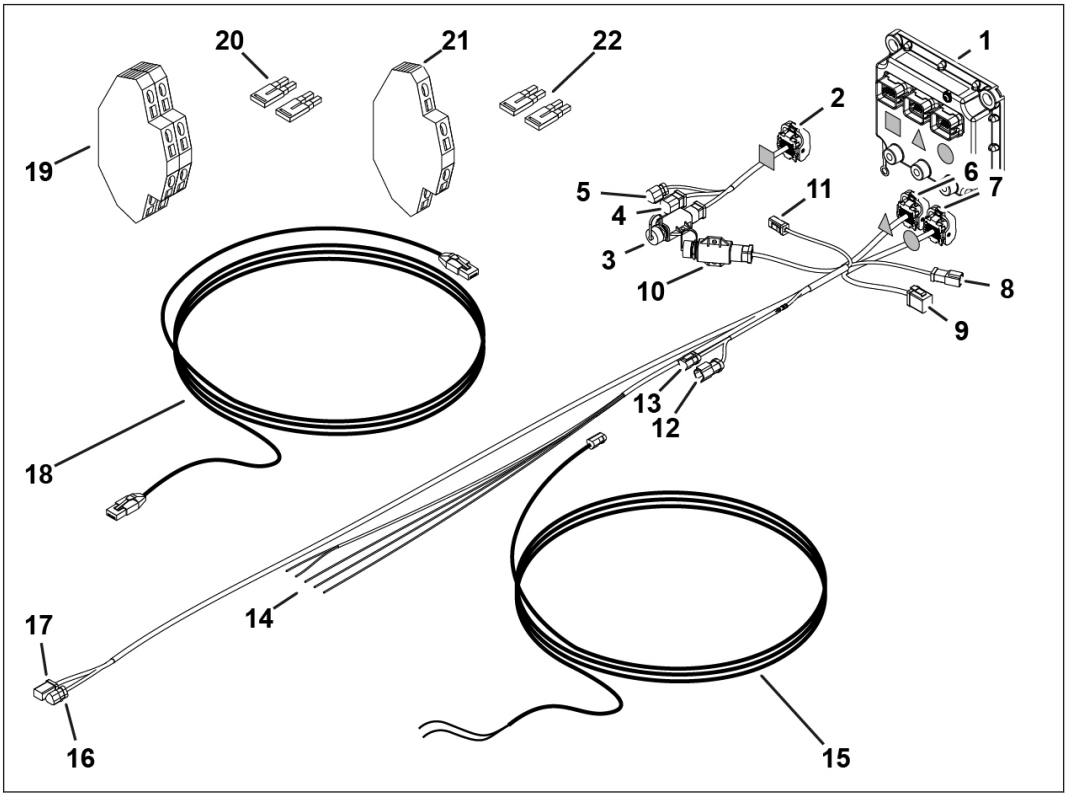


74653-001

1 Mounting plate
2 Network Manager
3 Bores for fastening screws D=6 mm
4 Cable duct
5 Fastening screws D=6 mm
6 Potential equalizer fastening
7 Adhesive label with the connector allocation

Wiring harnesses and connection accessories

Depending on the situation and delivery, the wiring harnesses may already be connected to the Network Manager.



74654-001

1 Network Manager

Wiring harness Modbus (A)

2 Connection A-C1: Wiring harness Modbus on Network Manager (symbol ■)

3 Connection A-C4: LAN patch cable on RJ45 Adapter

4 Connection A-C3: LAN external (operator-side)

5 Connection A-C2: not used

Main harness (A) with connection accessories

6 Connection A-C1: Main harness on Network Manager (symbol ■)

7 Connection A-C2: Main harness on Network Manager (symbol ●)

8 Connection A-C4: not used

9 Connection A-C6: not used

10 Connection A-C5: RJ45 Adapter, optionally used

11 Connection A-C7: not used

12 Connection A-C10: not used

13 Connection A-C3: for extension of CAN bus (15)

14 Power supply connections
- Wire designation 101 / wire color RD (red): +24 VDC
- Wire designation 200 / wire color BK (black): GND 24 VDC
- Wire designation 308 / wire color YE (yellow): key switch
- Wire designation 892 / wire color BN (brown): not used
- Wire designation 893 / wire color GN (green): not used

15 CAN bus extension cable

16 Connection A-C8: optionally for cellphone radio

17 Connection A-C9: optionally for cellphone radio

18 LAN patch cable

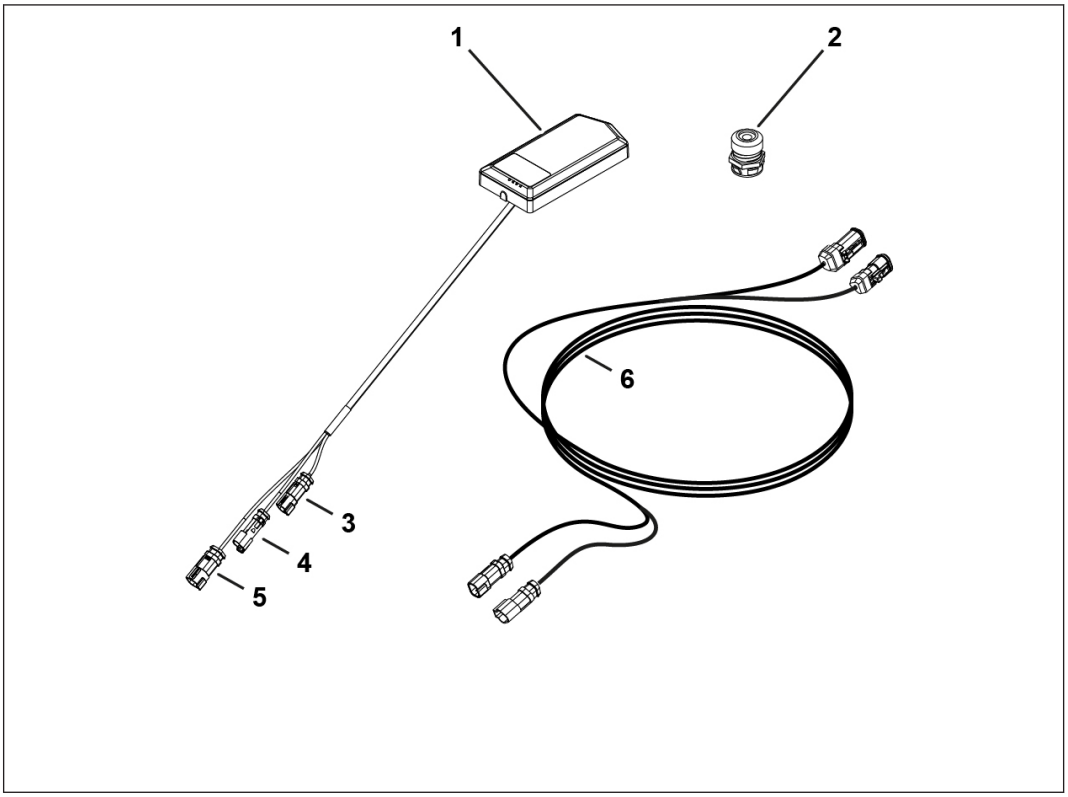
19 Two-tier terminal (2 units) for -53X7

20 Jumpers (2 units) for -53X7

21 Jumpers (2 units) for CAN bus connection

22 Two-tier terminal for CAN bus connection

6.3.2 Cellphone radio (optional)



74655-001

1 Cellphone radio

2 Cable gland (not included in the scope of delivery)

Wiring harness (C)

3 Connection: power supply

4 Connection: Ethernet

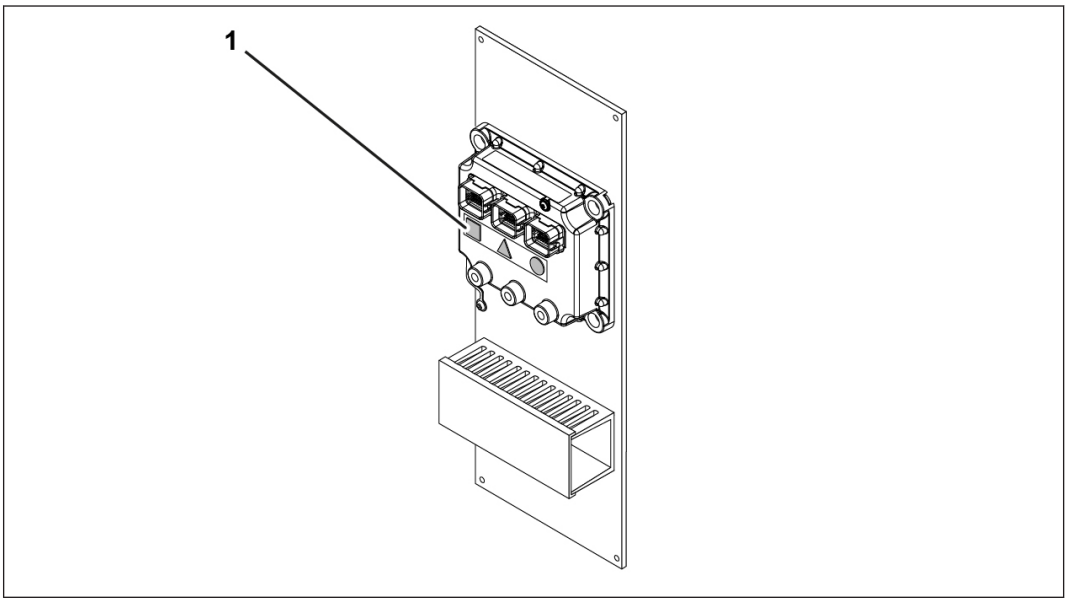
5 Connection: not used

6 Cellphone radio extension cable

6.4 Preparation

6.4.1 Firmware and configuration

The Network Manager is delivered with firmware and a standard configuration. Firmware and configuration are updated on commissioning. Only one Network Manager with the connector allocation sticker is flashed and described with firmware as well as a configuration file.



74938-001 Example illustration without connecting cable

- Before assembly, check whether adhesive label (1) is present
  - If the Network Manager does not have an adhesive label, consult the responsible dealer or service partner.

6.5 Installing Network Manager

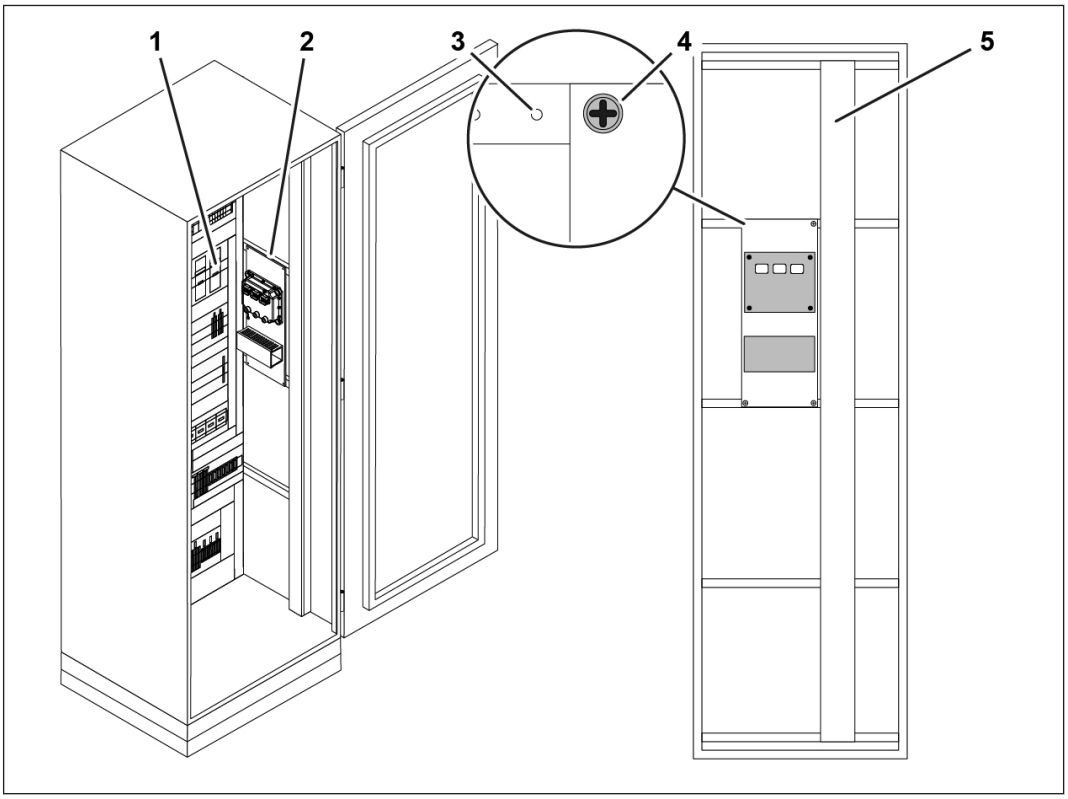
It is installed in the switch cabinet TPEM Control Cabinet (TPEM CC).

6.5.1 Switching off power supply

The connection of the power supply for the switch cabinet TPEM Control Cabinet depends on the design of the plant on site.

- Shut down and secure asset (genset)
- Disconnect, relieve and secure power supply and measuring lines to the switch cabinet TPEM Control Cabinet
- Open switch cabinet TPEM Control Cabinet and ensure safe working conditions. For necessary information on safety, see chapter 6.1 Safety notes 50

6.5.2 Installing mounting plate



74657-001

1 Switch cabinet mounting plate
2 Network Manager mounting plate
3 Mounting rail with pre-cut mounting holes
4 Fastening screw

5 Available cable duct

- Position the Network Manager mounting plate (2) to the left of the cable duct (5) and screw tight
  - The connection to the mounting rails (3) must be electrically conductive to ensure potential equalization.
  - The cable duct (5) may need to be shifted slightly.

6.6 Installing cellphone radio (optional)

6.6.1 Selecting installation site

The following requirements apply when selecting the installation site:

- Sufficient distance from operating personnel. For necessary information, see chapter 2.4 Emissions 17.
- Install cellphone radio horizontally, with the line of sight to the sky as unobstructed as possible. Any other positioning will result in inaccurate or unavailable GPS position data
- Maintain a minimum distance of 205 mm from all metal structures protruding above the level of installation. Any metallic obstruction will result in reduced radio and GPS connectivity.
- To use the GPS signal, install the mobile device under a non-metallic cover
- No extreme heat conditions such as direct sunlight. Exposure to excessive heat can lead to malfunction. For necessary information, see chapter 3.2 Cellphone radio (optional) 24.
- Do not expose the cellphone radio or connections to high-pressure spraying
- Maintain a minimum distance of 500 mm from other radio antennae such as CB radios, data radios and commercial communication radios
- Observe maximum cable length. For necessary information, see chapter 3.2 Cellphone radio (optional) 24

6.6.2 Testing reception quality

In order to test the reception quality, find the final installation site with the cellphone radio connected and the Network Manager in working order, or use other means. For further information on testing reception quality, see chapter 10.3.2 Service Dashboard 94.

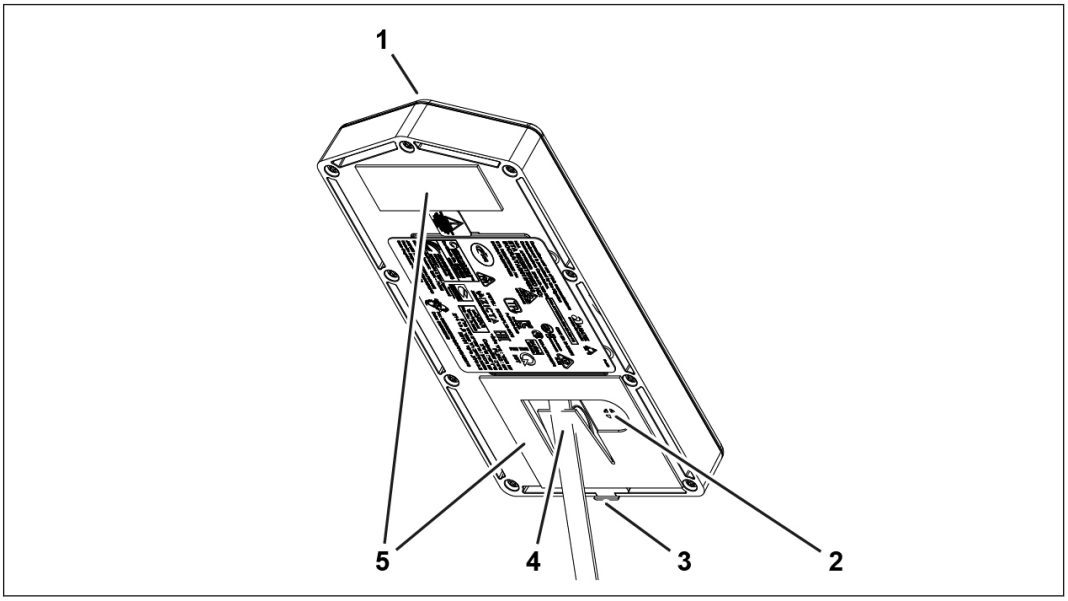
6.6.3 Affixing cellphone radio

To achieve the required adhesive properties, the minimum temperatures for the cellphone radio and the assembly surface must be observed during assembly:

- Adhesion to a metallic surface not below −7 °C
- Adhesion to a non-metallic surface not below −2 °C

If necessary, increase the temperature of the cellphone radio and the assembly surface before adhering. In colder climates, complete adhesion may take over 24 hours.

The cellphone radio (1) can be mounted with bottom cable outlet (delivery condition) (4) or rear cable outlet (3). Use the heavy-duty adhesive tape (5) only for securing and not for sealing openings. Do not cover the ventilation opening (2).



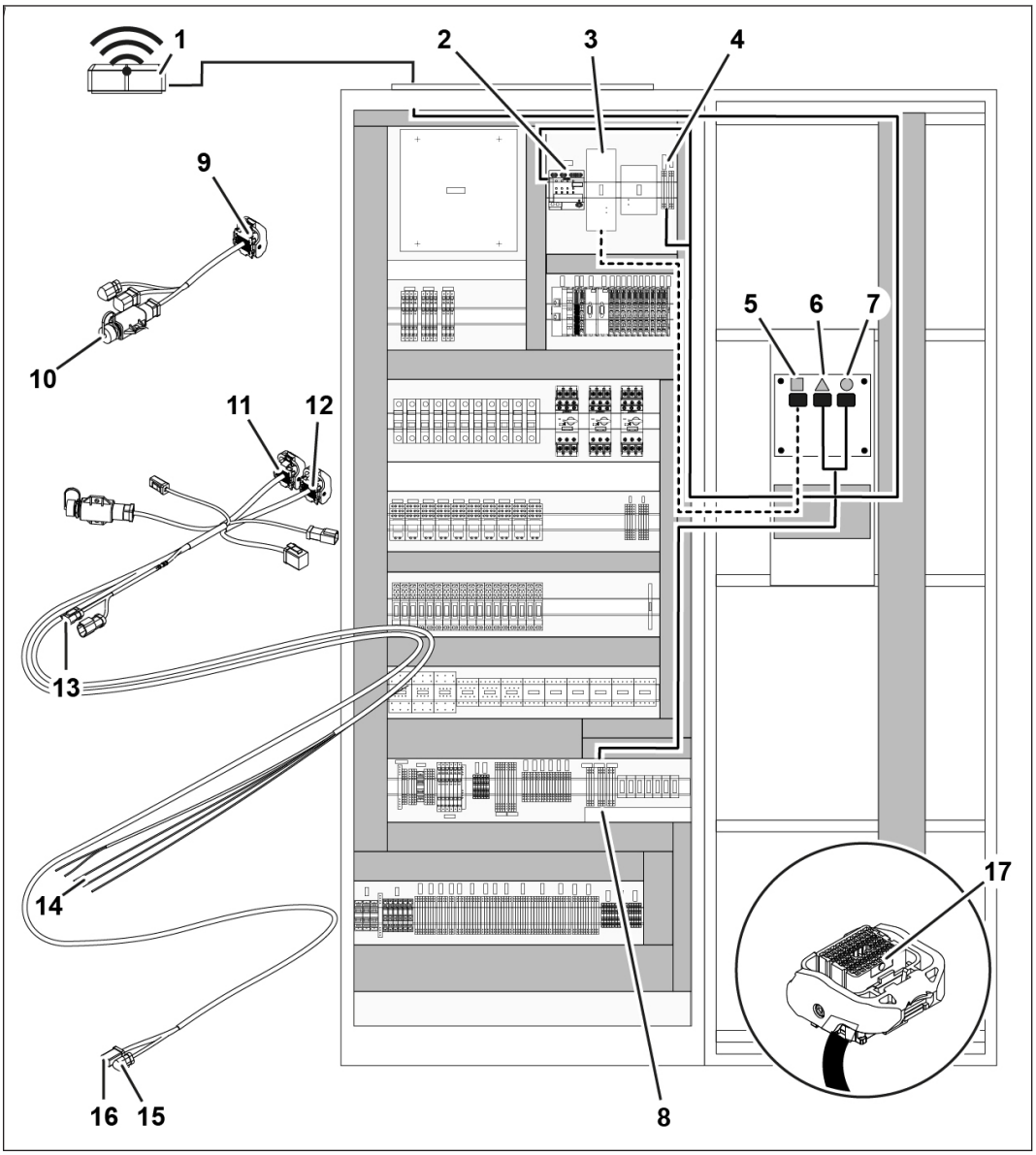
74659-001

1 Cellphone radio
2 Ventilation opening
3 Rubber insert for rear cable outlet
4 Bottom cable outlet
5 Heavy-duty adhesive tape with protective film

- Connect wiring harness to cellphone radio (1)
- Put Network Manager into operation
- Select installation site according to reception
- Depending on the situation, choose cable outlet (3) or (4)
  - Remove rubber insert (3) for rear cable outlet
- Clean assembly surface
  - Clean assembly surface until it is clean and free of grease.
  - Use clean, lint-free cleaning cloths.
  - Depending on the degree of contamination, use a suitable cleaning agent and appropriate gloves.
  - Observe the safety data sheet for the cleaning agent.
- Remove the protective film from the heavy-duty adhesive tape (5)
- Position the cellphone radio (1) on the assembly surface and press firmly until it stays in place by itself

6.7 Cable routing and connection

6.7.1 Overview of connections



74937-001 Connections and cable routing

1 Cellphone radio (optional): Connection of radio wiring harness for data exchange and power supply

2 Selectivity module: Connection -55F1. Output 4 monitors the +24 VDC of the Network Manager

3 TPEM RPG: Connection -W53.2 on RPG modem (-55T7). LAN 3 socket for TPEM Modbus TCP on the Network Manager

4 Connection -53X5 for power supply 24 VDC of the Network Manager

5 Network Manager: Connection (symbol ■) for Modbus wiring harness

6 Network Manager: Connection (symbol ▲) for main harness

7 Network Manager: Connection (symbol ●) for main harness

8 TPEM Can bus: Connection -49X4 CAN bus high and low for CAN bus extension cable

9 Modbus wiring harness: Connection to Network Manager (symbol ■)

10 Modbus wiring harness: Connection for LAN patch cable to the TPEM Remote Plant Gateway (TPEM RPG)

11 Main harness: Connection to Network Manager (symbol ▲)

12 Main harness: Connection to Network Manager (symbol ●)

13 Main harness: CAN bus extension cable connection

14 Main harness: Power supply

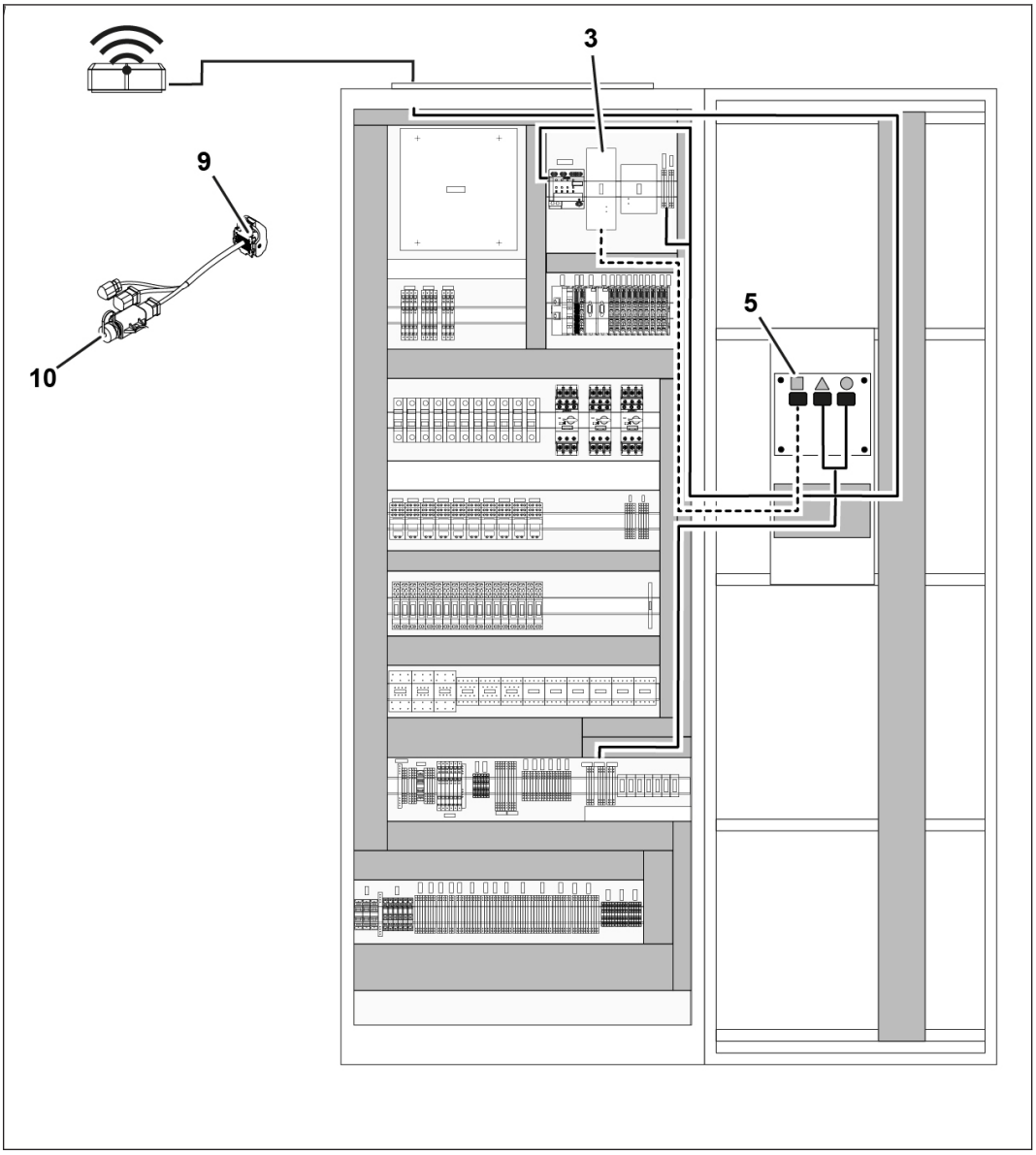
15 Main harness: Connection of cellphone radio extension cable (optional)

16 Main harness: Connection of cellphone radio extension cable (optional)

17 Position of the symbols on the connectors (9), (11) and (12)

For further information on the scope of delivery, see chapter 6.3 Scope of delivery 53.

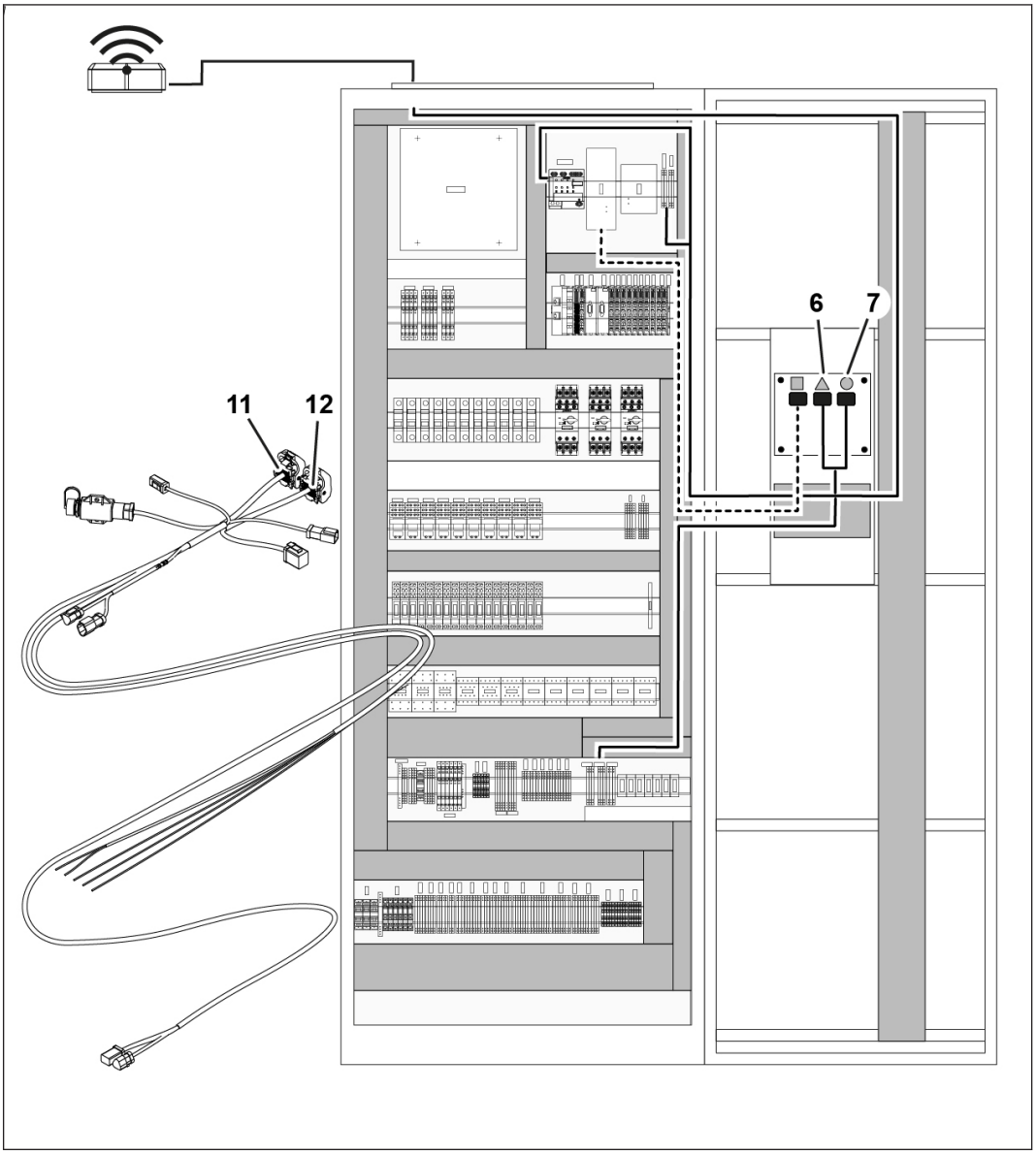
6.7.2 Connecting Modbus wiring harness



74940-001

- Connect the Modbus wiring harness with connector symbol ■ (9) on the Network Manager to connector symbol ■ (5)
  - Allow a short section of the wiring harness to protrude horizontally on the Network Manager (5) initially and then route it downwards.
- Connect patch cable in plug-in connection (10), guide to the TPEM Remote Plant Gateway (3) and connect to LAN 3

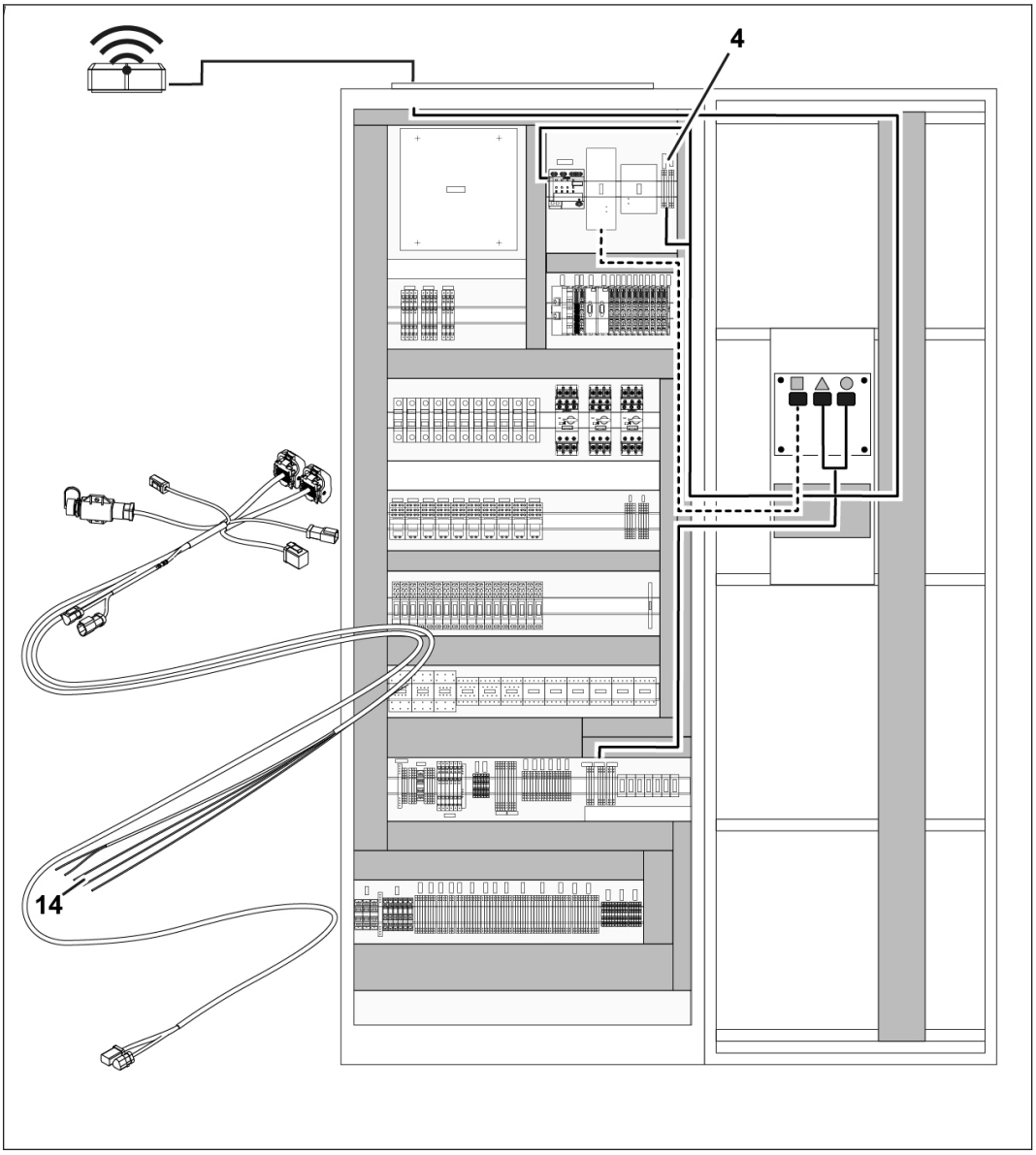
6.7.3 Connecting main harness to Network Manager



74941-001

- Connect the main harness with connector symbol ▲ (11) on the Network Manager to connector symbol ▲ (6)
  - Allow a short section of the wiring harness to protrude horizontally on the Network Manager (6) initially and then route it downwards.
- Connect the main harness with connector symbol ● (12) on the Network Manager to connector symbol ● (7)
  - Allow a short section of the wiring harness to protrude horizontally on the Network Manager (7) initially and then route it downwards.

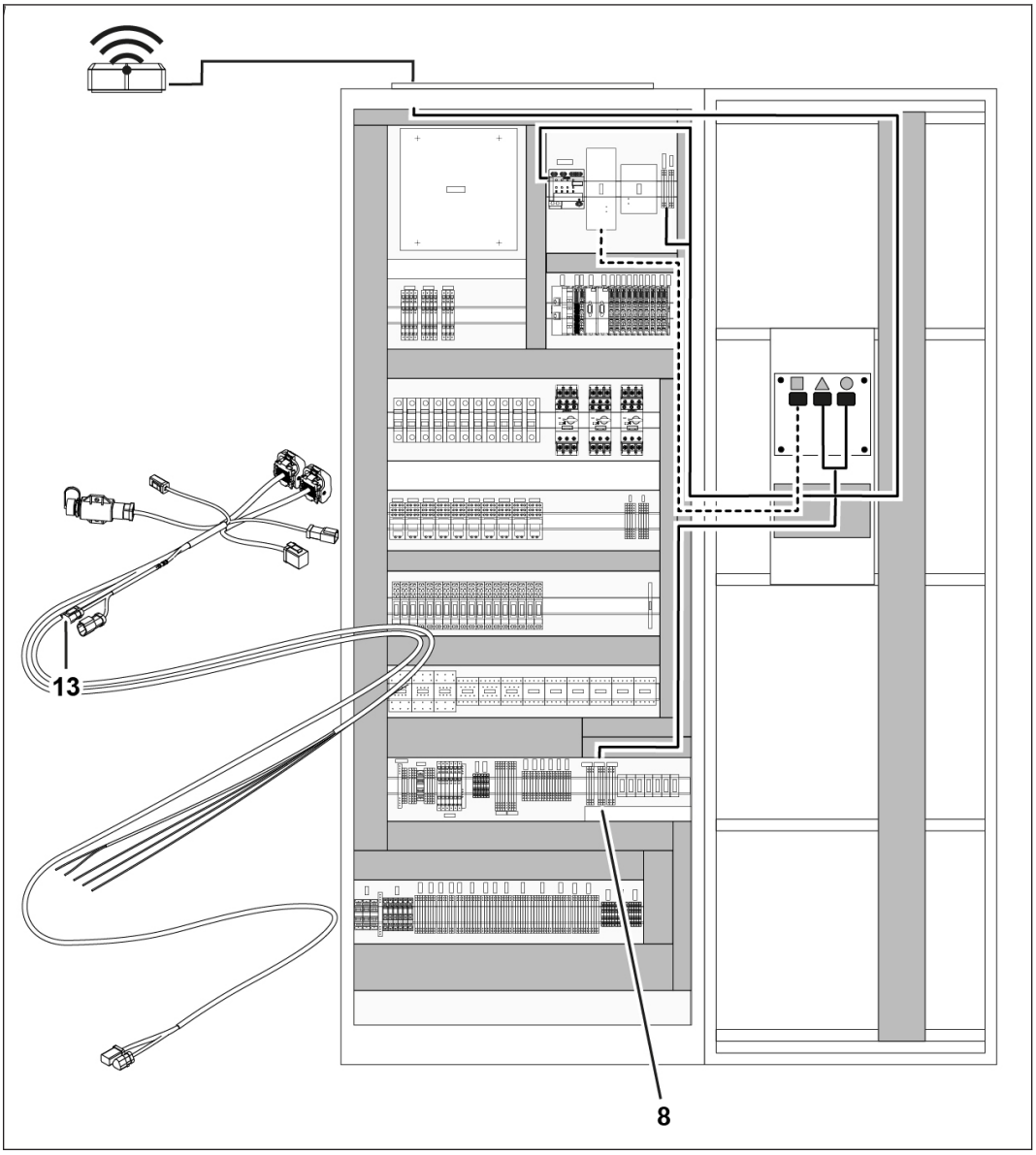
6.7.4 Connecting main harness to power supply



74942-001

- Install 2 two-tier terminals -53X5 on the mounting rail (4)
- Connect terminal numbers 1 and 3 (+24 V DC) and terminal numbers 2 and 4 (GND 24 V DC) with both jumpers
- Connect -53X5:1 to -55F1 output 4
- Lay wire 101 (14, red) to the two-tier terminal and connect to -53X5:1 (+24 V DC)
- Lay wire 308 (14, yellow) to the two-tier terminal and connect to -53X5:3 (+24 V DC)
- Connect -53X5:2 to -4X1
- Lay wire 200 (14, black) to the two-tier terminal and connect to -53X5:2 (GND 24 V DC)

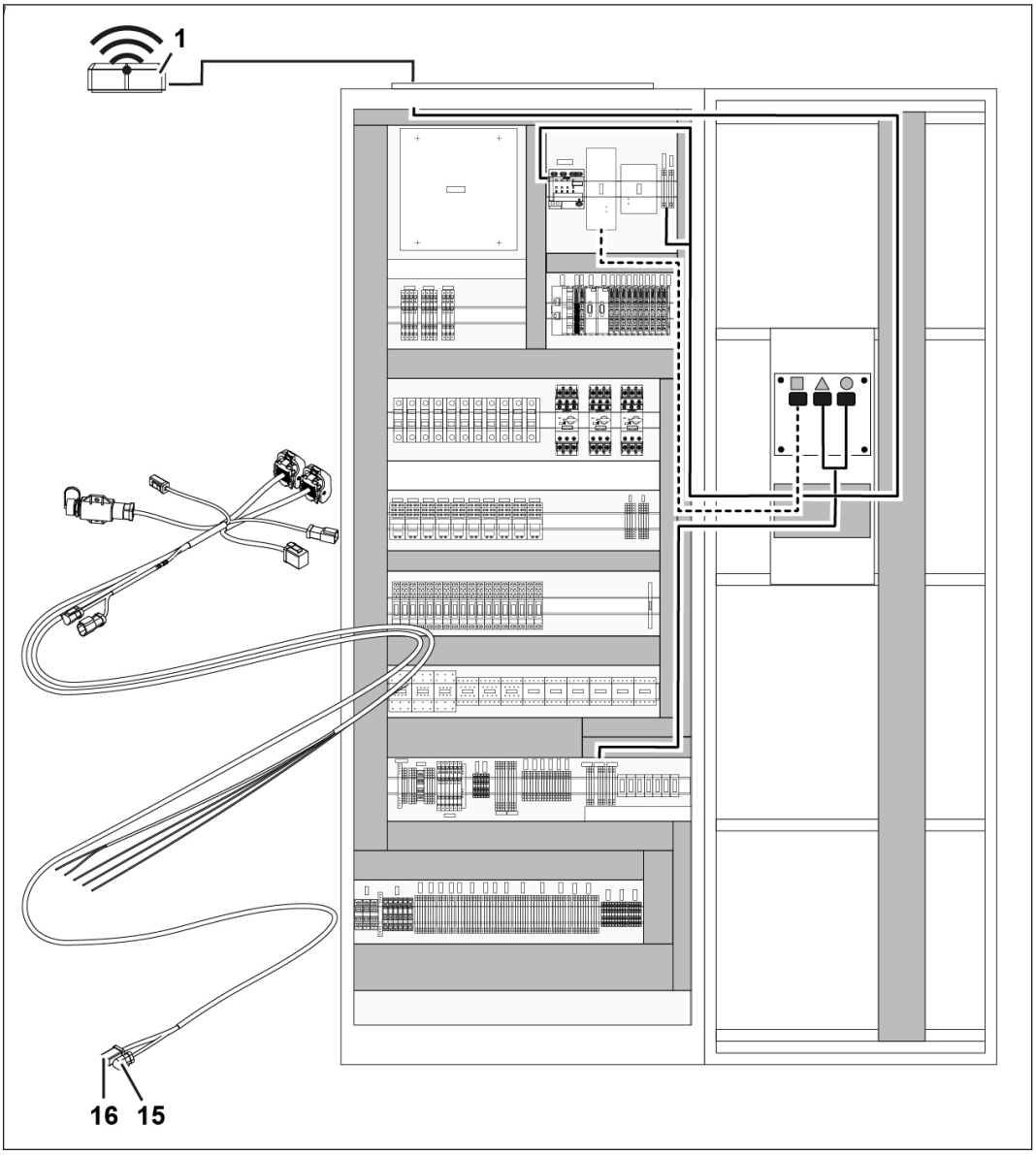
6.7.5 Connecting CAN bus extension cable



74943-001

- Connect extension cable for TPEM CAN bus to main harness (13) and lay to connection -49X4 (8)
- Install the two-tier terminal for extending -49X4 on the mounting rail (8)
- Connect terminal numbers 1 and 3 with jumper
- Connect terminal numbers 2 and 4 with jumper
- Connect wire CAN+ (YE/yellow) to terminal -49X4:3
- Connect wire CAN− (GN/green) to terminal -49X4:4
- Connect shield to terminal -49X4:PE

6.7.6 Connecting cellphone radio (optional)



74944-001

- Connect cellphone radio extension cable to main harness (15 and 16)
- Route the cellphone radio extension cable through the cable inlet at the top or bottom from the switch cabinet to the cellphone radio
  - Ensure proper cable feedthroughs. Moisture must not be able to enter the switch cabinet.
- Connect cellphone radio extension cable to the cellphone radio (1)

6.7.7 Electrical tests

Before commissioning, the electrical installation must be checked for safety and function by an authorized qualified specialist in accordance with the regional regulations by testing and measuring. The results must be documented in a test report.

The scope of testing includes the following general points and is to be determined according to the local conditions and the specific installation.

- Cable routing (cable correctly secured, short-circuit-proof routing, insulation, etc.)
- Installed operating equipment (fastening, insulation, no damage)
- Continuity of equipotential bonding
- Check continuity of cables
- Insulation resistance
- Power supply of the switch cabinet TPEM Control Cabinet and the operating equipment
- Perform electrical safety tests without and with power supply
- Only approve the installation for commissioning after successful testing
- If commissioning will take place at a later time, bring the switch cabinet TPEM Control Cabinet into a safe state, re-establish the power supply and enable the plant for operation

7 Commissioning

Table of contents

7.1 Safety notes

WARNING!

Electric shock if live components are touched

This can lead to severe injuries and even death.

- Only authorized specialist personnel may work on the electrical system.
- Turn off electrical power supply and secure against restarting:
  - Disconnect electrical system.
  - Secure against reconnection.
  - Check that equipment is de-energized.
  - Ground and short-circuit the electrical system.
  - Cover or cordon off adjacent components which are electrically live.

The disconnection of the plant also includes the measuring lines. Since individual measuring lines are connected upstream of the generator circuit breaker (GCB), they can carry mains voltage even when the genset is stopped and the power supply of the switch cabinet TPEM Control Cabinet (TPEM CC) is disconnected.

WARNING!

Injury due to improper commissioning

This can lead to severe injuries and even death.

- Only authorized specialist personnel may operate the product

Risk of destruction of components

Electrostatic charging of the assembly personnel or their tools can damage sensitive components or restrict their function.

- Observe handling regulations for components subject to electrostatic hazards

7.2 Network administration (only if required)

For communication, different ports must be enabled for the individual applications in the operator's network. Depending on the network, these must be parameterized manually by the network administrator.

All connections are outbound connections.

Main server IP

Currently:

- Target 104.214.119.85
  - via TCP port 443
  - via TCP port 5012

In the future:

- Target 18.216.73.179
  - via TCP port 443
  - via TCP port 5012
  - via UDP port 123 (NTP)

Backup server IP

This server is the redundancy of the main server.

Currently:

- Target 23.96.237.118
  - via TCP port 443
  - via TCP port 5012

In the future:

- Target 18.219.80.244
  - via TCP port 443
  - via TCP port 5012
  - via UDP port 123 (NTP)

RAM server

This connection is actively used only when RAM is enabled on the Network Manager and is sending data.

Currently:

- Target 66.22.7.61
  - via TCP port 443

Previously:

- Target 165.26.255.37

DNS resolution

This connection is actively used only when RAM is enabled on the Network Manager and is sending data.

If necessary, the DNS service from Google can be used. Otherwise, an internal DNS server must be used.

- Target 8.8.8.8
  - via TCP port 53
  - via UDP port 53
- Target 8.8.4.4
  - via TCP port 53
  - via UDP port 53

7.3 Putting Network Manager and cellphone radio (option) into operation

7.3.1 Switching off power supply

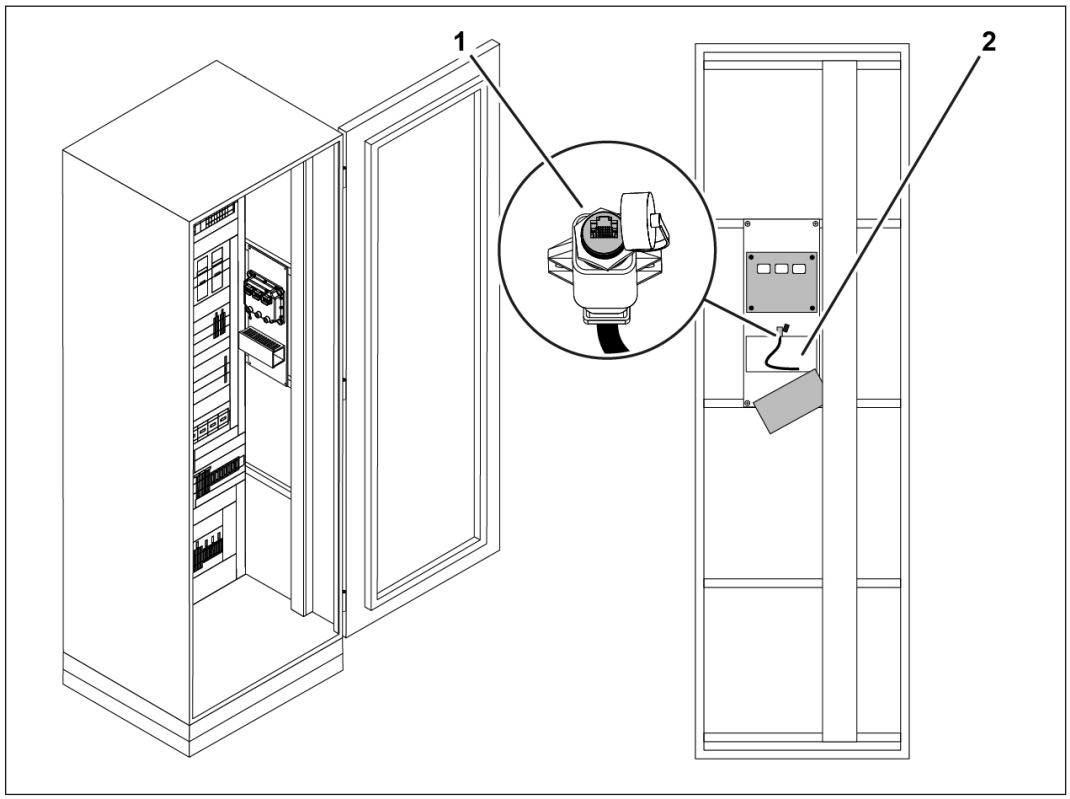
The connection of the power supply for the switch cabinet TPEM Control Cabinet depends on the design of the plant on site.

- Shut down and secure asset (genset)
- Disconnect, relieve and secure power supply and measuring lines to the switch cabinet TPEM Control Cabinet
- Open switch cabinet TPEM Control Cabinet and ensure safe working conditions. For necessary information on safety, see chapter 7.1 Safety notes 72

7.3.2 Connecting service computer

The service computer is connected in the switch cabinet TPEM Control Cabinet to the main harness.

The RJ45 Ethernet connection (1) is located in the cable duct (2). The Network Manager cannot be accessed via the other TPEM Ethernet connections on the front of the switch cabinet TPEM Control Cabinet and the TPEM Connection Box.



74660-001

1 RJ45 Ethernet connection

2 Cable duct

Service computer IP

- Static IP address: 165.26.78.2
- Subnet mask: 255.255.254.0

Procedure

- Save old IP configuration from the service computer and RAM!
- Enter the static IP address for the Ethernet adapter on the service computer
  - Windows > … > IP settings
- Connect service computer to the Network Manager
  - Open switch cabinet door.
  - Open cable duct (2) and pull out Ethernet adapter (1).
  - Open Ethernet adapter (1) and connect service computer with appropriate cable.
  - Leave switch cabinet door slightly open and secure it.
- After commissioning, change the IP configuration of the service computer back to the original state, store the Ethernet adapter and close the cable duct

7.3.3 Switching on power supply

- Switch on power supply to the switch cabinet TPEM Control Cabinet
  - The Network Manager is supplied with voltage and starts up according to the internal firmware.
  - The internal configuration file is loaded.
  - An attempt is made to connect to the operator-side network.
  - The RAM connection is tested.
- The cellphone radio (option) is supplied with voltage

7.4 Switching on power supply

- Switch on power supply to the switch cabinet TPEM Control Cabinet
  - The Network Manager is supplied with voltage and starts up according to the internal firmware.
  - The internal configuration file is loaded.
  - An attempt is made to connect to the operator-side network.
  - The RAM connection is tested.
- The cellphone radio (option) is supplied with voltage

7.5 Registration and connection with RAM

The Network Manager must be registered in the RAM infrastructure in order to thoroughly test the connection of the Network Manager with RAM and to enable monitoring. If the Network Manager is registered and the existing internet connection is enabled with the necessary ports and internet addresses, it can be subscribed to in the Dealer Services Portal.

7.5.1 For devices not yet registered

If the device is not registered yet, there is no automatic connection with RAM.

The following steps initiate the registration:

- Establish an online connection to the Network Manager
- Check communication
  - During this process, the RAM infrastructure checks if a connection with the Network Manager is possible.
  - Depending on the result, a corresponding message is promptly sent to the operator and/or the service personnel.
  - If the connection is successful, the RAM infrastructure starts the registration process. This may take some time.
- If the registration was successful, check the functionality in the portals

For further information on checking communication, see chapter 10.5 Performing Communication Check 104.

7.5.2 For already registered devices

In the case of a prepared Network Manager, the registration has already taken place.

- The Network Manager automatically connects to the RAM infrastructure after switching on
- The asset (genset) is displayed in the customer portal

8 Operation

Table of contents

8.1 Safety notes

WARNING!

Injuries due to improper operation

This can lead to severe injuries and even death.

- Only authorized and qualified operating personnel may operate the asset (genset) with the installed RAM components.
- The operating personnel are prohibited from making any changes to the hardware and its connections, parameters, files, etc.
- Before operation, ensure that all the covers and safety devices have been mounted and are functioning properly.
- Never shut down or remove safety devices during operation.

Risk of destruction of components

Unusual odors, noises or other problems may indicate critical system conditions or damage to the product

- Never examine or open the product, but switch it off or disconnect it from the mains immediately
- Contact the responsible service personnel

Risk of destruction of components

Liquids penetrating components can lead to damage

- Keep liquids away from the product

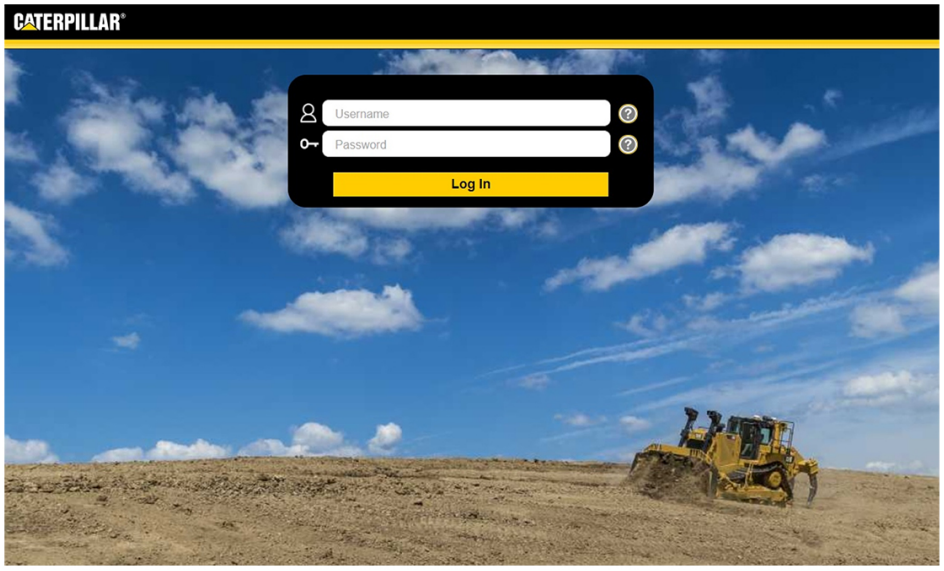
8.2 First steps

The Network Manager and the cellphone radio (optional) do not have operating elements for switching on, switching off or changing an operation mode. Use by the operating personnel takes place via RAM interfaces approved for the user. This chapter describes the first steps by way of example, which can be used to check the function of the installation, for example.

For further information on the RAM interfaces, see

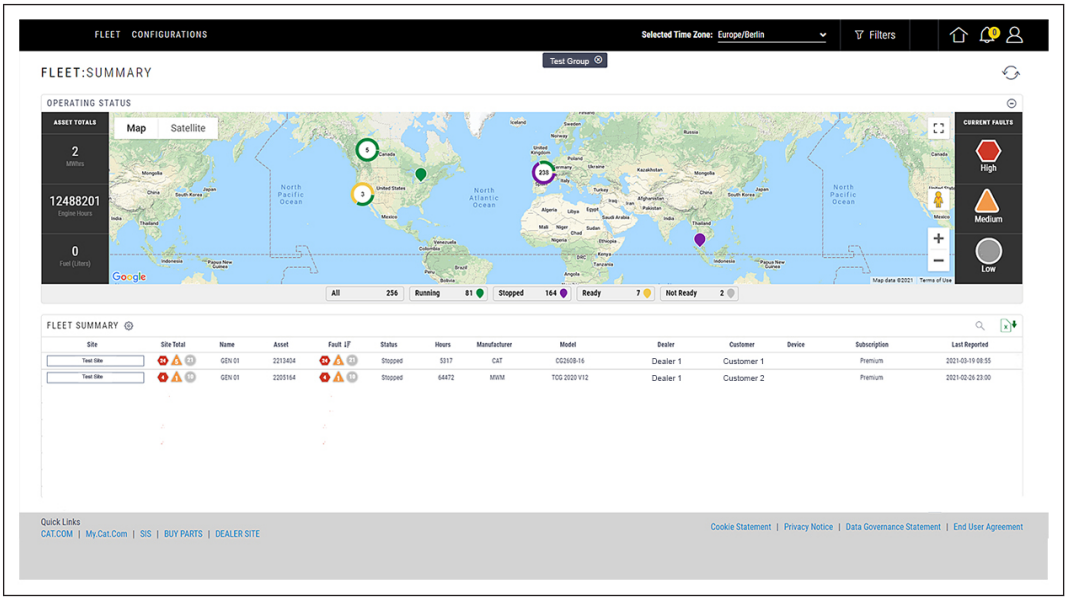
- Responsible dealer or service partner

Starting RAM web application



74661-001 Example illustration

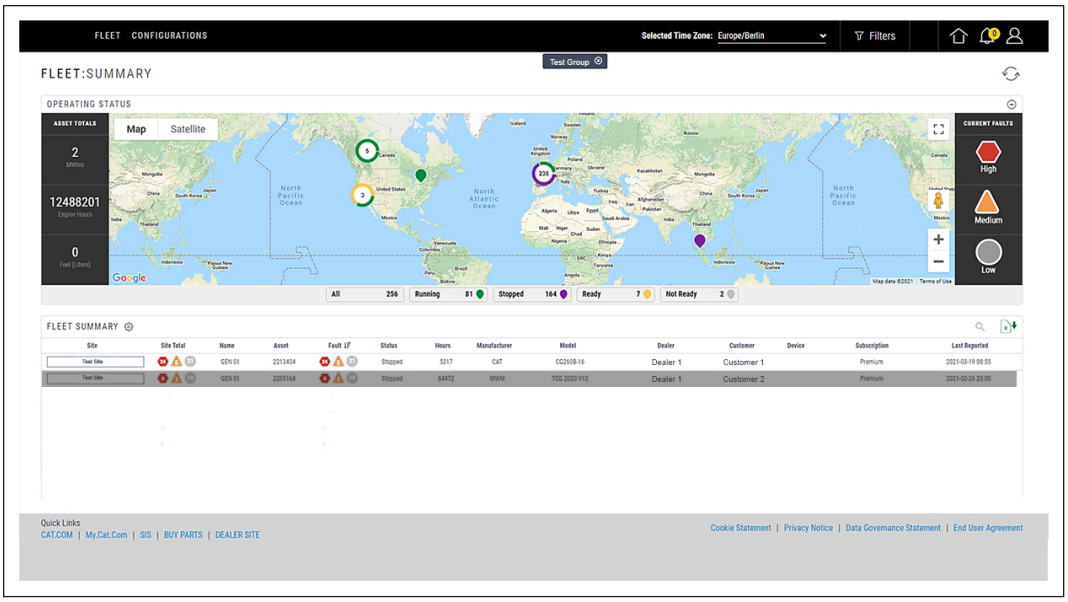
- Open browser and enter web address: RAM.CAT.COM
- Log in with CWS ID
  - The RAM homepage appears



74668-001 Example illustration

Displaying registered asset (genset)

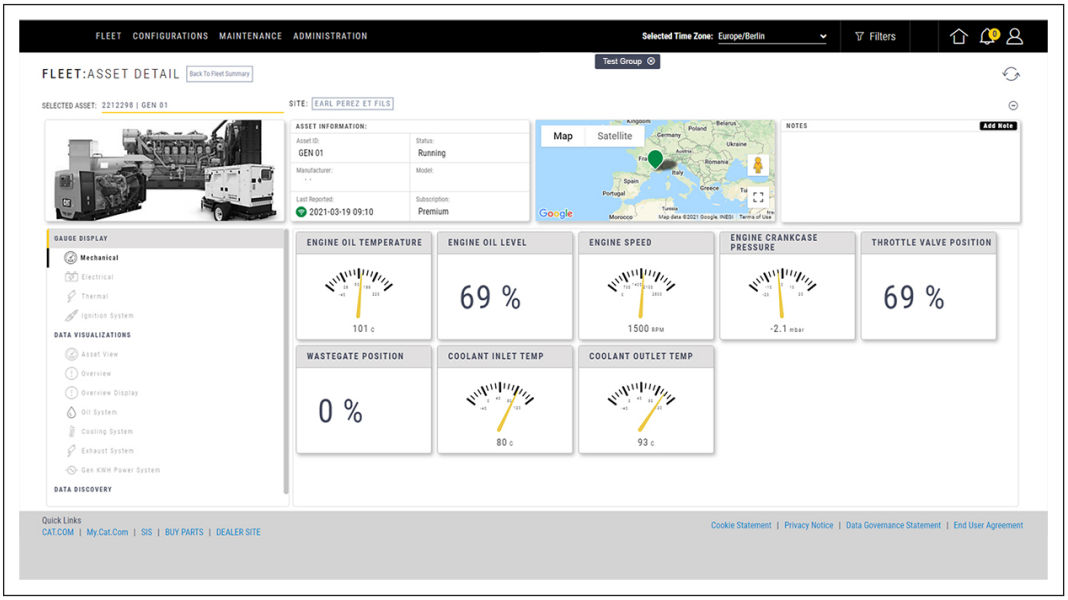
The RAM homepage lists the assets (gensets) valid for registered access on a map and in a table. Assets (gensets) are combined into groups and fleets depending on the configuration. In addition, the homepage displays an excerpt of important characteristic data and visualizes the number and severity of pending error messages.



74667-001 Example illustration

If required, a detailed representation of an asset (genset) can be called up.

- Using the mouse, select the desired asset (genset) in the table and click in the gray bar



74666-001 Example illustration

- If logging in is not possible or the installed Network Manager does not appear as an asset (genset) in RAM, contact the responsible dealer or service partner.

9 Troubleshooting

Table of contents

9.1 Safety notes

Conduct in the event of faults

1. In the event of faults that pose an immediate danger to people or property, press the emergency stop switch immediately
2. Inform those responsible at the operating site of the fault
3. In case of troubleshooting in the danger zone, stop the genset normally and secure it against restarting ⇒ Job card B 0-0-10
4. Depending on the type of fault, have it rectified by authorized specialist personnel or fix it yourself ⇒ Section Rectifying fault

   → If necessary, commission the contact person: Service partner.

9.2 Fault displays and messages

9.2.1 Network Manager

There are no fault displays on the Network Manager.

9.2.2 Cellphone radio

LEDs for fault display are located on the cellphone radio.

Signal	Meaning
Yellow	Mobile connection
Blue	Ethernet connection
Orange	GNSS connection

9.2.3 TPEM system

For further information on the fault displays, see

- Operating Manual ⇒ Operation ⇒ Control
  - TPEM Operating manual

9.3 Rectifying faults

9.3.1 Connection failures

In case of connection failures, the Communication Check should be performed first. For further information on the Communication Check, see chapter 10.5 Performing Communication Check 104.

For further information on faults on the Network Manager and the cellphone radio (optional), see

- M0111044-0 (en-us) - PLE702 Troubleshooting Guide

10 Maintenance

Table of contents

10.1 Safety notes

WARNING!

Electric shock if live components are touched

This can lead to severe injuries and even death.

- Only authorized specialist personnel may work on the electrical system.
- Turn off electrical power supply and secure against restarting:
  - Disconnect electrical system.
  - Secure against reconnection.
  - Check that equipment is de-energized.
  - Ground and short-circuit the electrical system.
  - Cover or cordon off adjacent components which are electrically live.

The disconnection of the plant also includes the measuring lines. Since individual measuring lines are connected upstream of the generator circuit breaker (GCB), they can carry mains voltage even when the genset is stopped and the power supply of the switch cabinet TPEM Control Cabinet (TPEM CC) is disconnected.

WARNING!

Risk of injury from improper maintenance

This can lead to severe injuries and even death.

- Only authorized specialist personnel may perform maintenance on the product
- Only qualified specialist personnel may work on the electrical system
- Only qualified specialist personnel may work on the fuel gas system
- Only use original parts

CAUTION!

Risk of burns from touching hot operating media or hot components.

This can lead to minor and severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to the ambient temperature.

Risk of destruction of components

Electrostatic charging of the assembly personnel or their tools can damage sensitive components or restrict their function.

- Observe handling regulations for components subject to electrostatic hazards

10.2 General

10.2.1 Further instructions

Further instructions are available online for authorized service personnel. A valid Corporate Web Security account (CWS) is required.

- Official shop for spare parts and service literature: https://catpublications.com
- Information system with media search: Service Information System (SIS 2.0)

10.2.2 TPEM system network information

Service computer

Service computer IP

- Static IP address: 165.26.78.2
- Subnet mask: 255.255.254.0

Network Manager

Port 10 Modbus and WAN port

- IP address: 10.0.0.66
- Subnet mask: 255.255.255.240

Cellphone radio

Port 7 Radio Module

- MAC address: see rating plate
- Subnet mask: see rating plate

Port 10 Modbus

- IP address: 10.0.0.66
- Subnet mask: 255.255.255.240

TPEM IPC

The Modbus is enabled for communication with the IP address 10.0.0.66 via port TCP/502.

TPEM RPG

- WAN/Modbus GateWay: br1
- IPv4 address: 10.0.0.65
- Subnet mask: 255.255.255.240

10.3 Software for maintenance

10.3.1 Web Configuration

Purpose

Web Configuration is the interface for accessing system data in the Network Manager.

Uniform Resource Locator URL

The Web Configuration URL is: http://165.26.78.1

Homepage

How to access

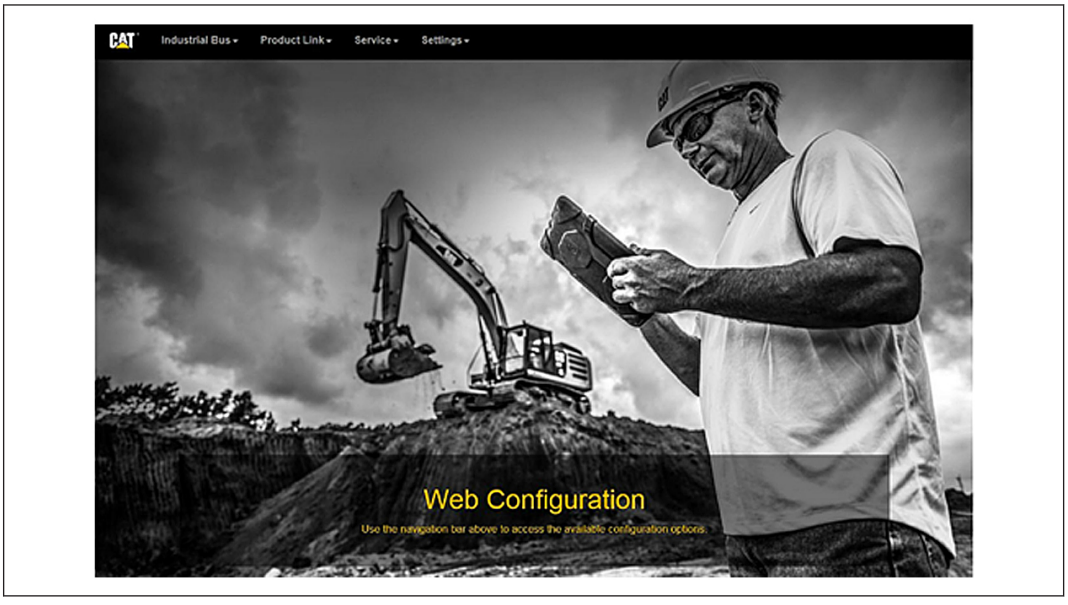
To call up the Web Configuration, the service computer must be connected to the Network Manager.

To display system data:

- Connect service computer to the Network Manager
- Establish power supply to the Network Manager
  - The Offline Configuration Tool starts

After starting, the Offline Configuration Tool in the service computer changes the adapter settings and thus enables offline access to Web Configuration via the URL.

Web Configuration homepage



74675-001 Example illustration of Web Configuration homepage

The main menu for selecting the desired functions is located at the top of the Web Configuration homepage. The contents of the main menu may differ depending on the version.

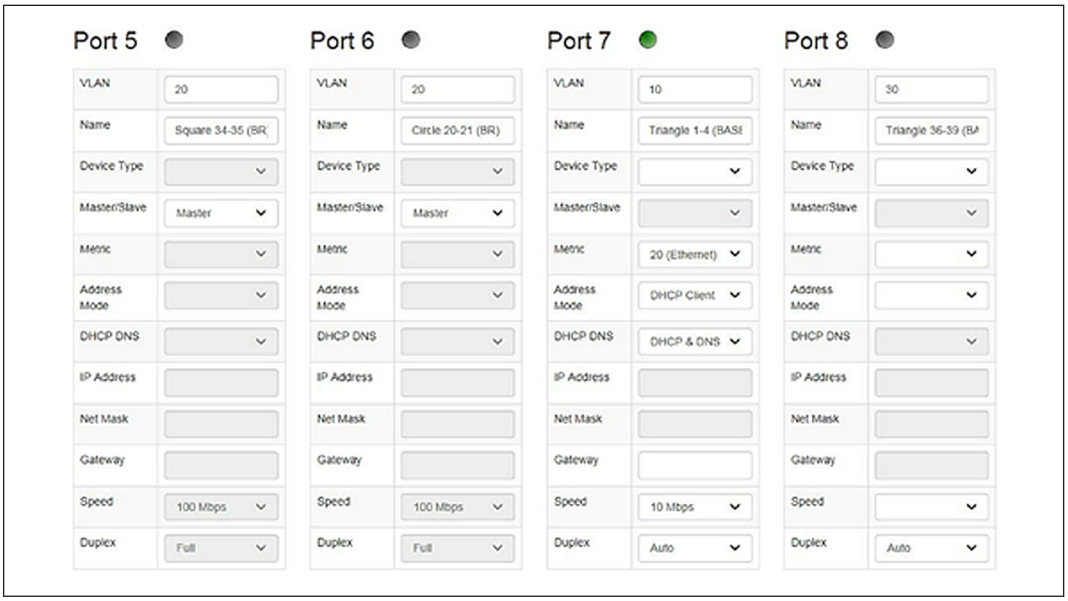
Network Configuration

The Network Configuration page allows administration of the interface and the network interfaces.

How to access

- Web Configuration homepage
- Main menu > Settings > Network Configuration

Network Configuration user interface



74676-001 Example illustration of Network Configuration

Changing settings (only port 7)

- To unlock the settings, click on the `Click to unlock and make changes` button
- Configure settings for port 7
- To apply the changes, click on the `Save and reboot` button

Example for port 7

`VLAN`: enables communication of VLANs (virtual networks). The factory setting `10` should be maintained.

`Device Type`: remains empty if no cellphone radio is connected.

`Metric`: Select `20` as value for wired Ethernet and twisted-pair-cable-based LAN. Select `30` as value for hardwired Ethernet and WiFi-based LAN.

`Address Mode`: Select `static` if the LAN is also equipped for static IP addresses. Select `DHCP Client` if the LAN is also equipped for DHCP.

`DHCP DNS`: remains empty if "static" was selected under `Address Mode`. Select `DHCP` or `DHCP & DNS` if `DHCP Client` was selected under `Address Mode`.

`IP address`: Enter `IP address` if `static` was selected under `Address Mode`. Remains empty if `DHCP Client` was selected under `Address Mode`.

`Net Mask`: Enter subnet mask if `static` was selected under `Address Mode`. Often specified by the operator. Remains empty if `DHCP Client` was selected under `Address Mode`.

`Gateway`: Enter the Gateway address if `static` was selected under `Address Mode`. Remains empty if `DHCP Client` was selected under `Address Mode`.

`Speed`: Select the appropriate speed. The factory setting is `10 Mbps`.

`Duplex`: Select the presetting. The factory setting is `Auto` and should be maintained if possible. A minimum of 100 Mbps full-duplex is typical.

For further information on the settings or network configuration, see

- M0111044-0 (en-us) - PLE702 Troubleshooting Guide
  - Settings - Network Configuration Page

10.3.2 Service Dashboard

Purpose

The Service Dashboard displays information and system data of the Network Manager and the cellphone radio (optional). Reports and tests and can be downloaded for troubleshooting.

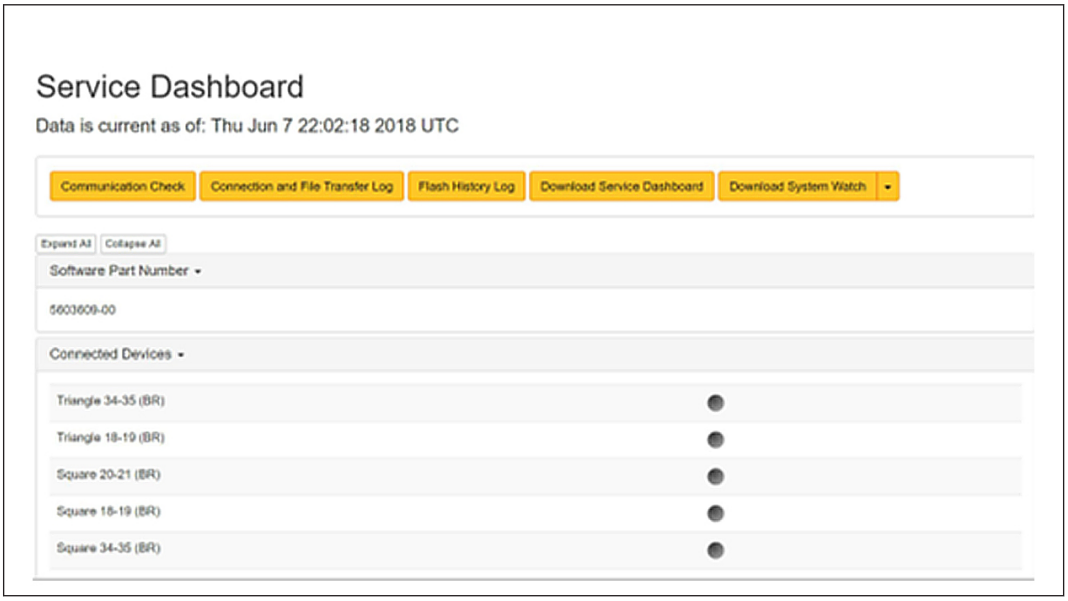
How to access

- Web Configuration homepage > Service Dashboard

To display system data:

- Connect service computer to the Network Manager
- Establish power supply to the Network Manager

User interface



74679-001 Example illustration of Service Dashboard

The user interface consists of:

- Toolbar with buttons
- Tabular display area

Toolbar

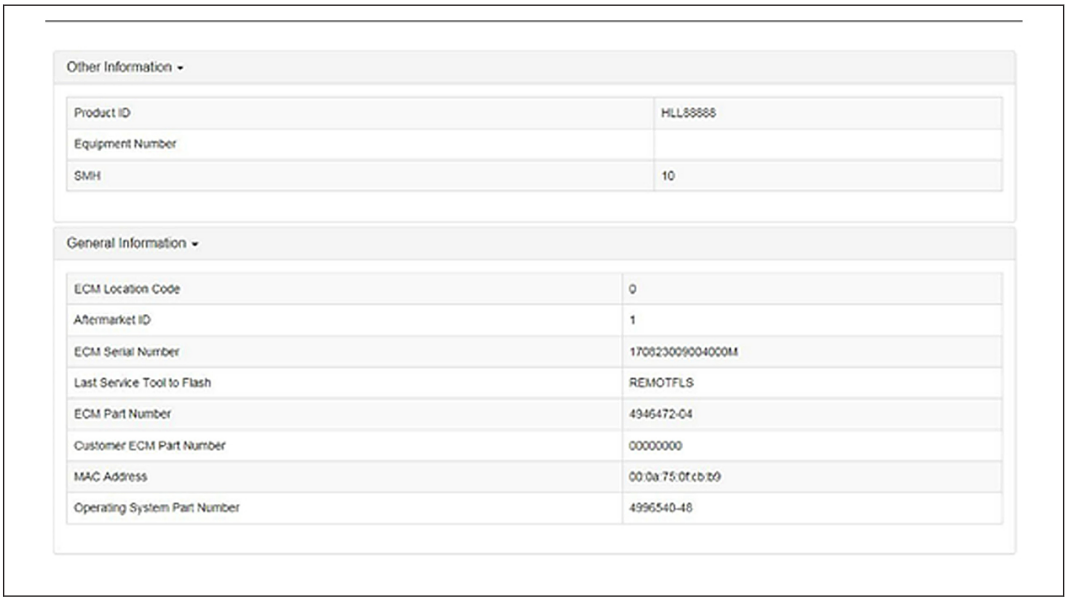
The following functions can be activated via buttons:

- `Communication Check`
- `Connection and File Transfer Log`
- `Flash History Log`
- `Download Service Dashboard`
- `Download System Watch`

Tabular display area

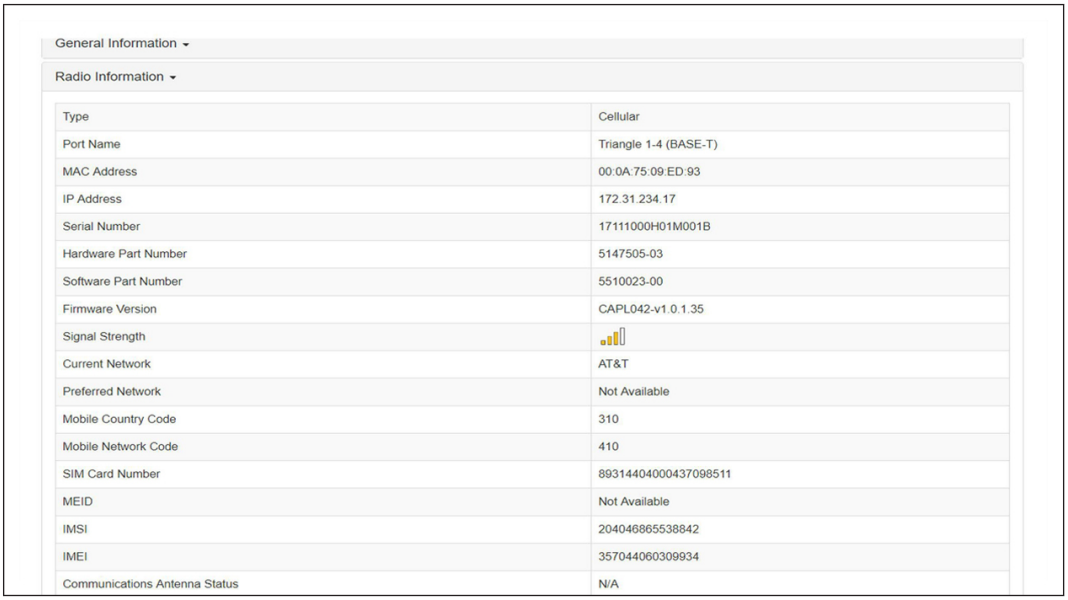
The display area shows specific system data or status messages. If a cellphone radio (optional) is installed, the display is divided into the `System Information` tab for the Network Manager and the `Radio Interface` tab for the cellphone radio.

This display provides information on the installed Network Manager.



74680-001 Example illustration for the system with the Network Manager

This display provides information on the cellphone radio (optional).



74681-001 Example illustration for the cellphone radio

Communication Check

Purpose

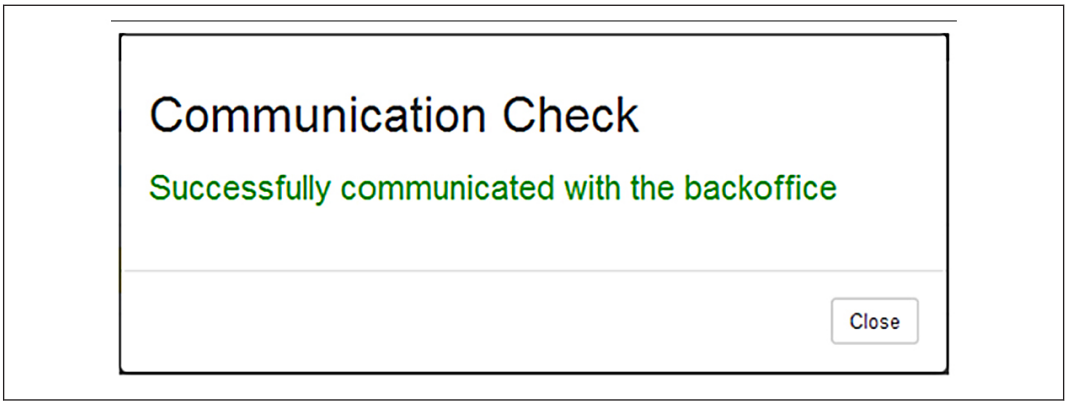
The `Communication Check` is an end-to-end test. It checks whether the Network Manager can send and receive data.

Procedure

As soon as `Communication Check` is selected, the test begins. The test may take a few minutes. As soon as the test is completed, a corresponding message appears.

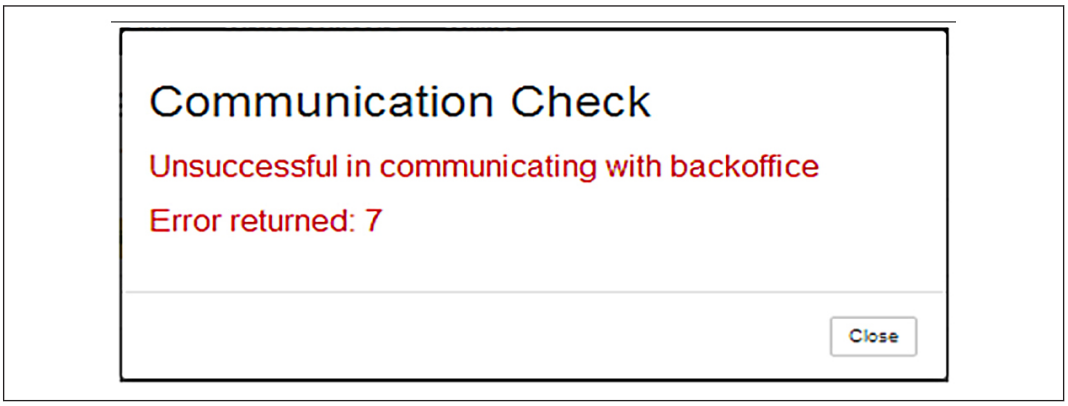
Messages

Message after a successful test:



74682-001 Example illustration of successful Communication Check

Message after unsuccessful test:



74683-001 Example illustration of unsuccessful Communication Check

Connection and File Transfer Log

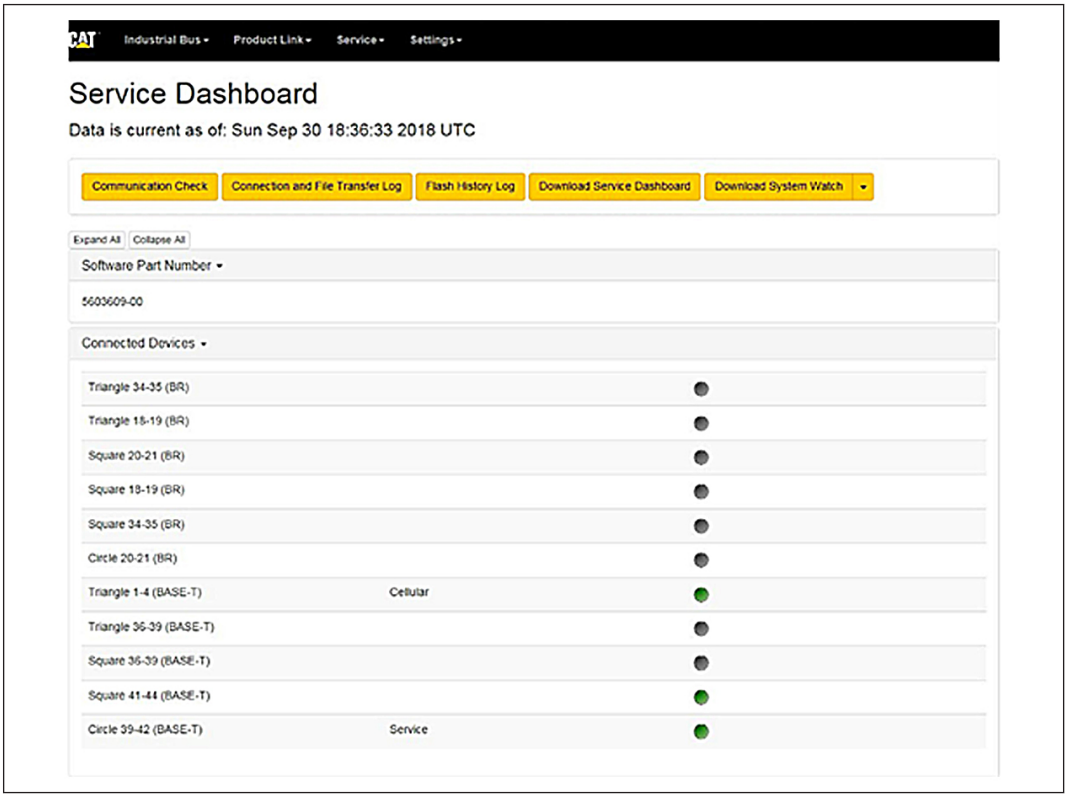
Purpose

The function `Connection and File Transfer Log` displays the status of the connected devices.

User interface

A visualized LED displays the status:

- Green: device is connected
- Gray: device is not connected



74684-001 Example illustration of Connection and File Transfer Log display area

Flash History Log

Purpose

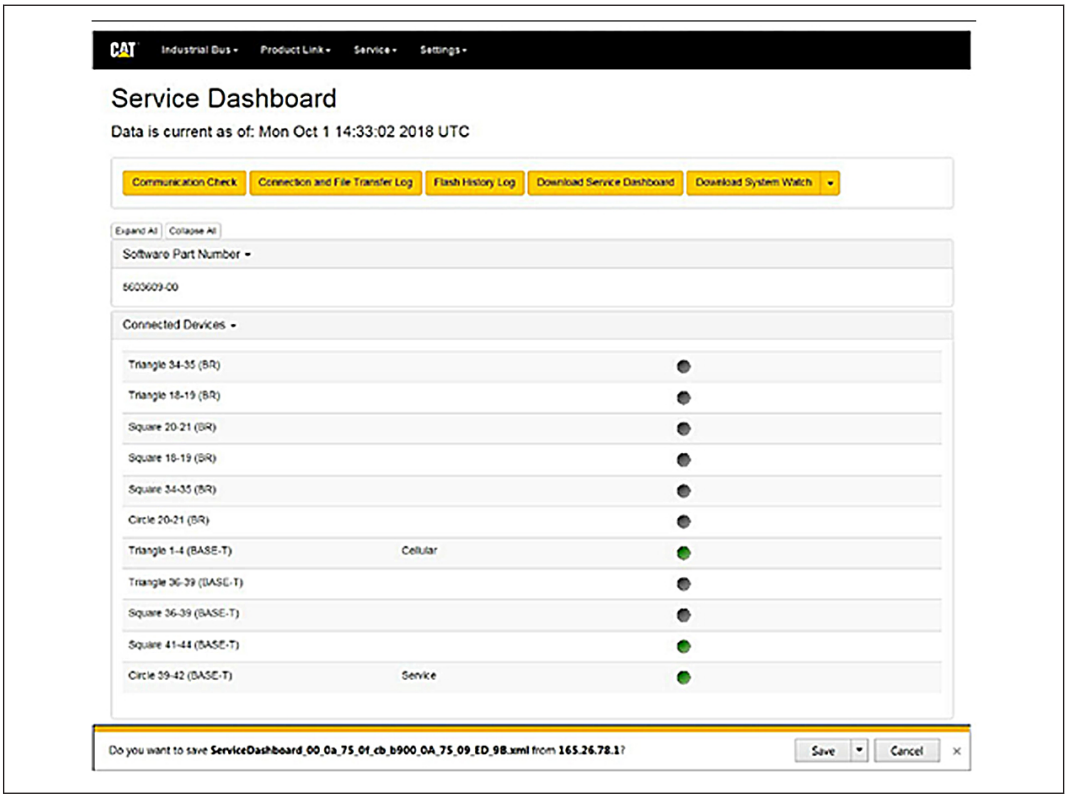
The function `Flash History Log` displays the previous flashes.

Download Service Dashboard

Purpose

The function `Download Service Dashboard` allows all the information from the Service Information screen to be saved in a single file. This file is especially useful when a DSN ticket must be sent.

User interface



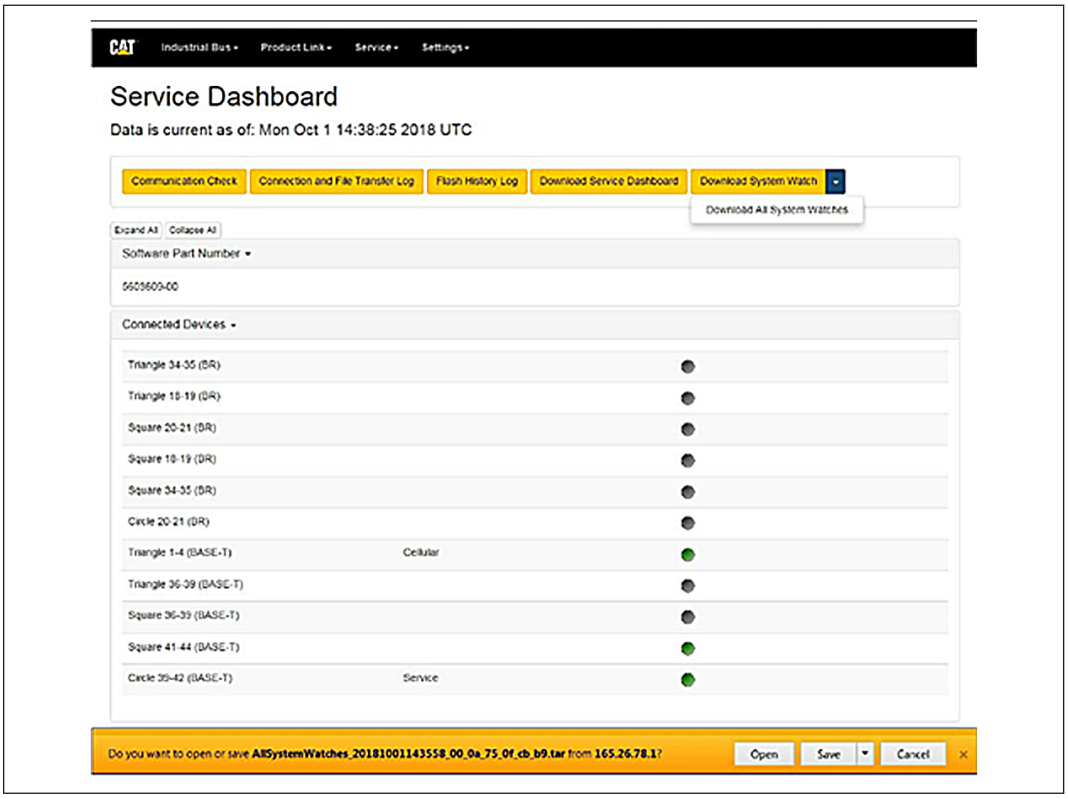
74685-001 Example illustration of downloading Service Dashboard

Download System Watch

Purpose

The function `Download System Watch` allows the file `All System Watches` to be saved. This file is required for a DSN ticket.

User interface



74686-001 Example illustration of downloading System Watch

10.3.3 Configuration Tool

Purpose

The `Configuration Tool` can be used to configure interfaces and functions of the Network Manager.

- Create and edit configurations
- Flash
- Load firmware onto the Network Manager
- Load, change and reload configuration files from the Network Manager
- Establish access to the homepage from `Web Configuration`

Installation

The software can be used on Windows operating systems and is available for download from various Cat web portals.

How to access

It can be accessed via the Windows user interface on the service computer.

To display system data:

- Connect service computer to the Network Manager
- Establish power supply to the Network Manager
- The `Configuration Tool` appears

User interface

74688-001 Example illustration of Configuration Tool

For further information on the Configuration Tool, see

- M0091831-5 (EN-US) Product Link Single Configuration Tool User Guide - Special Instruction

10.4 Initial setup of Web Configuration with certificate

Access to `Web Configuration` with certificate is set up in the `Configuration Tool`. Setup is carried out on the service computer and the Network Manager.

Service computer IP

- Static IP address: 165.26.78.2
- Subnet mask: 255.255.254.0

Accessing Configuration Tool

- Connect service computer to the Network Manager
- Establish power supply to the Network Manager
- The `Configuration Tool` appears

Certification

- Menu `DEVICES` > `REMOTE WEB PAGE`
- Tab `Certificate Authority` > `Create`
- Enter required information for identification of the certificate > `Apply`
  - The `Certificate Authority` tab displays the new entry.

Setting up key (token)

- Tab `Device` > `Get Token`
  - The Configuration Tool connects to the Network Manager and retrieves a token.
- If the tab displays the token > `Apply`
  - Access is provided and the data of the control components is displayed.
- In the line with the data next to the serial number entry, click to select the line
- In the small tab above the lines > `Edit`
  - The description can be customized as needed for easier identification.
- Click in the field `Authority` > Select certificate > `Apply`
- Click in the line with the data next to the serial number entry to select the line as before
- In the small tab above the lines > `Sign`
  - A file with the access data is generated.

Setting up Network Manager for access

- Click in the line with the data next to the serial number entry to select the line as before
- In the small tab above the lines > `Deploy`
  - The Network Manager data is displayed
- If not activated, activate the option field next to the IP address > `Apply`
  - Access is set up

For further information on the Configuration Tool and Web Configuration setup, see

- M0091831-5 (EN-US) Product Link Single Configuration Tool User Guide - Special Instruction

10.5 Performing Communication Check

The `Communication Check` checks whether the installation can communicate with the RAM infrastructure.

Service computer IP

- Static IP address: 165.26.78.2
- Subnet mask: 255.255.254.0

Procedure

- Establish power supply for the switch cabinet TPEM Control Cabinet
- Connect service computer to the Network Manager
- Access `Dashboard`
- `Main Menu` > `Communication Check`

If the check fails on error code 22, another check is performed after 5 minutes. If the check fails on error code 22 for more than 20 minutes, or if it fails on any other error code, find the cause.

For further information: chapter 10.3.2.2 Communication Check 96.

10.6 Uploading firmware (flashing)

Note

When firmware is uploaded, the internal memory of the Network Manager is deleted (flashed). All data is then lost!

Before the upload, backup files must be created for: Product Status Report (PSR), Electronic Control Module (ECM) Replacement file, Service Dashboard, all System Watch files and VIMS downloads.

There are different ways to flash the Network Manager. The procedure with Web Configuration is described below.

Service computer IP

- Static IP address: 165.26.78.2
- Subnet mask: 255.255.254.0

Uploading firmware

- Establish power supply for the switch cabinet TPEM Control Cabinet
- Connect service computer to the Network Manager
- Start `Web Configuration`
- `Menu Bar > Industrial Bus > Backup/Restore Settings`
  - This opens the user interface for file selection
- Select file with the firmware > `Upload and Restore Settings`
  - The file is uploaded and the Network Manager is flashed.
  - A bar displays the progress.
- Then load the newest configuration file in the same way

Checking configuration

- Menu Bar > Settings > Network Configuration
- Check data

10.7 Device replacement

10.7.1 Network Manager

To ensure that the subscription services in the Dealer Services Portal are not canceled, proceed as described below.

Preparation

- Check status of the new Network Manager in the RAM infrastructure

SWAP devices

For a refurbished Network Manager (SWAP device), reset the product ID to the default value of CAT00000.

Procedure

- Disconnect power supply for the switch cabinet TPEM Control Cabinet (TPEM CC)
- Disconnect connecting cable on the Network Manager
- Dismount mounting plate with Network Manager
- Clean assembly surface
- Install new Network Manager on the mounting plate with a new fastening set. Note tightening torque, see chapter 3.1.7 Mounting plate 22
- Connect new Network Manager
- Establish power supply for the switch cabinet TPEM Control Cabinet (TPEM CC)
- Set the product ID of the Network Manager to the Prime Product serial number
- For checking communication with the RAM infrastructure, see chapter 10.5 Performing Communication Check 104
- Check subscription status in the Dealer Service Portal

Re-logging in is not necessary since the asset (genset) downloads all required parameters from the RAM infrastructure.

10.7.2 Radio

Accessories

The removal tool is not included in the scope of delivery and must be ordered separately through the responsible dealer or service partner.

Article number: CAT 468-1897

Designation: Removal Tool

Procedure

- Disconnect power supply for the switch cabinet TPEM Control Cabinet (TPEM CC)
- Disconnect connecting cable
- Loosen affixed radio using the removal tool (accessory)
  - Position the removal tool at the edge of the cellphone radio.
  - Slowly slide the removal tool around the perimeter of the cellphone radio to loosen the adhesive.
  - Once enough of the adhesive has been removed to lift the cellphone radio without the removal tool, remove it completely from the adhesive surface.
- Clean assembly surface
- Install and connect new cellphone radio
- Establish power supply for the switch cabinet TPEM Control Cabinet (TPEM CC)
- For checking communication with the RAM infrastructure, see chapter 10.5 Performing Communication Check 104.
- Check subscription status in the Dealer Service Portal

11 Dismantling and disposal

Table of contents

11.1 Safety notes

CAUTION!

Injuries due to improper dismantling

This can lead to minor and severe injuries.

- Only service personnel may disassemble the product.
- Properly release the saved residual energies or allow them to escape.
- Handle open sharp-edged components carefully.
- Dismantle the components properly. Observe the partially high dead weight of the components. Secure components from being knocked over or falling down. If necessary, use lifting equipment.
- In case of doubt, contact the responsible dealer.

Danger to the environment

Auxiliary and operating media and materials can cause environmental damage

- When dismantling, adhere to all the valid national and regional environmental protection regulations
- Ensure that the auxiliary and operating media do not leak
- Drain off, collect and dispose of the auxiliary and operating media properly
- Sort the reusable materials (e.g. plastics, metals) and recycle them
- If necessary, commission a designated and certified specialist company to do this
- Improper dismantling may cause environmental damage

11.2 Disposing of components

Dismantling components

- Dismantle components and cabling

Notes on recycling

Unless a return agreement or disposal agreement was concluded, recycle the dismantled components.

The local authority or specialist companies for disposal shall provide information on environmentally sound disposal.

Warnings

Danger to the environment

Incorrect disposal of components and operating media may cause environmental damage.

- Electronic scrap, electronic components, lubricants and other auxiliary media are subject to the treatment of special refuse
- Electronic scrap, electronic components, lubricants and other auxiliary media may be disposed of only by designated and certified specialist companies

Proceed as follows:

- Scrap metals
- Disconnect and recycle electronic components and cables
- Recycle plastic elements
- Sort the remaining components as per the material properties and dispose of them properly

12 Appendix

Table of contents

12.1 List of abbreviations

Abbreviation	Explanation
DES	Demand for external starting preparations
JC	Job card
AKC	Anti-knock control
DMT	Dependent maximum current time protection
ANSI	American National Standards Institute
ETC	Exhaust turbocharger
AVR	Alternator Voltage Regulator (generator controller)
IAP	Intake air preheating
EHE	Exhaust heat exchanger
BDEW	Bundesverband der Energie- und Wasserwirtschaft (German Association of Energy and Water Industries)
oh	Operating hours
CHPS	Combined heat and power station
BY	Exhaust bypass
CH4	CH_4 Switch-On
PF	Power factor
TV	Throttle valve
M levels	Maintenance levels
f	Frequency
FRT	Fault Ride Through
FC	Frequency converter
FCC	Frequency converter cabinet
GGB	Generator group breaker
MC	Mixture cooler
MCC	Mixture cooling circuit
MCC RDTR	Mixture cooling circuit radiator
GPF	Generator power field
GAM	Gas-air mixer
GCB	Generator circuit breaker
GTR	Gas train
AD test	Auxiliary drive test
h	Hour
HAS	Auxiliary drive cabinet

Abbreviation	Explanation
HP	High pressure
HC	Heating circuit
HC EHE ECC	Heating circuit with exhaust heat exchanger in engine cooling circuit
HT	High temperature
HVRT	High Voltage Ride Through
ILF	Integral local frequency control
I/O	Input/Output
CAT	Catalytic converter
CPH	Coolant preheating
CL	Competence level
CHE	Coolant heat exchanger
LFSM	Limited frequency sensitive mode
CB	Circuit breaker
LVRT	Bridging of undervoltage (Low Voltage Ride Through)
MTDVM	Mains time-dependent voltage monitor
min	Minute
Max. / max.	Maximum
Min. / min.	Minimum
at least	at least
ECC	Engine cooling circuit
Grid code	Grid code requirements
DCC	Dump cooling circuit
DCC RDTR	Dump cooling circuit radiator
MCB	Mains circuit breaker
LT	Low temperature
P	Pressure
P diff	Differential pressure
PMV	Parameterizable measured value
PMC	Parameterizable controllers
PHE	Plate heat exchanger
TDC	Top dead center
PTFE	Polytetrafluorethylene
PHE	Plate heat exchanger
RAM	Remote Asset Monitoring

Abbreviation	Explanation
P&I diagram	Piping and instrumentation diagram
CV	Cabin ventilation
RP	Power decrease (Reduced power)
S	Speed
s	Second
busB	Busbar
SSOV	Safety shut-off valve
SC	Shutdown controlled
Act	Actuator
QCV	Quick closing valve
LHE	Lube oil heat exchanger
T	Temperature
TPEM	Total Plant and Energy Management
TPEM CB	TPEM Connection Box
TPEM CC	TPEM Control Cabinet
TPEM CU	TPEM Control Unit
TPEM GC I/O	TPEM Grid Code I/O Controller
TPEM I/O	TPEM I/O Controller
TPEM MFR	TPEM Multi Function Relay
TPEM PLE	TPEM Product Link Elite
TPEM RC	TPEM Remote Client
TPEM RC DT	TPEM Remote Client Desktop
TPEM RC TP	TPEM Remote Client Touch Panel
TPEM RPG	TPEM Remote Plant Gateway
TPEM RVS	TPEM Rendezvous Server
TPEM SaC	TPEM Safety Chain
TPEM TP	TPEM Touch Panel
TPEM TSG	TPEM Troubleshooting Guide
TR	Technical Bulletin
UPF	Underpressure filter
BDC	Bottom dead center
PLP	Prelubrication pump
WG	Wastegate
WO	without auxiliary drives

Abbreviation	Explanation
IG	Ignition general
SP	Spark plug
DCR	Dual core radiator