Advanced Multi-Purpose Very Low Power Data Logger with Global Connectivity

METEODATA-4000 SERIES

INTRODUCTION

The MTD-4000 series is Senseca's 6th-generation data acquisition system for environmental monitoring. Its versatility, reliability, robustness and very low power consumption make it suitable for meteorological, hydrological, solar, road, weather and many other applications.

As an open platform, METEODATA-4000 works with a wide range of commercial off-the-shelf sensors and communication technologies, while providing onboard processing, self-diagnostics and alarm management to ensure high data quality and autonomous operation in harsh outdoor conditions.

FEATURES

Universal sensor compatibility

Interfaces with almost any COTS sensor: analogue (voltage, current, resistance), pulse inputs and smart digital sensors (RS-232/RS-485, SDI-12, Modbus, NMEA, ASCII).

Onboard data processing & alarms

Implements algorithms based on key meteorological standards and manages real-time self-diagnostics and up to 32 alarm channels.

Low-power, rugged design

Industrial-grade components with built-in ESD, surge and brownout protection, plus optional ultra-low-power LCD HMI, ensure reliable outdoor operation.

Autonomous cabinet versions

Cabinet models include one to three internal batteries, protections, power supply and connectors, which, along with the integrated charger, ensure several days of operation without the need for external power.

Flexible communications & software ecosystem

Supports multiple communication interfaces and protocols for integration into existing networks, SCADAs and IoT platforms, and is fully supported by the Geo-DataView software package for data access and datalogger management.

CONFIGURATION & MEASUREMENT

Sensor interfaces & configuration

The acquisition interface supports analog sensors with pulse outputs, as well as digital and smart sensors via RS-232, RS-485, SDI-12, Modbus, and other protocols. The configuration software uses an online Senseca sensor library that allows new sensors to be set up on the device using a simple drag-and-drop action.

Measurement channels & logging

Each unit manages up to 32 measurement channels. For each channel, two independent logging periods can be programmed, with up to 32 statistical calculations per period. The data are stored in integrated eMMC memory (more than two years in typical configurations). Optionally, removable microSD card backup storage can be used, offering the advantage of fast data recovery in the field.

Communications & synchronisation

The METEODATA-4000 connects to data networks via 2.5G/3G/4G/5G cellular modems, redundant Ethernet ports, USB, Wi-Fi, Bluetooth or satellite IP, using protocols such as Proprietary Binary Protocol, Modbus RTU/TCP, SDI-12 and IoT schemes. A built-in multi-constellation GNSS receiver (GPS, GLONASS, BeiDou/Compass, Galileo) provides precise time synchronisation and geographic location.

- **UNIVERSAL DATALOGGER FOR UP TO 32 ANALOGUE, PULSE AND SMART DIGITAL SENSORS**
- **BUILT-IN PROCESSING WITH STANDARDS-BASED ALGORITHMS, SELF-DIAGNOSTICS AND UP TO 32 ALARM CHANNELS**
- **VERY LOW-POWER, RUGGED DESIGN WITH OPTIONAL LCD HMI FOR HARSH OUTDOOR ENVIRONMENTS**
- **CABINET VERSIONS WITH INTERNAL BATTERIES, CHARGER AND PROTECTIONS FOR SEVERAL DAYS OF AUTONOMOUS OPERATION**
- **MULTI-INTERFACE COMMUNICATIONS (CELLULAR, ETHERNET, WI-FI, BLUETOOTH, SATELLITE) AND MODBUS / SDI-12 / IOT PROTOCOLS**
- **INTEGRATED GNSS (GPS/GLONASS/BEIDOU/GALILEO) FOR PRECISE TIME SYNCHRONISATION AND LOCATION**
- **FULLY SUPPORTED BY GEO-DATAVIEW SOFTWARE FOR CONFIGURATION, DATA ACCESS AND VISUALISATION**
- **PASSWORD-PROTECTED EMBEDDED WEB SERVER FOR REAL-TIME DATA VALUES, SELF-DIAGNOSTIC REPORTS, AND EASY NETWORK CONFIGURATION.**

FUNCTIONAL ELEMENTS

COMMUNICATION PORTS WITH APPLICATIONS OR SYSTEMS

1 Ethernet #1
- Link LED
- Activity LED

2 COM #1 The following options can be configured at the time of purchase:
- Redundant Ethernet #2
  - -Link LED
  - -Activity LED
- WiFi
- RS-232/RS-485/SDI-12
- Bluetooth Low Energy
- IoT, satellite, optic fibre, radio, etc.

3 2G/3G/4G/5G/LPWAN BB & NB IoT Modem
- SIM Card Slot
- Compatible with 3FF SIM and eSIM M2M
- Modem Connector & Antenna
- GNSS Connector & Antenna

4 USB Port
- CDC
- MSC

5 BUILT-IN GNSS RECEIVER
- GPS
- GLONASS
- Galileo
- BeiDou/Compass
- QZSS

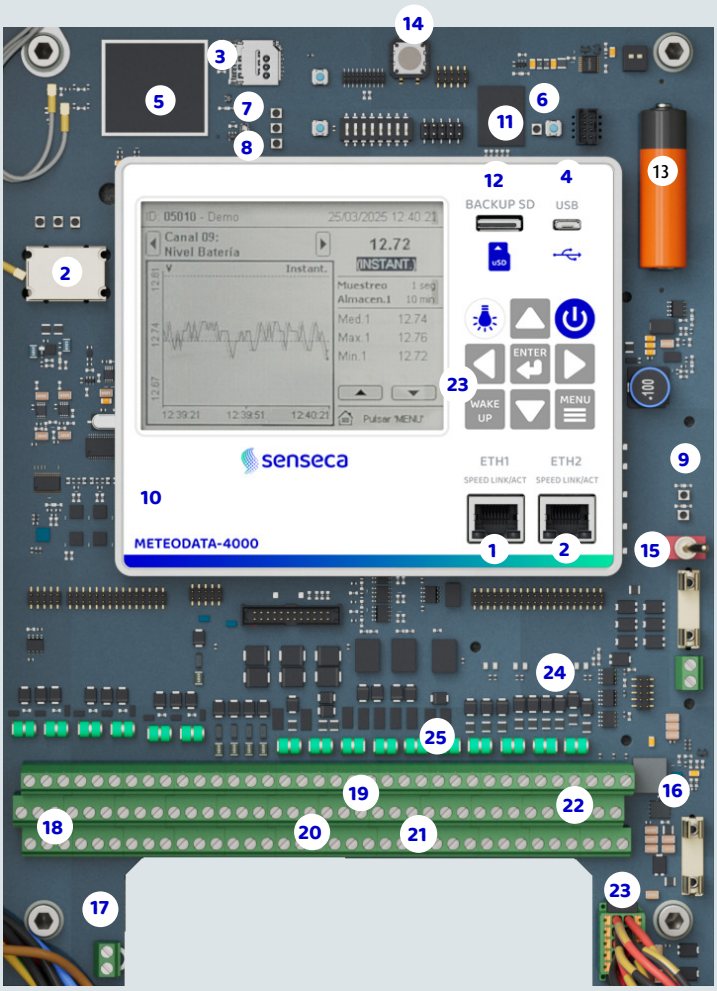
STATUS & OPERATION LEDS

6 Memory & General Operation

7 USB Port Status

8 Modem Status

9 Charger & Internal Batteries Status



STORAGE

11 Embedded eMMC Memory
- 8 / 16 / 32 GB

12 Removable micro-SD Card (Optional)
- 8 / 16 / 32 / 64 / 128 GB
- Backup storage

13 LITHIUM BATTERY
For proper operation of RTC and other circuits dedicated to the proprietary brownout data protection.

14 WAKE-UP BUTTON

15 GENERAL POWER SWITCH

16 BUILT-IN DUAL BATTERY CHARGER

10 ULTRA LOW POWER CONSUMPTION HUMAN MACHINE INTERFACE HMI-4000
- Memory-Display LCD QVGA 4.4"
- Ultra low power consumption
- 120° viewing angle
- Independent keyboard
- Multi-language (English, Spanish, etc.)
- Instantaneous & Statistical Data
- Graphs & Values
- Self-diagnostic
- Date / Time Synchronization

TERMINALS FOR POWER SUPPLY, SENSORS AND OTHER EXTERNAL ELEMENTS

17 Ground Terminals

18 Analog inputs

19 Digital Inputs & Outputs

20 Power Supply Outputs (Permanent Switched)

21 Counters

22 COM#2, COM#3 & COM#4 Ports (Smart Sensors)

23 Power Supply Inputs
- Internal Batteries
- External Batteries
- Charger #1-2: Solar Panel / Electrical Power Grid

PROTECTIONS

24 EMI Filtering
- Types of Filters: Block, LC PI, RC

25 ESD / SURGE Protections
- Varistors, inductors in serie, fuses & transzorbs
- Gas dischargers

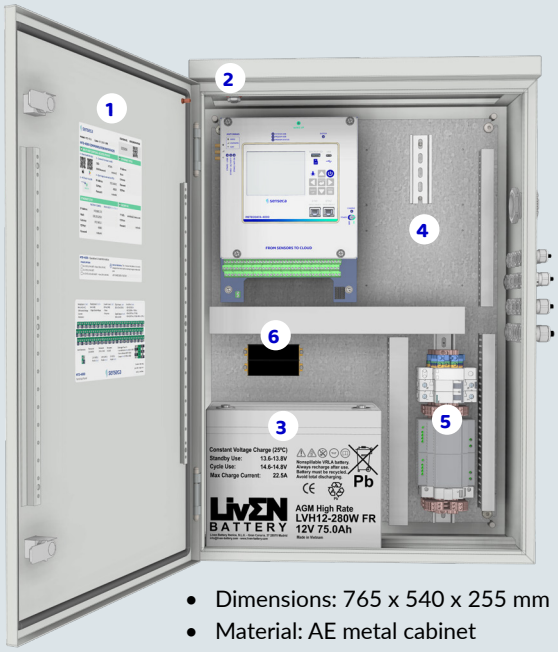
METEODATA-4000 MODELS

MTD-4000 M
Metallic IP 66 Cabinet

1 Information Labels
- Communication Info
- Power supply info
- Terminals description

2 Multi-purpose Antenna
- Wi-Fi
- GNSS
- 2G/3G/4G

3 Batteries
- 12 VDC batteries
- Up to 3 x 9 Ah for models CM/CP
- Up to 75 Ah for model M



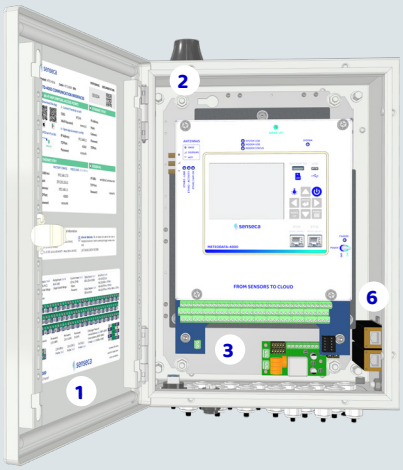
4 Fiber optic
- Area to locate fiber optic to Ethernet converter.

5 Power Supply Protections
- Mains protection against transient failures and permanent failures due to neutral disconnection (overvoltages and undervoltages), etc..

6 Network Protections
- Dual Ethernet protections
- ESP-100-POE

- Dimensions: 765 x 540 x 255 mm
- Material: AE metal cabinet
- Protection: NEMA 4, NEMA 4X, IP 66
- Corrosion protection: UNE/EN ISO 12944 Class C3 (optional Class C4)

MTD-4000 CM
Compact Metallic IP66 Cabinet



- Dimensions: 450 x 300 x 210 mm
- Material: AE metal cabinet
- Protection: NEMA 4, NEMA 4X, IP 66
- Corrosion protection: UNE/EN ISO 12944 Class C3 (optional Class C4)

MTD-4000 CP
Polypropylene IP67 Cabinet

- Dimensions: 450 x 330 x 175 mm
- Material: Polypropylene
- Protection: NEMA 6, NEMA 6P, IP67
- Certification: STANAG 4280- DEF STAN 81-41, MIL C-4150J

MTD-4000 P
Aluminum IP40 Enclosure

- OEM Datalogger
- Multifunction antenna
- Protection: IP40

EMBEDDED DATA PROCESSING

Statistical processing of instantaneous sensor data acquired by each of the datalogger's 32 measurement channels.
- Up to 32 statistical calculations can be configured per channel: average, accumulated value, integrated value, maximum, minimum, standard deviation, logical OR function, WMO BUFR quality index, time of maximum and minimum value, moving average, etc.
- Up to 2 configurable calculation periods for each statistic, from 1 minute to 24 hours.

Alarms. Instantaneous data monitoring for the generation of realtime alarms from a single channel or a combination of channels. Up to 32 alarm channels.

Algorithms and mathematical functions programmed to perform internal calculations in accordance with WMO, ICAO, etc.

Internal calculation of variables included in the solar tracking algorithm.

MODELS - METEODATA-4000 SERIES

	METEODATA-4000 M	METEODATA-4000 CM	METEODATA-4000 CP	METEODATA-4000 P
SENSOR INTERFACES				
Analog inputs for V/I/R/ratiometric measurements	16 (SE)* / 8 (DIF)*	16 (SE) / 8 (DIF)	16 (SE) / 8 (DIF)	16 (SE) / 8 (DIF)
Low-power counters (32 bits with 16-bit prescaler)	1	1	1	1
Counters (32 bits with 7-bit prescaler)	4	4	4	4
Non-isolated TTL/CMOS digital input ports	2	2	2	2
Isolated 'PHOTOMOS' digital input ports	2	2	2	2
Isolated 'PHOTOMOS' digital output ports	4	4	4	4
Serial port exclusively for sensors (SDI-12/RS232/RS422/RS485)	3	3	3	3
Maximum number of logic channels	32	32	32	32
COMMUNICATION INTERFACES				
Port 1: Ethernet #1 – LAN Ethernet 10/100	✓	✓	✓	✓
Port 2: Configurable: Ethernet #2, WiFi, RS-232/RS-485, etc.	✓	✓	✓	✓
Port 3: Modem 2.5G/3G/4G/5G LPWAN, IoT and GNSS	✓	✓	✓	✓
Port 4: USB (CDC communication through COM Virtual), MSC	✓	✓	✓	✓
POWER SUPPLY				
Connection to 10-24 VDC solar panel	✓	✓	✓	✓
Connection to 12 VDC external battery	✓	✓	✓	✓
Power supply unit to connect to 100-240 VAC power grid	✓	✓	✓	(Optional)
Two/three 12VDC 9Ah internal batteries included		✓	✓	(Optional)
One 12VDC 60-80Ah internal battery included	✓			(Optional)
ENCLOSURE				
M: Metal enclosure, paint class C3 ISO12944, IP66, NEMA4/4X	✓	✓		
CP: Polypropylene portable case. IP67 NEMA 6/6P compact			✓	
P: Aluminum enclosure, IP40				✓
OPTIONAL ELEMENTS				
HMI-4000	✓	✓	✓	✓
CM paint class C4 ISO12944: metal cabinet	✓	✓		
2G/3G/4G high-gain antenna	✓	✓	✓	✓
Multipurpose hardware interface extension modules	✓	✓	✓	(Optional)
SOFTWARE COMPATIBILITY				
GEO-DATAVIEW Software package	✓	✓	✓	✓
GEO-DATALINK App	✓	✓	✓	✓
WEBTRANS-4K Web Platform	✓	✓	✓	✓
SCADA (Modbus RTU / TCP)	✓	✓	✓	✓
IoT MQTT, LoRA, SigFox	✓	✓	✓	✓

** SE: Single-Ended / DIF: Differential*

STANDARD COMPLIANCE SPECIFICATIONS

WMO - World Meteorological Organization
- No. 8 Guide to Meteorological Instruments and Methods
- Guidelines on Quality Control Procedures for Data from AWS

ICAO - International Civil Aviation Organization
- 9837 Manual on Automatic Meteorological Observing Systems at Aerodromes

Roads
- (DGT) UNE 135441-2, (NTCIP) NTCIP 1204 V03

Nuclear Facilities
- ANSI/ANS 3.11-2015 Determining Meteorological Information at Nuclear Facilities

Solar Plants
- UNE/EN 61724-1 Photovoltaic system performance: Monitoring
- ISO 9060 Solar Energy Specification and Classification of Instruments

Air Quality
- ANSI/UL 2075 Standard for Gas and Vapor Detectors

Automatic Weather Stations Networks
- (Datalogger) UNE-500540
- (System) UNE-500510, 500520, 500530, 500550

SURGE Surge classification: IEC 61643-11 Type 2 and Type 3

TI **Safety:** EN IEC 62368-1

IP **Ingress protection rating:** IP66/IP67, NEMA 4/4X

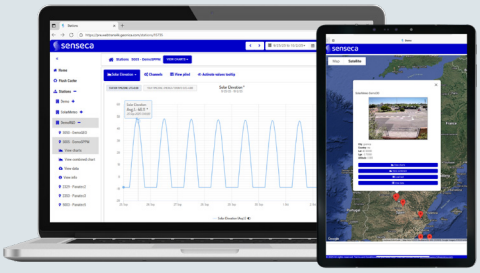
CE **European Directives EU**
- Low Voltage: 2014/35/EU | EMC: 2014/30/EU | RoHS: 2011/65/EU

EMC
- **EMC: Emissions:** CISPR22 Class B / EN-55022
- **EMC: Electromagnetic immunity:**
  - IEC 61000-4-2 ESD immunity (level 4)
  - IEC 61000-4-3 RF immunity
  - IEC 61000-4-4 EFT immunity Class 3
  - IEC 61000-4-5 Surge immunity Type 2 and Type 3
  - IEC 61000-4-6 Immunity to induced disturbances

GEO-DATAVIEW SOFTWARE PACKAGE VERSIONS

The Geo-DataView software package is a set of applications for managing and displaying the data collected by the datalogger series METEODATA-4000. Senseca provides different versions in order to cover the different clients needs. Each version includes specific services and applications.

	GEO-DATALINK App	WEBTRANS-4K Cloud Service	Data contract (SIM Senseca)	TELETRANS-W4K Software	Distributable Web Server WEBTRANS-4K
GEO-DataView BASIC	✓		Optional		
GEO-DataView ADVANCED	✓	✓			
GEO-DataView PREMIUM	✓	✓	✓		
GEO-DataView PRO	✓		Optional	✓	
GEO-DataView ENTERPRISE	✓		Optional	✓	✓

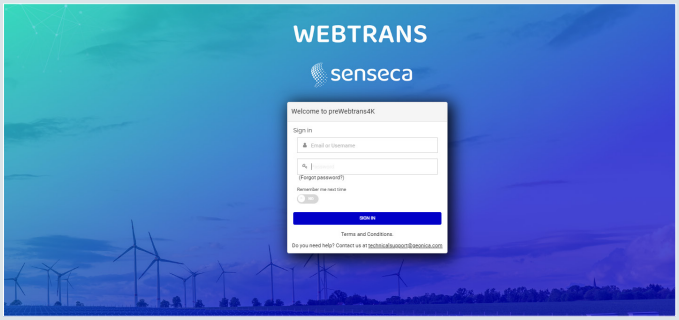


GEO-DATALINK App

- TCP/IP (Modem, WiFi, Ethernet) and BLE (Bluetooth Low Energy) communication with each station.
- Instantaneous and log data displayed in graphs and tables.
- Internal diagnostics of the stations power supply lines, memories and communication interfaces.
- Data download (CSV) in the terminal and via FTP.
- Configuration of the station: calibration constants, storage periods, Modem and Ethernet communications, date, time, timezone, etc.
- 'Remote Access' mode: the station connects to Senseca's Cloud through the 3G/4G SmartPhone connection for technical assistance, system assessment, etc.

WEBTRANS-4K Cloud Web Service

- Access through a Web platform to log data collected by station and stored in the cloud.
- Does not require any installation by the user.
- Web access protected by username and password.
- Multi-language interface (compatible with more than 70 languages)
- Geolocation of stations on a map and access to real-time data through tables and graphs.
- High-powered graphics that allow zooming, displaying maximums/ minimums/ averages and selecting the date range.
- Data download in CSV, TXT and Excel formats.
- Web Service API access to easily integrate the data collected by the stations series METEODATA-4000 into third-party platforms or developments.



TELETRANS-W4K Desktop Software

- Management for networks with a large number of stations.
- Automatic download of data from the stations into an SQL database.
- Automatic download of the station wiring diagram.
- Automatic download of the station Modbus memory map.
- Interactive station configuration: possibility of adding new sensors ('Drag and Drop') from an online sensor library. Any requested sensors will be added to this library within no more than 7 days.

Distributable Web Server WEBTRANS-4K

- Web platform that can be installed on Windows servers as a virtual machine.
- Own management of databases, stations and users.
- Customization of Web interface.
- It allows stations to be geolocated on a map, provides access to recorded data for visualization in graphs, and enables export in CSV, TXT, and Excel formats.

IOT-BASED DATA COLLECTION PLATFORMS

The METEODATA-4000 format and transmission adapted to IoT protocols (through Narrow Band IoT, SigFox, LoRa, MQTT) facilitates the display of the data collected by the stations by means of specific software used for IoT data display and analysis.

General specifications

Main processor	32-bit ARM Cortex M4 Microcontroller optimized for low power consumption, with FPU, Multiply Accumulate Unit MAC (single cycle) and SIMD at 95 MHz (up to 150 MHz available).
Operating Temperature	(Industrial range) -40°C to +85°C Extended range: -55°C to +85°C (optional, including certificate).
Memory and data storage	
Total onboard memory	• System memory: 8MB SRAM + 8MB Flash NOR. • Data storage, settings and CPU drive FAT32: 8/16/32 GB Flash NAND.
Removable redundant data storage backup (optional)	• Backup data storage and CPU drive FAT32: 8/16/32/64/128 GB microSD card (industrial temperature range). • Redundant log data and raw data backup. • Makes it possible to extract a copy of the data without having to wait for it to download.
Sample period	3.125 ms (32 channels @ 10 Hz) to 1 day (including data acquisition, processing, filtering, statistical calculation, logging and real time display/transmission).
Power Consumption	
Idle mode (RTC and SRAM retention)	41 µA @+12 V: 0.5 mW
Active mode (32Hz scan + 3 active serial ports RS-232/ RS-485)	37.1 mA @+12 V: 0.4 W
Ethernet #1 power requirements (Link + data exchange)	Active mode + 39.2 mA @+12 V: active mode +0.5 W
RTC - TCXO Real Time Clock	
Resolution	1ms (combined RTC + SysClock).
Accuracy	±1 min. per year (typ.)
RTC Power	Li-socl2 3.6V 2.6Ah (Saft LS14500) industrial grade lithium battery for RTC and SRAM for 6-year autonomy without external power supply.
Smart Synchronisation	Optional PPS GNNS correction ±10 µs or ±20 ms with NTP. Automatic selection of the best / more accurate clock source.
ARM RTOS (real-time operating system)	with application running in multitasking mode ('Pre-emptive Round Robin Multitasking').
Brownout protection	the integrity of user data is guaranteed during power supply failures through proprietary hardware and software algorithm that prevents data from being corrupted or lost.
GNSS	automatic correction of site position (< 3m 95%), date and time (with accuracy better than 0.1 s) by means of an integrated GNSS receiver with automatic time synchronization.
FOTA (Firmware Over The Air)	firmware automatic update to keep the system updated with most recently developed features.

INPUT INTERFACES FOR DATA ACQUISITION

Analogue 16 (SE) / 8 (DIF)	• Individually configured to measure voltage, current or resistance • 2 x 24-bit resolution delta-sigma converters (up to 25.1 bit ENOB) • Measurement Accuracy: 0.02% from 0 to +40°C K=1 / 0.03% from -40 to +85°C K=1
5 x Counters	Pulse width or period, frequency and pulse totalizer measurements.
4 x Digital Inputs and 4 x Outputs	Compatible with: ON/OFF status, edge detection, quadrature input, pulse-width modulation.
3 x Smart Sensors Serial Ports	• Each port can be configured to collect data from multiple sensors sharing the same communication bus. • SDI12/RS232/RS422/RS485 (2-wires/4-wires) and half/full duplex. • From 1200 bps to 1 Mbps for RS232 or RS485, (7, 8 or 9) data bits, (1, 1.5 or 2) stop bits and no parity, even or odd parity

OUTPUT INTERFACES FOR COMMUNICATION

Interfaces (always included)	• Ethernet Native • Modem 2G/3G/4G • USB • COM #1 configurable as : redundant Ethernet, Wi-Fi, Serial Port, Bluetooth, IoT, satellite, radio, etc.
Protocols	• Proprietary Binary Protocol (for GEO-DataView software) • Modbus RTU • Modbus RTU over TCP/IP • Modbus TCP • HTTP • FTP • NTCIP • MQTT IoT

POWER SUPPLY

Inputs	• Solar panel (10VDC - 24VDC), power grid (100 to 240 VAC) and battery • 2 x MPPTS integrated chargers to concurrently charge batteries from mains and solar panel. • Reverse voltage protection, overcurrent protection and voltage detection / measurement
Outputs (Voltage excitation)	• 12 outputs internally managed by the logger through activation profiles for power consumption optimization • 12 V / 5 V / 2.5 V

Ordering codes

MTD-4016CM	metal IP66 cabinet.
MTD-4016CM-A	metal IP66 cabinet, 100–240 Vac power supply
MTD-4016CP	polypropylene IP67 cabinet.
MTD-4016CP-A	polypropylene IP67 cabinet, 100–240 Vac power supply
MTD-4016M-60	IP66 cabinet ISO 12944 C3, wired, mounted and tested, 60Ah battery
MTD-4016M-40	IP66 cabinet ISO 12944 C3, wired, mounted and tested, 40Ah battery
HMI-4000	Ultra Low Power Graphic Memory-Display LCD QVGA 4.4" & Keyboard

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