NESA

Environmental monitoring
system and remote control

evolution — High-performance Linux datalogger according to CEI 13005

Main features

- ✓ Linux O.S. with integrated Apache Web Server and PhP
- ✓ No software to be installed
- ✓ Direct easy to use and powerful interface with browser
- ✓ Ethernet, WiFi, USB serial and remote access
- ✓ @24 bit high accuracy on all AC/DC inputs
- ✓ Compact design and very low power consumption, 100% full operating
- ✓ Integrated battery charge controller
- ✓ Wide range of activable features
- ✓ User programs and scripts sharable via web
- ✓ Easy to configure with wizard or XML
- ✓ Automatic recognition of connected sensors
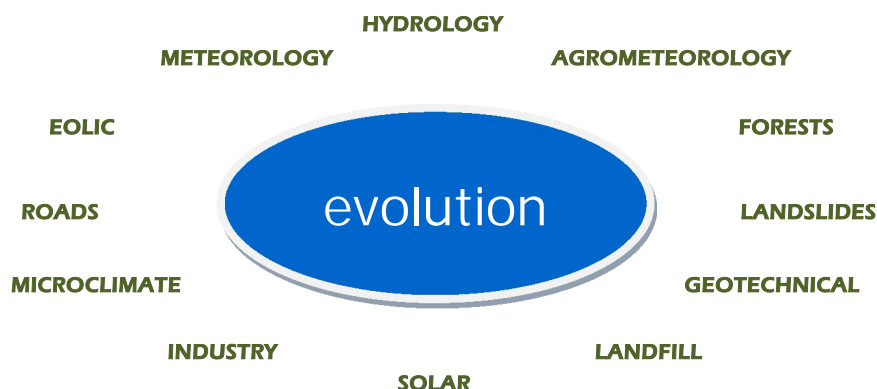- ✓ Modular and expandable, up to a high number of I/O
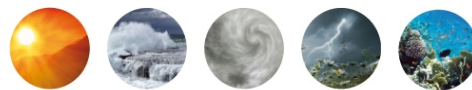
Description

evolution represents the natural transition from dataloggers TMF series, which revolutionized over ten years ago the world of data acquisition systems, to a more modern technology, finally bringing to the development and manufacturing of this extraordinary product, which has no competitors in terms of performances and ease of use. It promises a second technological revolution in this field.

A modular high-accuracy datalogger, with **Linux** operative system, **Apache web server and PhP interpreter**, usable **without any external and/or proprietary software**, fully **configurable via web**, **customizable with user scripts and programs sharable via web**.

It has **the most widespread and modern communication interfaces** and an **intelligent and automatic recognition of the connected sensors** (both Nesa and third party): in other words, a really technologically advanced device. Acquisition, processing, programming, storage, alarm management, data processing and transmission, have never been so user friendly as with evolution.

A completely new and efficient experience when using it, upgradable and expandable at any time through a wide range of extra functions. All of this compliant to the latest norms in the environmental monitoring field.

HYDROLOGY

METEOROLOGY   AGROMETEOROLOGY

EOLIC   FORESTS

ROADS   **evolution**   LANDSLIDES

MICROCLIMATE   GEOTECHNICAL

INDUSTRY   LANDFILL

SOLAR

Main features

- ➢ Multi-channel datalogger, versatile and accurate, for analogue, digital, frequency and serial signals.
- ➢ High accuracy verified following UNI CEI EN 13005 standard type A.
- ➢ Automatic recognition of connected sensor type.
- ➢ Full protection from overcurrent and overvoltage.
- ➢ Multiple power supply from solar panel, 12Vdc battery, external power supply system.
- ➢ 24bit analogue and digital inputs for measuring status, frequency and counts.

- ➢ Three levels of self-diagnostic functions.
- ➢ High number of I/O with expansion modules or datalogger networks.
- ➢ PS2 standard connections or with the addition of external terminals with intrinsic protection.
- ➢ Three memory levels: internal, external, USB memory up to 512 GB or external HD.
- ➢ Support for serial sensors RS485/ RS232, SDI12, etc.
- ➢ USB and LAN network 10/100Mbs interface
- ➢ Possibility for the user to create scripts or algorithms .
- ➢ Many other functions can be optionally activated.

Applications and use

In **environmental** applications, evolution is suitable for any type of monitoring, thanks to its great versatility in integrating **sensors of every model and brand**. The **older monitoring networks** can be easily **updated, simply replacing the existing datalogger** with evolution, real core of digital intelligence, and **keeping the existing sensors**, thus giving an high added value to the technologic content of your system. evolution is the perfect datalogger **for any climatic condition** for automatic weather stations, monitoring systems for photovoltaic and wind power plants, water quality analysis, hydrological risk, landslides warning and more over. The **integration of cameras** or the **control of sirens and lights**, the possibility of creating custom applications that allow to measure environmental parameters and others, connecting them with each other, allows the user to get **amazing results**, following the reference norms for the specific application.
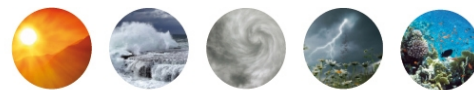
In **industrial** applications, thanks to **standard protocols** and the possibility to create **networks of dataloggers**, as well as the **great number of I/O**, evolution is a powerful and flexible device to supervise and control many types of implant, as **distributed control systems** (DCS), **control of the gas concentration in the air** (emissions), **control of the temperature of cells** or specific environments, **management of large numbers of** analog and digital **I/O** (order of thousands), such as the status of switches, valves, photocells, pumps, and **control processes** of the industrial realities. To use **signals transmitted via cable** with **signals transmitted via radio** (VHF, UHF or ZigBee), ensures, where is difficult to use wires, **high flexibility installation with minimum invasiveness**.
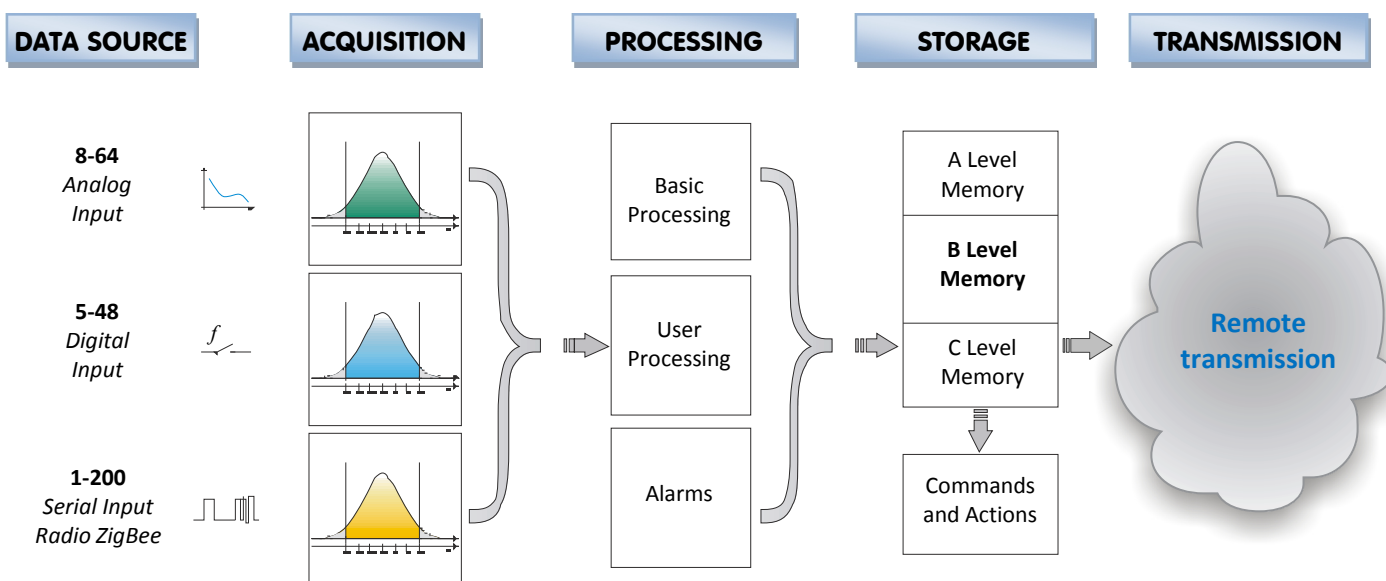
In **laboratory** applications, evolution provides the best performances, thanks to the possibility of **customization** and the wide range of **applications** never seen before. **Many standard functions are already implemented**, and the possibility to develop and integrate targeted and **custom solutions** is limited only by the user's imagination.

You can **program** evolution **also via XML** providing a library of applications, that you can share via web, simplifying research and development activity. A perfect device for laboratory measurements, which can be certified with reference to the metrological chain.

General specifications

DATA SOURCE	ACQUISITION	PROCESSING	STORAGE	TRANSMISSION

8-64
Analog Input

5-48
Digital Input

1-200
Serial Input Radio ZigBee

Basic Processing

User Processing

Alarms

A Level Memory

B Level Memory

C Level Memory

Commands and Actions

Remote transmission

Acquisition ability: evolution has the **ability to acquire signals without any limit**, just related to physical connections available. It can interface 10÷64 analog signals, 5÷48 digital inputs, 2÷6 serial RS232, up to 100 RS485 or SDI12 serial devices, 3 USB, LAN network, wireless, I2Cbus, ZigBee, etc. It's difficult to imagine anything more versatile.

Processing ability: evolution has the **computing power of a 32 bit processor**, over 20 years of experience of Nesa technicians and its knowledge of methods and algorithms for data processing and treatment. From the **storage of the primary standard according to guideline in CEI ENV 13005**, to **standard statistical processings** (minimum, average, maximum, standard deviation, deviation, etc.) and their validation and treatment **according to ISO 13528**, to the implementation of specific **mathematical models** for **derived measures** as the potential evapotranspiration of **Penman Montheith**, or the sunshine duration calculated with the **Angström-Prescott** method, **wind chill** and **humidex** indexes, are only few examples of the many functions that **the user can use, modify, create and share with other users via web, along with hundreds of already existing functions**.
Scheduling of acquisition and processing, storage and transmission are all independently programmable.

Storage: evolution has different **types of memory** to protect data or copies of them, at **different security levels**. At the A level it has an internal **backup memory**, that contains all data from the first power-on in factory, the datalogger history, a circular memory that can store, on average, up to 10 years of data. A second memory of B level, called **system memory**, inside the logger, contains temporary data that are acquired before a remote transmission, and can handle and store data of about 5-7 years; long periods of fault in remote transmission system don't affect this datalogger. At last, a **C level memory** or **external memory** (USB or HD), of variable capacity, but normally greater than the sum of the internal memories.
Due to the big dimension of the **memories**, their **control is cyclical** (overwriting of the older data) and **optimized** (consumption and memory management) by **Linux** operating system, chosen also for this ability. The user can choose between storing data in unencrypted mode (ASCII characters) or in encrypted mode, with Hash key at 256 bit.

NESA Srl si riserva di apportare eventuali modifiche al presente prodotto senza obbligo di preaviso / NESA Srl intend to do any modifications to this product without warning obligation

Data transmission: With evolution, data transmission has never been so simple. In addition to standard functionalities already installed in the other datalogger TMF series, such as the possibility of choosing among **many available channels** (modem, radio, mobile phone network, satellites, optic fiber or copper cable, etc.) and the availability of the **majority of protocols** for the information transmission systems (RS232, RS485, Modbus, TCP-IP, SMTP, FTP, Soket, SDI12, etc.), it's now possible to "**dress up the information**" in the most suitable way. This allows an easy reading mode, for example e-mail, XML, Excel, ASCII, etc. Using advanced features, the user can **create specific data records**.

Local display and programming: In evolution, **the powerful and useful functions of programming and data representation, both in numerical and graphical format via web,** already implemented in the dataloggers TMF series, have been enhanced with last generation libraries, light and effective, compatible with smartphones and tablets. **Real-time data** visualization, in numerical and graphical format, allows the user to have full control on field, especially for slowly varying parameters. Moreover allows to check **data acquired during the last month (historical data)**, to an immediate identification of any anomaly or specificity in the measures, downloading the related **Excel files**, which are helpful for maintenance operations.

For programming, the **internal web-server** allows **total management of the datalogger** both on sensor interface side, and related data acquisition and processing (measure units, reliability range, accuracy of representation, linearization by correction formulas, types of processing, derived measures, scanning and storage times, alarms, actions and commands, activated scripts, etc.), and on device, protections, storage and data transfer side. The user can do all of this **without any proprietary software**, thanks to the **PhP web interface** and to the **browser**, usually available on Pcs, tablet or smartphones. In addition, there are **special applications** to test the **transmission system** (target check), the **memorization** and the **diagnostics**, available on line on the datalogger.
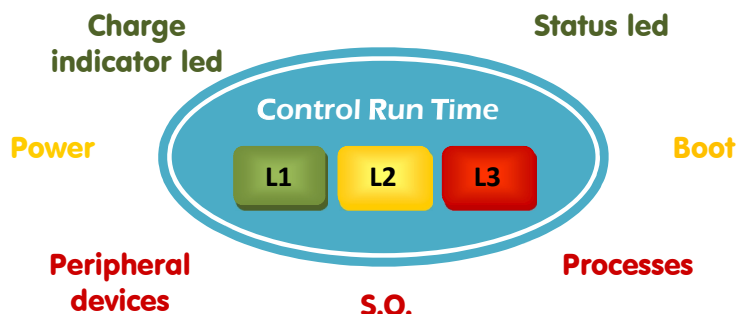
If the **hot-spot feature** is enabled, the user no longer needs the physical connection to the datalogger. Through a wireless connection, with a device equipped with a WiFi interface, **it can access to the datalogger standing far** or placing a smartphone in front of the **QR-Code** of the monitoring station to be automatically redirected to its configuration web page, after authentication. From the point of view of the **technicians who installs or maintains** monitoring systems equipped with evolution, this is an **help and a simplification for the use of the station, completely innovative and forefront.**

Diagnostics: evolution has an efficient management of the **diagnostics**, following the guidelines in **ISO14230**, inspired on the **strong KWP2000 protocol automotive derived, with three retrieval levels (watch dog)**. The diagnostics is **sequentially performed at each datalogger startup** and **during its operation (CRT)** with time intervals that depend on what the device is doing.

In particular, the check is for functions of **operating system** and on **active processes** (acquisition, storage, transmission), **boot**, **peripheral device status** (if needed), **main power supply system**
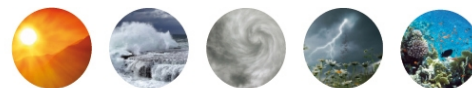
conditions (solar panel or main network), **secondary** power supply system (battery), and **environmental operating conditions** (temperature and humidity), if the related feature is enabled. The **diagnostic log** is always present in from the web pages inside the datalogger, **stored and downloadable** locally or remotely and it can be used also for the management of system alarms.


Main technical detail

CPU	ARM Cortex A8 - 500MHz processor @32bit with **Embedded Linux Kernel 2.6.37** operating system on board.
Internal memory	4MB NOR Flash for kernel, 128MB NAND + 128MB RAM programs, user programs and for A and B level data memory
External memory	Pen-drive USB 8GB ÷ 64GB (-40°C÷+60°C) included for C level data memory, HD or SSD otherwise
Communication ports	n. 2 RS232 (DE 9 Pin), n. 1 isolated RS485 5KVrms , n. 3 USB: 2 Host (12Mb/s) @500mA + 1 MiniUSB slave (480MB/s), n. 1 LAN Ethernet 10/100 Base T RJ45. With options active, the following ports are available: SDI-12 (1÷100), I^2CBus, WiFi.
User interface	Display LCD 24x2
Data-clock	Internal with resolution 1mS and accuracy ±3 minutes per year, updating through server NTP (requires internet or Lan connection), or synchronization with optional GPS. Internal Lithium battery 3.6Vdc
Watch dog	3 levels (1 hardware & 2 software) + visual inspection by status led
Protections	Inside protection against polarity reverse and transient by EMC filters Overcurrents by replaceable fuse 6A Outside protection available on M2Ch modules ESD ±3 kV type according to IEC 1000–4-2
Current consumption	Depends on the active functions: < 0.2W (15mA @ 12Vdc), with clock rescaling in full operation < 2W full operation with GPRS and hot spot active
Power supply	24Vac, 110Vac, 220Vac (with external power supply) 10.5 ÷ 24Vdc Solar panel, Wind generator 10.8 ÷15Vdc from battery.
Integrated charge controller	Controller for sealed cyclic batteries (max 5A DC), *Dual Level Float Charge* integrated control at 4 phases according to CEI 21-6/3. Charge indicator led included

Analog inputs	-100÷100mV / -2÷2Vdc	n. 8 ÷ 32 @ 24bit **differential input** with **C116** Exp. Each input provides max 12Vdc@250mA power supply and voltage reference at 2.048Vdc
	Pt100 4fili / 0÷100mV 0÷2V / 0÷5V / 0÷10V 0÷20mA 4÷20mA	n. 16 ÷ 64 @ 24bit **common mode input** with **C116** Exp Each input provides max 12Vdc@250mA power supply and voltage reference at 2.048Vdc
		n. 2 @ 12bit **bounded input** for battery monitor and main power supply
		n. 3 @ 12bit **optional, bounded input** for internal pressure, temperature and humidity measurement
Digital inputs		n. 5 ÷ 48 frequency input (Max 5000Hz), status (On/Off) or count, with **C118** Exp. *transient voltage suppressor protection* 600 W, <10 μs
Serial inputs configurable via web		n. 1 ÷ 100 via **RS485, RS232, SDI-12** (if the related option is enabled)
Radio inputs configurable via web		n. 1 ÷ 100 via **ZigBee** (ZBC radio module)
Programmable analogic outputs		n. 4 @ 12bit - 0÷2Vdc (convertible through MCS in 0÷1Vdc, 0÷5Vdc, 0÷10Vdc, 0÷20mA, 4÷20mA, RS485 or RS485-ModBus)
Digital outputs		n. 4 ÷ 48 open collector (Vmax=50V, Imax=200mA, 5000Hz) with **C118** Exp
Other outputs		n. 1 power output 12Vdc max 5A n. 1 controllable power output 12Vdc max 5A
Sampling interval		< 100μS
Validation interval or primary sample		1 ÷ 10 sec
Elaboration interval and/or data transmission		1 sec ÷ 1440min with fixed step
I/O signals protections		Inside EMC protection filters for each analog channel Opto-insulation 5KVrms for digital inputs EMC filters on communication ports
Integrated operative monitors		Battery monitor Main power supply monitor Internal pressure, temperature and humidity (optional functions)
Supported protocols		**Modbus RTU & Tcp, TCP-IP, HTTP, FTP, NTP, Telnet, SMTP, Socket, I²CBus, SDI-12, RS232/485 command line, ZigBee**. Others as option
Programmability and remote control:		Locally via LAN cable, from remote via modem GPRS, WiFi, satellite, modem, radio. It requires only a web browser or an XML configurator or a text editor
Data format available		**ASCII txt file, Excel, CVS, XML, email, AES encrypted,** any other created by the user
Operative temperature		-40 ÷ +70 °C non-condensing
Dimensions and protections		200x110x74.5mm – IP54
(optional) Box IP65 – IP67		Standard in polyester or stainless steel 300x400x220mm (other dimensions on request)
Weight and material		700g – Polycarbonate and anodized aluminum
Installation		DIN Rail or wall
Norms used as reference		CE, WMO, EN-13005, ISO-13528, CEI-21-6/3, IEC-61400-12, ISO-9060, D.Lgs.-36/2003, CE-128/2009
Included processing algorithms		Dew point (Magnus Tetens), Vapor Pressure, Rainfall intensity, Hourly Precipitation, Daily Precipitation, QNH, QFE, Potential Evapotranspiration (Penman Motheith), Sunshine Duration (Angström-Prescott), Wind Chill, Humidex. Others are optional or can be implemented by the user.
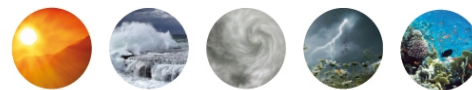
Performance details

Stabilized analogue input @25°C *

Input impedance				20 GΩ typical	
Input limits				10.2Vdc	
Range	Resolution Type	Accuracy 0÷40°C	Accuracy -40÷70°C	Offset	
±100mV	100nV	±50nV		±2µV	
±2V	2.5µV	±1µV		±5µV	
0÷2V	3µV	±8µV	±0.06% reading + offset	±5µV	
0÷5V	6µVt	±15µV		±10µV	
0÷10V	10µV	±30µV		±25µV	
0÷20mA	30nA	±80nA		±20nA	
4÷20mA	30nA	±80nA		±20nA	
Pt100	0.5/100°C	±0.05%	±0.05%		

*Components with Tcr 5ppm/°C

Digital input (frequency) @25°C

Duty cycle 50%		
f (Hz)	Accuracy 0÷40°C	Accuracy -40÷70°C
5	0.02%	0.025%
50	0.02%	0.025%
500	0.03%	0.05%
5000	0.05%	0.1%

Optional activable features

Internal Hot Spot: in evolution you can enable the Hot Spot function. In this way you can access to the datalogger via WiFi, for example through a QR code, or connect to other available networks and use them for data transmission.

External GPS: connecting an external GPS USB, evolution identifies the position in WGS84 GD geographic coordinates. These coordinates are memorized and transmitted with the same frequency used for data transmission. This function is enabled via web browser. You can use the GPS also to synchronize date and time.

Internal/external GPRS/UMTS: in evolution you can enable an internal GPRS modem or use a standard external modem. It's not necessary to use specific modem with custom commands. If you chose the internal modem, the external antenna will be supplied with it.

External camera: you can connect any IP camera directly to the LAN port in evolution. Images from the camera are acquired as individual frames, stored and transmitted with the same frequency used for data transmission. This function is enabled via web browser.

Internal pressure: in evolution you can have a precision barometer mounted in it. This option is useful in case of monitoring systems with the datalogger mounted in a box with protection degree lower than IP68, because the connection with outer air homogenizes the atmospheric pressure inside and outside the box. This feature is optional and is enabled via web browser.
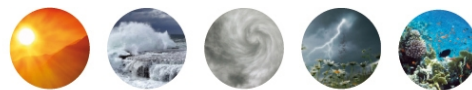
Humidity and temperature: in evolution you can acquire operating temperature and humidity of the datalogger while it's working. You can use it for researches, in laboratories and to obtain specific correction curve to improve the accuracy of acquired data. This feature is optional and is enabled via web browser.

Sending voice messages: evolution normally handles alarms by sending SMS, recording the event and related commands. Furthermore, it can send voice messages, in over 20 languages, to a device that can reproduce them. They can be recorded by the user or created by the datalogger in wav format.

Radio Zig Bee interface: evolution, through a Nesa ZigBee concentrator, can interface with up to one hundred radio transmitters, using sensors with Pt100, 4-20mA or 0-2Vdc output. This feature is optional and is enabled via web browser.

Optional standard interfaces

C116: Expansion module with **16 analogue channels and/or Pt100 temperature**, **@24bit resolution** for Nesa datalogger. You can connect up to 2 modules to evolution

C118: Expansion module with **16 optoisolated digital input + 16 open drain output** (for relay command) for Nesa datalogger. You can connect up to 3 modules to evolution

MCS: Module for signals conversion with 18-bit resolution, that accepts any analogue or digital signal as input, and generates normalized output signals as voltage, current or Modbus RS485 serial. It interfaces directly to evolution both to increase the number of inputs available on the RS485 line and to strengthen the analogue outputs of the datalogger converting them to the format chosen by the user.

M2Ch: 2-channel electric signals protection module for evolution. Equipped with double level of protection from voltage surges and indirect lightning using special diodes and gas discharge tubes. It protects the datalogger and the acquired data, and brings signals on a terminal for an immediate interfacing with each sensor.
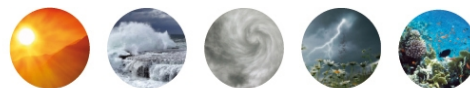
RELE: Rail DIN module for command control, complete of base and 12Vdc relay with double contact (NO and NC). Maximum current on contacts 8A.
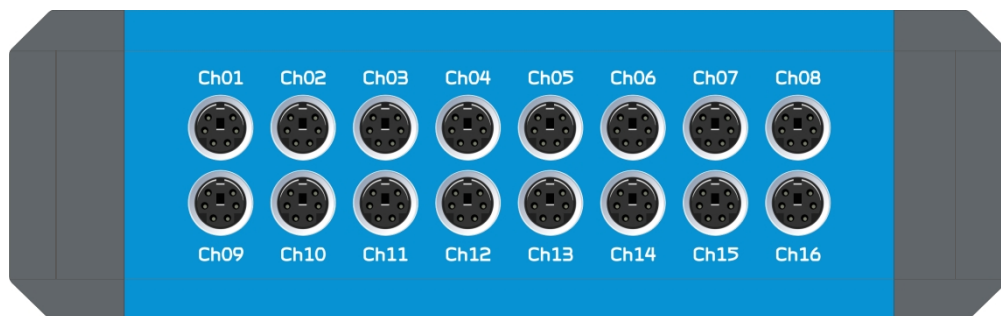
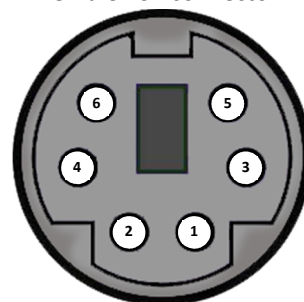**IS485/USB**: USB/RS485 interface capable to supply also 12Vdc@250mA max.

I-SDI12: SDI12 interface for Linux capable to connect up to 100 SDI12 devices.
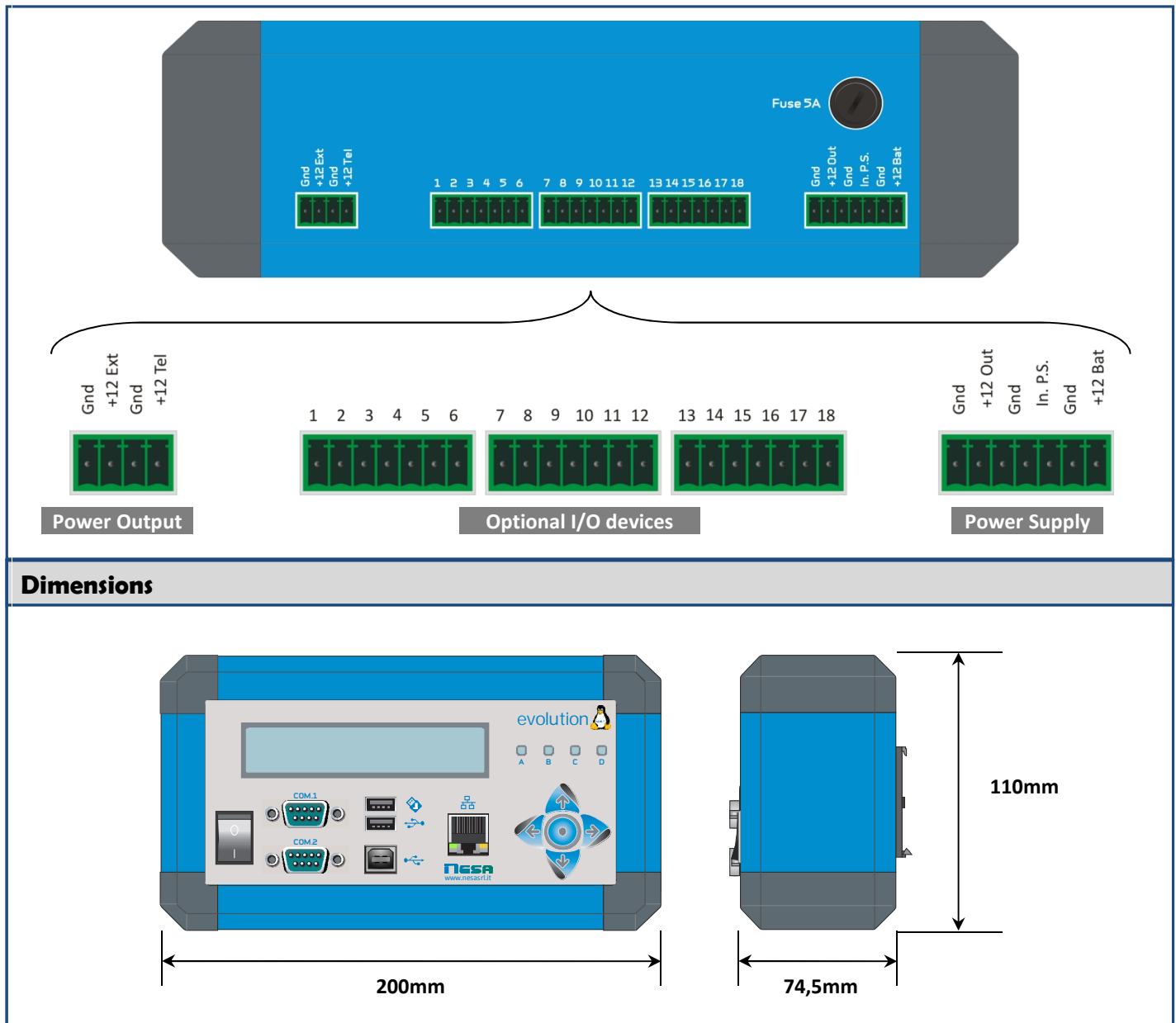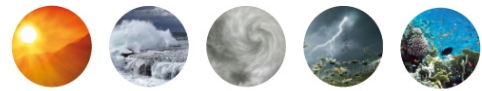
Connections

Female PS2 connector

Analogue channels	Ch01 ÷ Ch08	Differential inputs, common mode, Pt100 and sensor power supply	Pin	Description	Limits
			1	I2+	22mA
			2	V2+	+2.5V
			3	V2-	-2.5V
			4	I2-	22mA
			5	GND	0
			6	+Vbatt	15V

Digital channels	Ch09 ÷ Ch13	Frequency, status or count inputs	Pin	Description	Limits
			1	O.C.	--
			2	Id+	--
			3	Id-	--
			4	*n.c*	
			5	GND	--
			6	+Vbatt	15V

Analogue outputs	Ch14	Voltage output 0-2Vdc convertible into: 0-1Vdc, 0-5Vdc, 0-10Vdc 0-20mA, 4-20mA RS485 (command line) or RS485ModBus	Pin	Description	Limits
			1	DAC.1	+2.048V
			2	DAC.2	+2.048V
			3	DAC.3	+2.048V
			4	DAC.4	+2.048V
			5	GND	0
			6	+Vbatt	15V

Digital outputs	Ch15	Separately controlled outputs Open Collector	Pin	Description	Limits
			1	O.C.1	--
			2	O.C.2	--
			3	O.C.3	--
			4	O.C.4	--
			5	GND	0
			6	+Vbatt	15V

Expansions	Ch16	Channel for expansions	Pin	Description	Limits
			1		
			2		
			3		
			4		
			5	GND	0
			6	+Vbatt	15V

Power Output

Gnd | +12 Ext | Gnd | +12 Tel

Optional I/O devices

1 2 3 4 5 6 | 7 8 9 10 11 12 | 13 14 15 16 17 18

Power Supply

Gnd | +12 Out | Gnd | In. P.S. | Gnd | +12 Bat

Dimensions

200mm

74,5mm

110mm

Order Form

Logger	Datalogger evolution complete of manual, USB 2/8GB memory, web application Esporta-Web2.0	**evolution**
Options	Analogue expansion module with 16 channels @24bit (indicate the amount, max. 2)	**x.C116**
	Expansion module 16+16 digital I/O (indicate the amount, max 3)	**x.C118**
	One- channel signal conversion module for pre-programmed I/O (indicate the amount)	**x.MCS-Light**
	Two-channel interface module with double signal protection level (indicate the amount)	**x.M2ch**
	RELAY module: relay interface 8Amax with double contact (N.A., N.C) (indicate the amount)	**x.Rele**
	Radio ZigBee concentrator module (factory programmed and requires Nesa wireless ZigBee sensors)	**ZBC**
	Internal Hot-Spot: router function with WiFi network and SSID	**HotSpot**
	Pressure with internal barometer	**e-Bar**
	Internal temperature and humidity	**e-TH**
	Additional RS485/USB interface with power supply max 12Vdc@250mA	**IS485/USB**
	Additional SDI12 interface up to 100 channels for Linux	**I-SDI**

Example of order code

evolution	1.C116