Data Concentrator
Technical Specification
CAM 3500

General
Description
The CAM 3500 data concentrator is a fully programmable device, used in
AMM systems for managing Bus communication and capturing data from slave
meters. At its heart stands the TST260 board with an ARM9 processor, 32 MB
(optionally 128 MB) memory and Linux operating system. CAM 3500 handles
required calculations and communication outputs. A USB flash disc can be
added to increase available memory, so as to enable capturing and collecting
of all data required. A permanent back-up is engaged, should a power outage
occur. The RTC processor (time generator) is backed up by an internal battery
as well. CAM 3500 is usually connected between the data central room and electricity
meters. It is used as a buffer memory between two Buses with different speeds,
e.g. Ethernet and PowerLine.
CAM 3500 can manage hundreds of electricity meters (up to 500). The exact
quantity is limited by Bus type and transmitted data volume.
CAM 3500 via M-Bus will serve two M-Bus masters, each with up to 250 slaves.
The RS485 Bus can be operated with up to 256 devices without introducing
repeaters.
As for the PLC bus, communication speed is the limit factor. Usually the number
of meters ranges between 100 to 500 per one data concentrator.

Optional Hardware Modules
CAM 3500 has 2xCOM + 2xUSB communication ports available. With respect
to data central room, TCP/IP communication is taken as default via Ethernet
connector, ADSL, WiFi, GPRS, PPP. In addition, CAM 3500 can optionally be
equipped with a GSM/GPRS modem, WiFi module, external communication
module connected via RS232 and internal or external USB2.0 port, e.g. PSTN
modem.
CAM 3500 can be connected to the electricity meter via any of the following:
PLC (PowerLine) modules, RS485, M-Bus via wires or ZigBee 0.868/2.4 GHz,
Wireless M-Bus, wireless RF Wavenis (868 MHz), manufactured by Coronis.
From CAM 3500 protrude one or two SMA connectors to which external
antennas can be coupled, facilitating wireless communication (GSM, Wavenis,
Wireless M-Bus or ZigBee). In some cases the internal antenna can be used.
Transmission reliability, however, cannot be guaranteed due to possible signal
strength insufficiency.
Communication Protocols
CAM 3500 uses open communication protocols, e.g. Wavenis, ZigBee Alliance, Ethernet (TCP/IP), all of which are AES protected when communicating with the electricity meters or SSH protected if communicating with the data central room. Data are binary encrypted and controlled (transmission reliability) using a CRC.

FRONT PANEL DESCRIPTION

SERVICE CONSOLE
Service connector for the Linux PCB (Connector Cannon 9 pin)

SERVICE PIN
Switches PLC modem to service mode
# LED Indicators

<table>
<thead>
<tr>
<th></th>
<th>RS485 Bus Status</th>
<th>PLC Modem Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Yellow LED lit</strong> Rx receiving</td>
<td><strong>Red LED lit</strong> ERR = no node is connected to PLC</td>
</tr>
<tr>
<td></td>
<td><strong>Green LED lit</strong> Tx transmitting</td>
<td><strong>Red LED flashes</strong> Poor communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Green LED lit</strong> NET = at least one PLC node is connected</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Green LED flashes</strong> Good communication</td>
</tr>
</tbody>
</table>

|        | PLC Service Mode Status                               |
|        | **Red LED** PLC modem in service mode                 |

|        | Device Power Supply Status                            |
|        | **Yellow LED lit** +12 V power supply status          |
|        | **Green LED lit** Linux status                        |

|        | GSM Module Power Supply Status                        |
|        | **Green LED lit** +3.4 V power supply status          |
|        | **Yellow LED lit** GSM                                |

|        | GSM modem Status                                      |
|        | **Red LED lit** GSM ring                              |
|        | **Yellow LED lit** GSM sync                           |

*(lit – communication established, flashing – connected to GSM network)*

## Dimensional Sketch

![Dimensional Sketch](image)
WIRING DIAGRAM FOR NETWORKING

Connectors

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS485</td>
<td>P4: source +12 V for line power supply</td>
</tr>
<tr>
<td></td>
<td>P5: GND</td>
</tr>
<tr>
<td></td>
<td>P6: RS485 A</td>
</tr>
<tr>
<td></td>
<td>P7: RS485 B</td>
</tr>
<tr>
<td></td>
<td>P8: RS485 shielding</td>
</tr>
<tr>
<td>ETH</td>
<td>RJ48 connector for Ethernet</td>
</tr>
<tr>
<td>PSTN</td>
<td>RJ11 connector for telephone line connection</td>
</tr>
</tbody>
</table>

Dashed line shows how to connect PLC to L1

WIRING DIAGRAM FOR CPL350 Add-ON

The CPL350 Add-On enables to expand PLC communication to the remaining 2 phases (shown are L2 and L3).
**TECHNICAL DATA**

### Basic Data
- Nominal Voltage Un: 3 x 230V
- Operation Voltage Range: 0.75 Un to 1.15 Un
- Own Consumption: typically 10 W, max. 20 W
- Nominal Frequency: 50 Hz

### Communication Connectors
- Ethernet: connector RJ48
- RS232: connector for universal application - Cannon 9 pin
- RS232: service connector - Cannon 9 pin
- RS485 with External Power Source: terminal board 5 x M3
- GSM Antenna: connector SMA
- RF Antenna for 868 MHz or 2.4 GHz: connector SMA

All communication connectors are galvanically separated (4kV) from mains.

### Impact of Surroundings
- Operation Temperature Range: -30°C to +70°C
- Storage Temperature Range: -35°C to +75°C
- Ingress Protection: IP51 as per EN 60529

### Voltage Impulse Resistance
- Impulse Voltage: 8 kV
- Impulse Shape: 1.2 μs / 50 μs

### Electromagnetic Compatibility
- Electrostatic Discharges: as per EN 61000-4-2
- High-frequency Magnetic Field: as per EN 61000-4-3
- Fast Transient Phenomena (impulse group) 8 kV: as per EN 61000-4-4
- Suppressing Radio Interference: as per EN 55022

### Power Supply Terminals L1, L2, L3
- Terminal Diameter: 3.2 mm
- Connecting Screws: M3 x 5 or M3 x 7
- Maximum Torque: 1 Nm
- Connecting Wire Cross Section: 0.75 to 2.5 mm²

### Power Supply Terminal N
- Terminal Diameter: 7.2 mm
- Connecting Screw: M6 x 14
- Maximum Torque: 3 to 5 Nm
- Connecting Wire Cross Section: 0.75 to 2.5 mm²

### Auxiliary / Communication Terminals
- Terminal Diameter: 2.6 x 4 mm
- Connecting Screw: M3 x 6
- Maximum Torque: 1 Nm
- Connecting Wire Cross Section: 0.75 to 2.5 mm²

### Weight and Dimensions
- Weight: approx. 1.5 kg
- Width: 178 mm
- Height: 284 mm
- Depth: 70 mm

### Miscellaneous
- Seals: 2 locations for CAM cover, 1 location for Terminal Board Cover
- Alarm messages: tampering with CAM/Terminal Board Covers; exceeding of temperature limits etc.
- Operation Position: vertical
- GSM SIM card: inside device in sealed compartment
DATA CONCENTRATOR FUNCTIONALITIES

Router / Repeater
The core functionality is data transmission from meters to the data central room. To do this, CAM 3500 gathers data from slave meters via one communication type and relays them to the data central room via another communication type. Data transmission is fully bi-directional; both from the meters to the data central room as well as from the data central room back to the individual meters.
CAM 3500 can also work as a repeater/router or, if so required in specific cases, as a RF communication router, providing for longer RF signal reach.

Services
CAM 3500 receives mass and planned commands in order to execute them via the Bus. Group commands are forwarded as broadcast or unicast, depending on communication bus type.
Broadcast (network addressing as a whole) is used for buses PLC and RF, RS485, M-Bus.
Unicast (distribution and communication with individual nodes) can be optionally used for M-Bus.
CAM 3500 loads planned commands into the scheduler (task planner) and these are carried out as defined.

Data Gathering / Concentration
CAM 3500 enables periodical (planned) data readouts from slave units. The data can be either relayed to the data central room directly, or memorized and relayed in a compressed format as required, e.g. in tgz or zip. Other key functionalities are CAM 3500 operation as well as communication progress monitorings. These activities are logged and the files can be relayed to the data central room in order to be mined for various data, e.g. communication speed, response time etc.

OTHER FUNCTIONALITIES

Events Logging
The events recorder logs all non-standard events and important infos together with a time stamp. Examples of non-standard events are poor communication, no response from meters, etc.

Communication Data Logging
For future analysis, communication traffic can be logged as a whole. As a rule, errors are logged permanently whereas traffic is assessed statistically.

Based on existing communication topology, CAM 3500 builds a communication table / tree. In PLC communication, as an example, if CAM 3500 sees no electricity meter directly, it will use another electricity meter to communicate.

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Alarm Messages
Alarm messages relate to preset events; at times they are relayed to the data central room. Alarm messages are always time stamped. Examples of alarm messages are data concentrator cover opening or too high a temperature, voltage level error, etc.

Slave Device RTC Adjustment and Inspection
As planned, (e.g. twice a day), a specific group command, containing actual time, is broadcasted. This command has no encryption and affects receiving device RTC only if its deviation exceeds preset limit, e.g. 15 mins. Slave device real time is checked on an ongoing basis and if its deviation exceeds prescribed value, an alarm message is either relayed to the data central room or concentrator tries to change the time in slave device.

Communication Statistics
The concentrator measures response time of each message and logs the result to a table together with recipient address and response time. Number of message recipients monitored can be limited. When the limit number is reached, new recipien statistics are not captured but the data central room is notified by an alarm.

Table
Head: AMM address, date and time of creation (resetting), date and time of the last message from the recipient
Data: actual day, yesterday, total from reset without the actual day and yesterday
Data structure: 8 items by 16 bits, when reaching the value of any item max – 1000 messages to the central room, when reaching the maximum, let the maximum be and do not count that item any more

<table>
<thead>
<tr>
<th>Item</th>
<th>response time</th>
<th>(response parameter can be changed as required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>0-5 sec</td>
<td></td>
</tr>
<tr>
<td>Item 2</td>
<td>5-10 sec</td>
<td></td>
</tr>
<tr>
<td>Item 3</td>
<td>10-20 sec</td>
<td></td>
</tr>
<tr>
<td>Item 4</td>
<td>20-50 sec</td>
<td></td>
</tr>
<tr>
<td>Item 5</td>
<td>50-100 sec</td>
<td></td>
</tr>
<tr>
<td>Item 6</td>
<td>100-err sec</td>
<td></td>
</tr>
<tr>
<td>Item 7</td>
<td>exceeding err sec</td>
<td></td>
</tr>
<tr>
<td>Item 8</td>
<td>number of messages sent by the recipient (error + log-on, not answers)</td>
<td></td>
</tr>
</tbody>
</table>
**DESIGN**

CAM 3500, stemming from a design traditionally proven, is designed so as to withstand demanding operation conditions, enable simple handling and deliver increased protection from unauthorized consumption. The design solution offers a simple installation. The installation is done using three screws to an A Base. The vertex can be adjusted by sliding the hook to achieve two dimensions - 155 mm (DIN 43857) and 175 mm. Sealing slots safeguard from unauthorized entry (tampering) in various places of the CAM 3500. CAM 3500 case and terminal block dimensions comply with DIN 43857. CAM 3500 cover enables stacking of devices during storage.

**INSTALLATION**

Installation is done using three screws to an A Base. Sealing slots safeguard from unauthorized entry (tampering) in various places of the CAM 3500.

**Installation Authorization**

CAM 3500 installation can only be conducted by a specially authorized person, compliant with all qualification requirements.

**TYPE DESIGNATION**

<table>
<thead>
<tr>
<th>CAM 3500, ## ##</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Internal Module for Communication with Central System</strong></td>
</tr>
<tr>
<td>Ethernet Module Installed</td>
</tr>
<tr>
<td>GSM/GPRS Module Installed</td>
</tr>
<tr>
<td>WiFi Module Installed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Type of Internal Module for Communication with Meters</strong></th>
<th>00 – FF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavenis 868 MHz Module Installed</td>
<td>xxxxxxxx1</td>
</tr>
<tr>
<td>ZigBee 2.4GHz Module Installed</td>
<td>xxxxx1xx</td>
</tr>
<tr>
<td>RS485 Module Installed</td>
<td>xxx1xx</td>
</tr>
<tr>
<td>PLC (zone A) Module Installed</td>
<td>xxx1xxx</td>
</tr>
<tr>
<td>PSTN Modem Installed</td>
<td>xxx1xxxx</td>
</tr>
</tbody>
</table>
PROPER DISPOSAL OF DEVICE AND PACKAGING MATERIAL

Device with expired service lifetime must be handed over to specialized companies that carry out material separation or their recycling, and unused products must be disposed off ecologically in line with the Law on Waste.

The device contains no radioactive or carcinogenic agents or other materials harmful to health or environment. All plastic parts can be recycled.

Packaging materials:
- special carton boxes can be recycled;
- used cartons to be handed over to companies, to be utilized as a source of secondary raw materials or energy.

NOTICE OF MANUFACTURER

The product can be used safely. The manufacturer issued the Statement of Conformity as specified in § 13 of Law No. 22/97.

In spite of this, however, the manufacturer draws attention to possible risks resulting from incorrect operation or use of the product:
- Installation and maintenance must be carried out only by trained persons with electrotechnical qualifications who will tell the customer all the conditions of safety at work.
- The product must not be used for purposes different than those it was manufactured for.
- The product must not be wilfully modified to be different than it is specified in the type specification.
- The product must not work with different voltage, current and frequency than it was manufactured for or must not be professionally modified.
- The product must be placed and secured in such a way that no unauthorized persons without electrotechnical qualifications, especially children, could handle it.
- Each time the product is again put into operation, e. g. after a repair, maintenance, complete protection must be secured as well as all necessary safety measures must be taken and the checkup must be made by authorized staff.
- It is necessary - during operation of the product - to prevent risks of fire or explosion in case of generated gases, inflammable liquid vapours or gun-powder occurrence.
- If an authorized person handle the product, there must be no voltage present in the unit; it does not apply to measuring using insulated tips.
- The product must not work in such conditions and environment that do not secure safety operation (e. g. installation on the inflammable base, the cover made of an inflammable material, imperfect protection against penetration of foreign bodies and/or water or other liquids).
- The product must not work in the rooms where vibrations and shocks are greater than it is given in the technical specification.

If the user does not respect any of the above warnings and if any defect occurs because of such neglect, the manufacturer is not responsible for such a defect.