

# AmsCPU-IO-NB/M



Data Sheet

## Description

The AmsCPU-IO-NB/M module is the fourth generation module for streetlight management and control. The module is designed for GridLight™ to provide basic needed functionality for feeder pillar streetlight control. Equipped with a powerful ARM9 processor and a Linux kernel, the module monitors and controls all other modules in the Amplex Module System. Direct communication and power supply between the modules are handled by means of an A-Bus interface, which is based on the industrially proven RS-485 technology. The AmsCPU-IO-NB/M module is an extended AmsCPU with three relays, MODBUS connections to smart meters, S0 interface to traditional pulse meters and connectivity to a leakage current sensor and NB-IoT/LTE-M with 2G fallback.



The AmsCPU-IO-NB/M module serves as a WAN communications and data concentrator module. Two-way communication with the central server takes place via NB-IoT (NB2), LTE-M (M1) or Ethernet. The module has the ability to automatically switch between different available communication carriers in order to provide stable and reliable communication. Other carrier types like, e.g. WIFI and LoRaWAN can be implemented later (using the USB or the Ethernet port on the module) to obtain the best, most reliable and cheapest communication in the future.

Data are either delivered to the server immediately or stored locally in the built-in flash memory of the AmsCPU-IO-NB/M module until scheduled delivery. Software and configurations are updated remotely from the server and stored on the AmsCPU-IO-NB/M module enabling it to autonomously execute tasks.

Voltage values on all three phases of the main supply are monitored by the AmsCPU-IO-NB/M module. If the module is installed together with an AmsBattery module, the AmsCPU-IO-NB/M will be supplied with backup power via the A-Bus in the event of power failure. This enables the AmsCPU-IO-NB/M module to store data and send a main power failure alarm to the central server before it shuts down safely.

## Functionality

Topic	Comments
<b>Monitoring</b>	Battery shutdown Battery low Communication class availability Over/under voltage (every phase) Main power failure Phase fault (every phase) Extra phase, for example cabinet door
<b>Communications</b>	The Amplex Communication Framework (AmpCom) enables two-way multi-carrier communication. AmpCom uses communication classes to define the priority of the data. One or more carriers are assigned to each class. If one carrier is not available, another carrier is used instead. Supported carriers: NB-IoT (NB2), LTE-M (M1), Ethernet
<b>Autodiscovery</b>	All modules and meters connected to the AmsCPU-IO-NB/M module are automatically discovered by the system. In case a module/meter is disconnected from the AmsCPU-IO-NB/M, this is reported to the server application and the module/meter is listed as missing. If the module/meter is reconnected to the AmsCPU-IO-NB/M or another AmsCPU-IO, it will be rediscovered by the system.
<b>Real-time clock</b>	The AmsCPU-IO-NB/M module has a calendar and a real-time clock with an absolute maximum deviation of $\pm 7$ seconds per 24 hours in the full temperature range. This is without synchronization with external units. Under normal conditions, clock deviation is automatically adjusted according to the Network Time Protocol (NTP) which gives a maximum deviation of $\pm 1$ second.

## Technical Specifications

### Operational specifications

Storage temp.	-40°C to +85°C
Operating temp.	-20°C to +65°C
Max humidity	90% (non-condensing)
IP grade	IP20
Input voltage	190 to 250 V AC (3P + N)
Power consumption	Typical < 2 W
Current consumption (A-Bus powered)	Typical 100 mA Max 300 mA

### Standards and approvals

2006/95/EC, Low Voltage Directive (LVD)  
2004/108/EC, EMC Directive  
1999/5/EC, R&TTE Directive  
2002/95/EC, RoHS Directive



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Topic	Comments
Local storage of data	The collected data are stored in non-volatile memory which holds the values until they are sent to the server. The AmsCPU-IO-NB/M module has the capacity to store data for at least 150,000 historical measurements, depending on the data size of the values.
Battery	Internal backup battery for clock and tampering monitoring
Front panel LEDs	Green (1): Power - flashes during startup, constant when ready. Small blinks if meter is connected. Yellow (2): Carrier - Indicates GSM/Ethernet connectivity, missing SIM card and signal strength. Red (3): Server connectivity. Lights up when server connection is established.
PCB LEDs	CPU LED (red): indicates whether the AmsCPU-IO-NB/M module is up and running. Communication status LED (green): indicates whether a GSM or an Ethernet connection has been established with the server. AMS Status LED (green): indicates whether the A-Bus is up and running.

## Connections

I/O	Comments
RS232 interface	Max data transfer rate 115.2 kbps
Service port	For use with Amplex service tools
A-Bus	12 V DC supply to client modules, 10 W (max) In case of power failure, the A-Bus also serves as backup power supply for the AmsCPU-IO-4G module.
Phase voltage	Phase voltage measure ( $\pm 2\%$ FSD in 190-250 V range, $\pm 5\%$ FSD outside this range) on three-phase supply and one extra phase (230 V AC analog input). This phase may be used for, e.g. cabinet door monitoring.
Power supply	The AmsCPU-IO-NB/M module can be powered by one, two or three phases + neutral. Nominal voltage: 230 V AC, Nominal frequency: 50/60 Hz. When powered by three phases, the AmsCPU-IO-NB/M module will be able to detect phase faults on the main power supply. If a fault occurs on one or two phases, the AmsCPU-IO-NB/M module will still be powered by the remaining phase(s). In this case, the AmsCPU-IO-NB/M module will send an alarm to the central server.
USB	USB 2.0 (12 MB/s) for additional devices, host port, max 250 mA, 5 V
Analog inputs	Analog input 0-10 V, 4-20 mA (0-20 mA): Impedance = 510 Ohms (DC) Accuracy = $\pm 2\%$ FSD  Can also be used as digital input: Threshold of approximately 1 V Max input voltage = 12 V (A-Bus voltage can be used.)
Digital input/ Tamper detection	One digital input with 1 MOhm internal pull-up. Off resistance less than 100 kOhms. It is intended for use with a relay contact or an NPN open collector device on input connections 6 and 5. In addition to digital input, it can for example be used for tampering detection using the internal backup battery.
Ethernet	RJ45 connector, 100 Mbps/10 Mbps, half & full duplex
Cellular	SMA connector for external GSM antenna. B2/B3/B5/B8/B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B27/B28/B66/B71/B85
SIM Card	SIM card is inserted behind top part of the cabinet.
Power consumption	If the AmsCPU-IO-NB/M module is connected to the maximum number of client modules possible, the setup consumes max 18 W. In an average installation consisting of the AmsCPU-IO-NB/M module and three AMS modules, the AmsCPU-IO-NB/M module typically consumes less than 2 W.
Relays	Three relays that are galvanically isolated and are used for switching minor loads on and off directly and three-phase or larger loads via an intermediate breaker. One of the three relays provides both NO and NC functionality. Max switching voltage: 250 V AC/30 V DC (resistive). Max switching load: 3A.
S0	One S0 input according to the DIN 43 864 and EN 62053-31 standards.
MODBUS	One MODBUS interface based on RS485
Leakage current sensor input	Input range: 1 - 15 mA, rel. accuracy: $\pm 0.3\%$ FSD, abs. accuracy $\pm 5\%$ FSD Detection range: 170 -3000 mA (Absolute max rating 7000 mA)

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## Technical Specifications

### Processor Details

Family	ARM9
Performance	200 MIPS

### Operating System Details

OS	Linux® operating system
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### GSM Details

Bands	NB-IoT/LTE-M1 bands: B1 (2100), B2 (1900), B3 (1800), B4 (AWS 1700), B5 (850), B8 (900), B12 (700), B13 (700), B18 (800), B19 (800), B20 (800), B26 (850), B27, B28 (700), B66, B71, B85 – 2G bands: B2 (1900) B3 (1800) B5 (850) B8 (900)
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Technology	LTE UE Cat M1/NB2 – EGPRS (2G Fallback)
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Max DL speed	LTE-M1 588 kbps – NB2 120 kbps – EGPRS 264 kbps
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Max UL speed	LTE-M1 1 Mbps – NB2 160 kbps – EGPRS 210 kbps
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MIMO Support	Yes
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SMS	MT, MO, CB, Text and PDU SMS storage: SIM card plus. Transmission of SMS can alternatively be user-defined
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SIM interface	Supported SIM card: 3 V
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## Physical Specifications

Weight	262 g
Top part	Gray (RAL 7035) Lexan 940
Base part	Black (RAL 7021) Noryl VO 1550
Coating	Conformal coated
A-Bus connector	0.14 - 0.5 mm <sup>2</sup> (AWG 26-20)
RS-232 connector	0.14 - 0.5 mm <sup>2</sup> (AWG 26-20)
Power connector	0.14 - 1.5 mm <sup>2</sup> (AWG 26-16)
Input connector	0.14 - 0.5 mm <sup>2</sup> (AWG 26-20)
Mounting	DIN-rail (EN50022)

## Reliability & Maintainability

### Topic Comments

Software upgrade	The software on the AmsCPU-IO-NB/M module can be updated remotely from the central server.
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Multi-layer system health	Various internal processes ensure that the system is up and running at all times. In case a process is stalled, it is restarted without disturbing other processes.
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Installation of new software	New software is transferred without interrupting the normal functionality of the AmsCPU-IO-NB/M module. When the software has been transferred, the integrity of the software is checked and the software is installed.
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Self-test	A built-in self-test (BIST) is performed after power-up.
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# AmsCPU-IO-NB/M

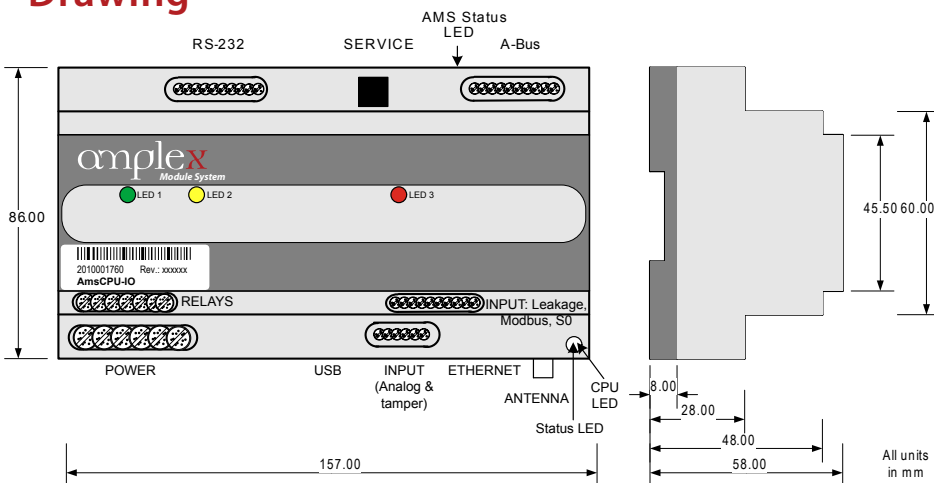


## Installation Guide

The AmsCPU-IO-NB/M module can be connected to any client module in the Amplex Module System, e.g. AmsRS485, AmsSwitch. The A-Bus connections are internally daisy-chained for easy installation.

Topic	Comments
<b>A-Bus cable</b>	Use shielded twisted pair cable.
<b>A-Bus cable length</b>	< 3 m
<b>Input cable length</b>	< 3 m
<b>USB cable length</b>	< 3 m
<b>RS-232 cable length</b>	< 3 m
<b>Ethernet cable length</b>	< 3 m
<b>0.5 mm<sup>2</sup> terminals</b>	Use a 2 mm slotted screwdriver to loosen/tighten the terminal screws.
<b>Functional earth</b>	It is recommended that the A-Bus connection 1 or 6 is connected to functional earth. This is not for safety protection as the AmsCPU-IO-4G module is protection class II equipment.
<b>Enclosure</b>	The AmsCPU-IO-NB/M module must be installed in an enclosure of protection degree IP65 or installed at a location that provides the module with the same level of protection.
<b>Antenna</b>	Insert the antenna in the antenna socket of the AmsCPU-IO-NB/M module and tighten it gently with your fingers. Do not use tools.

## Drawing

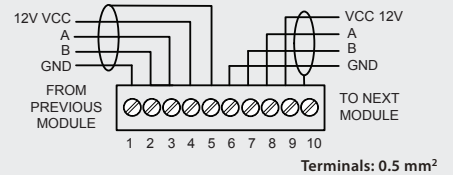


## Ordering Information

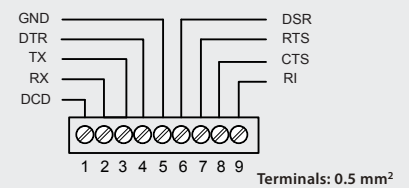
Product	Order number	Product	Order number
AmsCPU-IO-NB/M	100-10-006	Leakage current sensor	200-20-000
Vandal resistant antenna	230-20-000	Amplex SIM Mini	260-10-000
Mini-PT Dual antenna	230-30-000	Varistor	250-30-000
Mini-PT Dual antenna 90°	230-30-001	Analog light sensor	250-40-000
Wifi USB Module	250-50-000		

## I/O Schematic

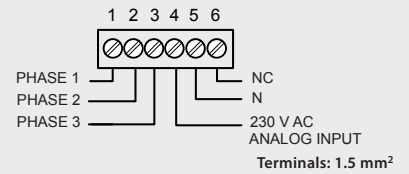
### A-Bus connection



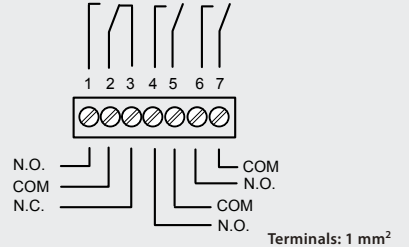
### RS-232 connection



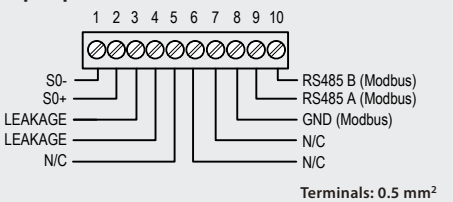
### Main power connection



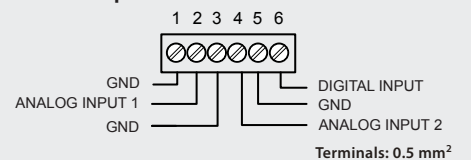
### Relay connection



### Top Input connection



### Bottom Input connection



Bødker Balles Gård 24-26  
8000 Aarhus C  
Denmark  
Phone +45 7199 2525  
Email info@amplex.dk  
www.amplex.dk