BABUC ABC
OPERATING MANUAL

Version 5.02 Eng/ 5.02/A22

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1. GENERAL DESCRIPTION

1.1. OVERVIEW

1.1.1. Introduction

BABUC ABC is a line of high technology instruments for the acquisition, processing, registration and transmission of meteoclimatologic and environmental measurements prevalently for the field environment. Its specific characteristics allow all data and event acquisition requirements to be met.

1.1.2. Models

Code	Channels N°				N°	Case		
	Analogue	Pulse	Tot.	Serial	Actuators	Case for	Dimension	Construction
DGB055	4	1	5	55	1+1		300x200x150	Polyurethane
DGB058	4	1	5	55	1+1	radio+add.batt..	400x420x200	Aluminium
DGB105	8	2	10	50	1+1		300x200x150	Polyurethane
DGB106	8	2	10	50	1+1	radio+add.batt.	400x400x200	Polyurethane
DGB108	8	2	10	50	1+1	radio+add.batt.	400x420x200	Aluminium
DGB205	16	4	20	40	2+2	radio+add.batt.	400x400x200	Polyurethane
DGB305	24	6	30	30	3+3	radio+add.batt.	400x400x200	Polyurethane
DGB109	8	2	10	50	1+1	Rack 19”	4 modules	
DGB209	16	4	20	40	2+2	Rack 19”	4 modules	
DGB309	24	6	30	30	3+3	Rack 19”	4 modules	
DGB409	32	6	38	22	4+2	Rack 19”	4 modules	
DGB609	48	6	54	6	6	Rack 19”	6 modules	
DGB107	8	2	10	50	1+1	Portable case	520x430x210	Polyurethane
DGB207	16	4	20	40	2+2	Portable case	520x430x210	Polyurethane
DGB307	24	6	30	30	3+3	Portable case	520x430x210	Polyurethane
DGC010	Memory card reader, power supply 220 Vac						140x45x210	ABS

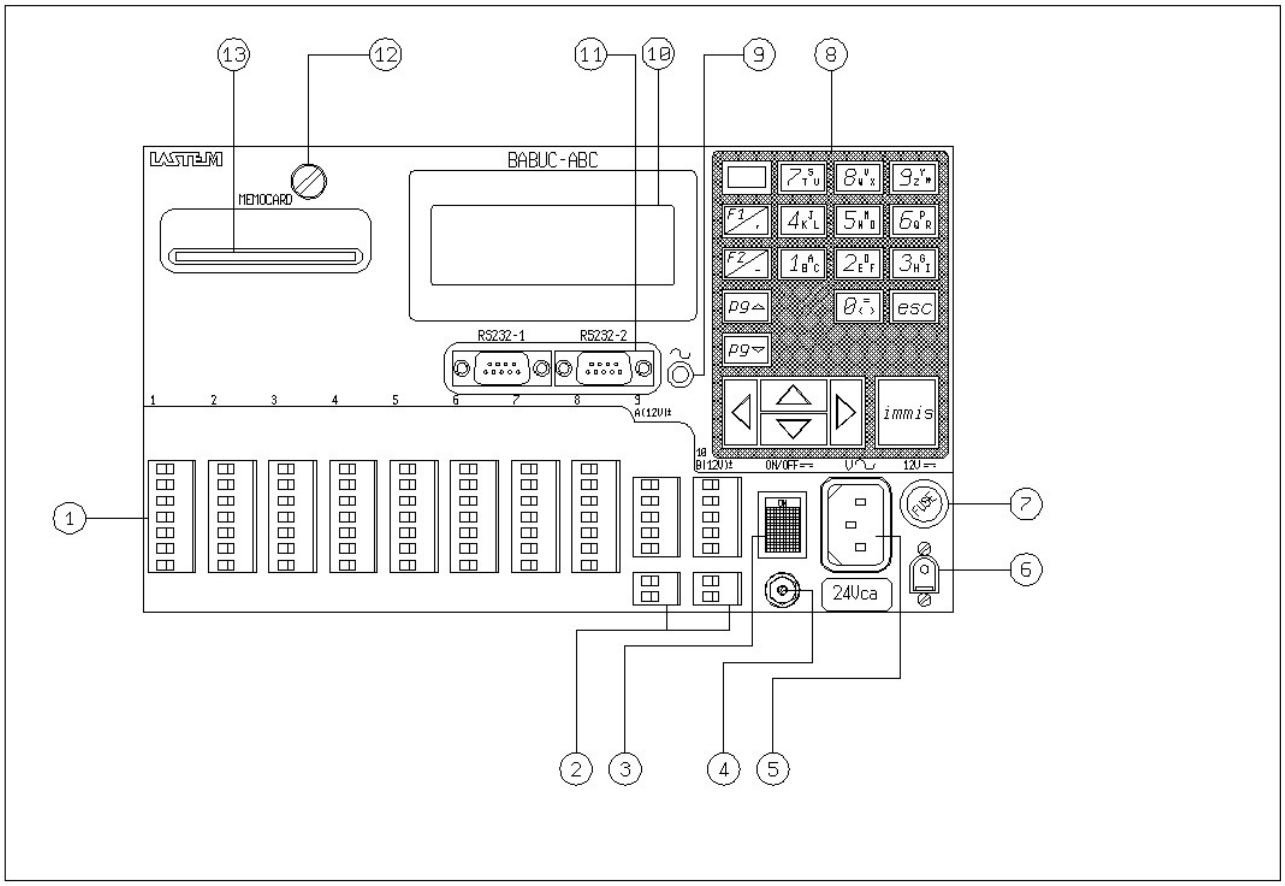
1.1.3. Technical specifications

Temporary Memory:	64 kB RAM
Mass Memory:	Models with removable memocard: sizes from 64 kB to 2 MB
Data transmission:	RS-232 (RS-485 opt.)
Display:	LCD 80 char. (20char.x 4 lines) Min. operative temp. -10°C
A/D converter:	15 bit
Clock:	With dedicated rechargeable battery, 3 months life, accuracy 1 min./month
Consumption:	3.5mA (averaged over acquisition/processing/idle with display switched off)
Power supply:	24Vac (220Vac opt.) and 12Vdc or solar panel.
Internal rechargeable batt.:	Standard: 12V Pb 2 Ah (optional: 7.2V NiCd 4 Ah)
Actuated outputs:	10...14 Vdc unstabilized. **Unit and total Imax: 0.25 A**
Permanent outputs:	10...14 Vdc unstabilized
Electrical protection:	Filters, gas dischargers, fuses on power supply; “transzorb” on inputs, serial lines.
Housing:	a) Shock-resistant polyurethane, painted white RAL9003. Protection IP65 b) Die-cast aluminium, painted white RAL9003. Protection IP55 c) Shock-resistant black portable case
Galvanic isolation between inputs and sensors:	Effected by inserting isolation units on the inputs; thermoresistance, thermocouple and Mv signal versions are available.
EMC	“Residential settings” emission EN 55022 “Industrial settings” immunity EN 50140 and 50204
Working limits:	-10°÷ +60°C (option –25°÷ +60°C)
Input signals:	Serial: acquisition from LSI sensors with serial output Physical: see table below

Signal	Range	Res.	Acc.	Signal	Range	Res.	Acc.
Pt100 resistance	-50°÷ +70 °C	0.02	0.1	TC-T	-200°÷ +200 °C	0.2	0.6
Pt100 resistance	-50°÷ +500°C	0,1	0,3	TC-S	0°C÷+1600°C	2	6
Ni100 resistance	-50°÷ +70 °C	0.02	0.1	Linear mV	-19 ÷ +19 mV	0.007	0.02
Linear resistance	0 ÷ 2500 Ω	0,5	2	(auto. range change)	-300 ÷ +300 mV	0.11	0.4
TC-J	-50°÷ +350 °C	0.15	0.5	S1 thermistor	0°÷ +44 °C	0.01	0.1
(auto. range change)	+350°÷ +600 °C	2	6	TTL impulses	0 ÷ 65000		
TC-K	-200°÷ +500 °C	0.2	0.6	Cold junction	-50°÷ +70 °C	0.05	0.4
(auto. range change)	+500°÷ +1300 °C	3	10				
TC-E	-200°÷ + 280 °C	0.1	0.3				
(auto. range change)	+280°÷ +1000 °C	2	5				

1.1.4. Panel description

1	Inputs:	N°1-8 for analogue inputs (7 contacts). N°9-10 for impulse inputs (4 contacts).
2	Output terminal:	a) 12Vdc actuated (2 contacts), b) 12Vdc permanent (2 contacts).
3	Switch:	Isolates equipment power feed from the internal battery. When the equipment is switched off but an external power supply is present (mains ac, external battery, solar panel), the internal battery remains under charge.
4	Ground:	Socket on the instrument's metal casing.
5	Ac main socket:	Socket for main power. Standard 24 Vca, optional 220 Vca.
6	Dc socket:	Socket for solar panel or external 12V battery.
7	Fuse:	2 A if 24 Vac power supply, 0.5 A if power supply 220 Vca.
8	Keyboard:	20 keys.
9	Power indicator:	Only lit when external power is present.
10	Display:	80 (20x4) character LCD
11	Serial line:	Unified 9 pin connector.
12	Fastening:	Fastening screw for fixing instrument to case.
13	Memocard:	Memory card driver (64 kB ÷ 2 MB).



1.1.5. Power supply, protections, galvanic separation

BABUC ABC can be powered from the mains, by battery and solar panel. All standard models use 24Vac power supplies and are equipped with an internal 12Vdc 2Ah Pb battery; versions with rechargeable 7.2V 4Ah NiCd battery is optional. Feeders 220/24Vac 50W (mod.DEA252) and 150W (mod. DEA253) are available. Protection devices against electrical disturbances are inserted on the power supply unit and on each input. These devices consist of filters, gas dischargers and zener diodes and integrate those already present on many LASTEM sensors. Galvanic isolation units are also available for sensors. Placed between input and sensor, variants are supplied for thermoresistances, mV signals and thermocouple signals. The power autonomy depends on the data acquisition rate and activator operations. In cases of external power blackout, the autonomy (without active actuators) is as follows:

Battery type	**Fast rate***	**Slow rate****
Standard 2 Ah Pb battery	1 day	15 days
4 Ah Ni-Cd battery	2 days	20 days
Standard battery + external supplementary 15 Ah Pb battery	8 days	90 days
Standard battery + external supplementary 40 Ah Pb battery	20 days	180 days

* Continuous sensor acquisition rate, serial line switch-off

**Sensor acquisition rate greater than 1 minute, serial line switch-off

1.1.6. Use of keyboard

The keyboard contains 10 numeric keys and 10 function keys. The normal significance of the keys is as follows.

Arrows △ ▽ — For data input screens, move the cursor one line at a time over the lines containing data input fields. For menu screens, move the selection arrow from one option to another (selection confirmed with "IMMIS"). For data display screens, perform single line or continuous scrolling when the number of data lines exceeds the screen's capacity.

Arrows ◁ ▷ — Move the cursor horizontally, one character at a time, through the data input field. Within the field, cursor movement is circular and without limits. In certain screens the format of displayed data changes.

pg △ ▽ — Move forwards and backwards a page in multi-page lists.

immis — Has the usual attributes of enter, confirmation, start-up.

esc — Exits the currently displayed screen and returns to the previously displayed one (backtracking along the current branch path).

F2/- — Functions as a "PAUSE" key during the "Statistics display"; the display of statistical data is temporarily blocked, but without affecting eventual registration of data.
Inserts the "-" sign when entering numeric data.

F1/, — Functions as a "RESET STATISTICS" key during the "Statistics display". Inserts the decimal point when entering numeric data.

On the display, there are ↑ ↓ when non-visible rows are available.

1.1.7. Use of the alpha-numeric keyboard

When the alphabetic part of the keyboard is needed, use the key where the request character is displayed. Other symbols are available using the "0" key (0 = < > space +: , % / \ ( ) & ? ! ' *) or the "9" key (Y Z " 9 y z @). Each alpha-numeric key may, if pressed repeatedly, be used to enter the number it represents, the uppercase letter which appears on it, or the same letter in lowercase.

1.2. DATA ACQUISITION

1.2.1. Input types

The ABC data acquisition inputs are capable of receiving a wide range of signals, automatically adapting their electronic circuits to the physical requirements of the signal from the sensor connected. The inputs are individually configured for signal type and for the significance and processing to be assigned to the quantity. The specified configuration is memorized until an eventual successive modification.
The instrument is able to acquire data from sensors with serial output; their connections happens through the RS232 serial port. Babuc ABC manages both the quantities acquired from physical, analogue or pulse sensors connected on its inputs and those acquired from the sensors connected on the serial port. These sensors can be programmed through the Setup module of GAP package (see the GAP manual); the factory configuration of Babuc ABC doesn't contain any sensor with serial output.

1.2.2. Data acquisition rate

The data acquisition interval is programmable from 1 sec (0.5 sec/input true minimum scan) to 24 hr (for processing periods in excess of 12 hours, the minimum data acquisition interval is 2 sec)
When feed probes are connected, the data acquisition rate could influences the battery life
(see §1.1.5. Power supply, protections, galvanic separation).

1.2.3. Sensor power supply

An un-stabilized 12Vdc output (unit and total Imax: 0.6 A) is associated with each input. This can be used for sensors that require a power feed or auxiliary functions. The period for which this output can be activated in advance of the acquisition is individually programmable for each type of quantity and is an integral part of the operational functionality for the quantity itself.

1.2.4. Sensor error correction and validation of input data

The acquired data points, apart from specific range checks, are subjected to three categories of programmable treatment, before being passed for further processing:

1) Sensor error correction: the eventual error of each sensor can be corrected by assignment of the values A and B in the linear correction equation $y = Ax + B$.
2) Validation of each single data items before inserting them in the statistical calculations database; acquired values are only inserted if they satisfy certain conditions:
   a) a) The data item is invalid if the difference between it and the previous one acquired exceeds a certain programmable level.
   b) b) The data item is invalid if outside a range defined by two programmable values.
   c) c) The data item is invalid if a different data item, for a another measurement of choice acquired in the same cycle, is absent or invalid.
3) Validation of the data sets acquired in each statistical (processing base) for statistical processing and successive recording of results:
   d) statistical results are only recorded if the difference between the two extreme data points does not exceed a specific programmed value.
   e) statistical results are only recorded if the difference between the two extreme data points exceeds a specific programmed value.
   f) statistical results are only recorded if the number of valid data items acquired exceeds a programmed percentage.
   g) statistical results are recorded even if it is out from the validation parameters.

1.2.5. Primary quantities and derivatives

In addition to the primary quantities directly acquired from the sensors, BABUC ABC can also be programmed to calculate numerous derived quantities, the factors of which can be based on other primary quantities, as well as constants and standard quantities taken from a local library.
For example, the relative psychometric humidity is calculated via the acquisition of two temperatures (dry bulb and damp bulb) and atmospheric pressure (standard quantity). To each primary quantity, five derivatives quantities could be joint (not more than 80 primary plus derivatives quantities are managed on the system).

1.2.6. Automatic survey suspension in low energy situations

During a survey, should the instrument detect that its energy reserves have reached a critical level, it will activate an automatic function for saving and suspending the survey. When the energy levels return to predetermined levels, the programmed survey will be reactivated. (§3.6.3. Check battery power level).

1.3. STATISTICAL CALCULATIONS

1.3.1. Calculation types

When the programmed time interval expires, the acquired data point sets are processed using the programmed statistical mode.
A programmable period is associated with each time interval, indicating the terminal part of the interval whose data is to be used for the calculations.
Up to 5 statistical and event processes can be assigned to each quantity (not more than 120 processes are managed on the system):

Name	Description
DTMinAveMaxStDvIst	Average, Dated min, Dated Max, Standard deviation, Inst, Valid data %.
MedDvSt	Average, Standard deviation, Valid data %.
MinMedMaxDvSt	Average, Minimum, Maximum, Std. deviation, Valid data % (Anadata Clima32 compatible)
DTMinMaxTot	Total, Dated min, Dated Max, Valid data %
MinMaxTot	Minimum, Maximum, Total.
DTMinMax	Dated Min. Dated Max
MinMax	Minimum, Maximum
AveStDv	Average, Standard deviation
Ave	Average
Tot	Total
DurationMin	Duration in minutes during the time interval
1Ist	Instantaneous value at the start of the time interval
10Ist	N° 10 equally distanced instantaneous values during the time interval.
60Ist	N° 60 equally distanced instantaneous values during the time interval.
Eolo0/1	Percentage distribution of direction and speed in "6+calm" wind speed classes (0,3-2; 2-4; 4-6; 6-9; 9-12; >12 ms^{-1}) and "1+calm" wind direction sectors. Average speed for each direction sector and each speed class. The speed class delimiters and the “calm” threshold value are programmable (into next version after 1.04).. This processing produces the aeolian events table on the PC.
Eolo0/16	As for Eolo0/1 but with distribution over 16 wind direction sectors.
Eolo0/18	As for Eolo0/1 but with distribution over 18 wind direction sectors.
Eolo0/32	As for Eolo0/1 but with distribution over 32 wind direction sectors.
Eolo0/36	As for Eolo0/1 but with distribution over 36 wind direction sectors.
Eolo1	Aeolian analysis of the Prevailing Sector for which the amplitude, bisector, mean weighted direction, standard deviation of direction and mean velocity are calculated. In cases where a prevailing sector is absent, the mean velocity and standard deviation of direction are calculated. The value of the calm threshold is programmable (default 0,3 m/sec.)
Eolo2	Resulting speeds and directions are expressed in modules and angle or sine and cosine vectors. Direction standard deviation (Sigma Teta).
Eolo3	Hourly aeolian processing, compatible with the program Clima32 from Anadata data logger on PC.
Eolo4	Daily eolian processing, compatible with the program Clima32 from Anadata data logger on PC.

1.3.2. Calculation time interval base

The time intervals for the calculations, that is the frequency with which the latter are performed and memorized can be assigned to groups of statistical calculations for each quantity. The last part (n) of the time interval that is used in the calculations is also programmable; by default it corresponds to the interval itself, i.e. all acquisitions made within the interval are processed. The time intervals run from 1 minute to 24 hours.

1	min(1)	2	min(n)	5	min(n)	10	min(n)	15	min(n)	30	min(n)	60	min(n)
2	hrs(n)	3	hrs(n)	4	hrs(n)	6	hrs(n)	12	hrs(n)	24	hrs(n)	free choice	

1.4. EVENTS

1.4.1. Event types

It is possible to memorize events, the definitions of which have previously been programmed (example: exceeding thresholds or gradients, concurrence of values) and impulsive events (example: rain trip or passage of an object). Each event is defined by type, assigned value and the date/time of the occurrence and is memorized in the same fashion.

Name	Description	Name	Description
EvMin	Assigned lower threshold exceeded event	EvDelta	Assigned offset event
EvMax	Assigned upper threshold exceeded event	EvImp	Impulse event

The choice of the event and calculation types with specification of the corresponding parameters, together with the association of the chosen types with quantities operation codes can only be programmed on the PC. The maximum number of programmable event and statistical calculation types for each quantity is five.

1.4.2. Operator messages

During a survey, the operator can specify and store messages of 19 characters, chosen from a menu made on the PC via a specific function. The first message is empty, allowing it to be written and deleted directly from the instrument's keyboard, pressing the corrisponding alphanumeric keys (§1.1.7. Use of the alpha-numeric keyboard).

When a message is specified, it stored with a date/time tag. Example:

07/10/94 18:59:43;Clear sky
07/10/94 19:06:02;Light cloud

1.5. RESULT AND EVENT STORAGE

1.5.1. The survey file, support and memory structure

The Survey file is a temporary file, containing the data and the methods for interpreting it, acquired and processed with the same method. Each survey file is composed of an identification number, a data interpretation header and the data records (processed data, events and messages).
BABUC ABC has 64 kB of temporary RAM memory, where data is held if "mass" memory is not available. The latter is a removable Memocard (in 64 kB to 2 MB formats).
BABUC ABC can use two memory types:

- An internal RAM memory with 64kB size, used when the memocard in not inserted, where can be store only one survey at a time. Without main power supply, the data in RAM are kept for about one month with a rechargable internal battery. After this period the data in the RAM may be lost and is necessary to reopen a new survey.
- A removable memory card with size from 64kB to 2MB. On this memory support it's possible to store more than one survey. Anyway is advisable to limit the number of surveys to 10. While the memory card is inserted the internal RAM is not used.

The data storage structure is programmable:

- circular (when all available memory is occupied, newly acquired data is written over the oldest). This will decrease the effective capacity of the memocard by a number of bytes equal to the size of the measurement concerned.
- linear (when all available BABUC ABC memory is occupied, further data is no longer accepted).

When using a Memocard, its removal does not suspend the storage of data in the temporary RAM memory; when reinserted, the data accumulated in the meanwhile will be automatically transferred. Storage autonomy is a function of the number of quantities involved, the number and type of calculations requested and the specified time intervals.
When the memocard is not in, it is not possible to store more than one survey into the RAM memory and in case of power supply breakdown or instrument shutdown the data are loose.

1.5.2. BABUC ABC data memory occupied by calculations (in bytes)

Certain structures, although not part of the calculation data structures, are anyway present in BABUC ABC memory and must therefore be taken into consideration when determining the amount of free memory.

MemInf: is always present at the start of memory.
RelMemHeader: survey header, always present at the start of every survey.
ChMemHeader: channel header, one for each active channel of the survey plus one; they follow the survey header.
FinderMemHeader: present on every survey in the ratio of 1 for every 50 calculations stored.

Table of calculations and various structures with corresponding sizes:

Calculation/structure	Size in bytes	Calculation/structure	Size in bytes
DTMinAveMaxStDvIstB	21	EOLO 0/36	526
DTMinAveMaxStDvtIstW	26	Eolo1	18
DTMinAveMaxStDvIstF	36	Eolo2	14
MinAveMaxStDvB	12	Eolo3	56
MinAveMaxStDvW	16	Eolo4	56
MinAveMaxStDvF	24	1IstB	8
DTMinMaxTotB	19	1IstW	9
DTMinMaxTotW	22	1IstF	11
DTMinMaxTotF	28	10IstB	17
MinMaxTotB	11	10IstW	27
MinMaxTotW	14	10IstF	47
MinMaxTotF	20	60IstB	67
DTMinMaxB	18	60IstW	127
DTMinMaxW	20	60IstF	247
DTMinMaxF	24	EvMinB	8
MinMaxB	10	EvMinW	9
MinMaxW	12	EvMinF	11
MinMaxF	16	EvMaxB	8
AveStDvB	10	EvMaxW	9
AveStDvW	12	EvMaxF	11
AveStDvF	16	EvDeltaB	8
AveB	9	EvDeltaW	9
AveW	10	EvDeltaF	11
AveF	12	EvPulseB	8
TotB	9	EvPulseW	9
TotW	10	EvPulseF	11
TotF	12	EvMessage	27
DurationMINB	9	MemInf	25
DurationMINW	10	RelMemHeader	107
DurationMINF	12	ChMemHeader	135
EOLO 0/1	36	FinderMemHeader	9
EOLO 0/16	246		
EOLO 0/18	274		
EOLO 0/32	470		

Example:
- n. 2 active channels (Temperature, TeGLOBOTERvn).
- calculations for both channels: DTMinAveMaxStDvIstW, AveStDvW.
- processing rate of 1 hour.

The memory requirement is given by summing:
- 1 MemInf (in the case of a first survey)
- 1 RelMemHeader
- 3 ChMemHeader (the two channels + 1)
- 4 calculations every hour (see calculation types for the two channels)

After 2 hour, the survey will have occupied the following memory space:

(*MemInf*)	25	+
(*RelMemHeader*)	107	+
(*ChMemHeader x (two channels+1)* = 135x3)	405	+
(*Elaboration DTMinAveMaxStDvIstW x two channels x two hours* = 26x2x2)	104	+
(*Elaborazione AveDvstW x two channels x two hours* = 12x2x2)	48	=
	689 bytes.	

1.6. ACTUATORS

1.6.1. Actuator equipment and their logics

The actuators (i.e. digital outputs) are useful when it is necessary, by means of BABUC ABC, to enable and disable external systems according to programmable logic in relation to information available in the instrument.
The actuators have 8..14 Vdc output, taken directly from the battery if it is the Pb type, or by means of a 12V voltage booster if it is NiCd type; unit Imax 0.3 A, Itot 0.3 A. There is also an amplifier/contact insulator (code DGD010) that can be installed in the back door of the instrument. With regard to programmability and positions, the terminals are divided into two classes:

1) Actuators to feed the sensors.
   There are 2 for each board with 8+2 inputs, one electrically common to all analog inputs, and the other to all the pulse inputs. The latter will, if not used by the impulse probes, automatically become a “true” actuator.
2) There are two “true” actuators used for various alarms and functions on each 8+2 input card §2.2. ELECTRICAL CONNECTIONS:
   - the first is always available on the panel connector which is marked, depending on the model of acquisitition devices B1, D1, and F1 with terminals 1 (+) and 2 (-) (programmable from the keyboard as outputs 1 (= B1), 3 (= D1), and 5 (= F1) respectively);
   - the second, when not being used by the impulse inputs, is available on connectors 10 (= B2), 20 (= D2), and 30 (= F2) on the marked panel, depending on the model of acquisition device, with terminals 4 (+) and 3 (-) (programmable from the keyboard as outputs 2 (= B2), 4 (= D2), and 6 (= F2) respectively).

   “True” actuators have two types of operating logic which may be selected from the appropriate menu in “*SYSTEM->ACTUATOR USE”:*
   - energy consumption logic: keeps the actuator turned off under regular operating conditions, and turns it on only when there is an alarm;
   - safety logic: keeps the actuator turned on under regular operating conditions, and turns it off when there is an alarm or when the instrument is not working properly or it is broken.

Once the operating logic has been selected in actuator logic, the “ON” status is used when the output went to the alarm conditions, and the “OFF” status is used when the output is remain under regular conditions.
The programmable types of actuator operating logic available in the current version are listed below. Actuator outputs may be controlled by one or more of these types of logic, up to 8 types. If the actuator logics have an output in common, the actuator output will be “ON” or have alarm status when any of the thresholds that have been set is passed (and will not change status if any other thresholds belonging to other actuators are passed thereafter). The actuator output will go “OFF” or be returned to normal status only when ***all*** of the values return within the thresholds that have been set.
For technical reasons connected with the circuit, the response (status) of the actuator alarm when the threshold is passed, may be delayed by ten to fifteen seconds to the acquisition of the signal. Intervention times in the actuator logic should be programmed at 10 sec.

1.6.2. Programmable logic actuators

WIND ALARM: The actuator switches to "on" when the wind, coming from a certain directional arc with axis D and amplitude L, has exceeded a threshold V1 for time t1; it returns to "off" when the wind speed drops below a threshold V2 for time t2 or leaves the arc D(L) for time t2.
The values D, L, V1, t1, V2 and t2 are all programmable; it should be noted that when D is set to any value and L = 360, this creates a condition that is independent from the direction. Physical absence or damage to the direction sensor limits the parameters only to the speed value, while physical absence or damage to the speed sensor locks the actuator in the off condition.

EVAPORIMETRIC PAN TOP UP: The electromagnetic valve to introduce water to top up the level in the evaporimetric pan is opened at time H, only if the level is below LIV2, and is closed when it reaches LIV1; if the level LIV1 is not reached, it is still closed after time t. The values H, LIV1, LIV2 and t are all programmable. The physical absence or damage to the level sensor locks the actuator in the off condition.

PRECIPITATION START WARNING: The actuator switches to "on" when at least one of the following conditions occurs: a) time t has elapsed from the start of precipitation; b) the quantity of rain PREC has fallen from the beginning of the precipitation. The start of precipitation is identified by the first tilt of the pluviometer. Resetting is performed after the RESET time from the last tilt. The values t, PREC and RESET are all programmable. The physical absence or damage to the pulse sensor cannot be detected, while that of the analog sensor locks the actuator in the off condition.

FLOOD WARNING: The actuator switches to "on" when a “PRECP” quantity of rain has fallen in a time never interrupted by an absence of precipitation. The absence of precipitation period (Tap) is detected when, in this time, the fell rain has not exceeded a minumum quantity defined by “precp”. The actuator return to "off”, and the cycle start again, when an absence of precipitation period (as defined before) is detected, or when the instrument is switched off, or for a manual reset by the operator.

GREATER THAN: The actuator switches to "on" after exceeding a maximum programmable value of a parameter that can be selected among those configured. The actuator returns to "off" when the value is again within its limits.

LESS THAN: The actuator switches to "on" after dropping below a minimum programmable value of a parameter that can be selected among those configured. The actuator returns to "off" when the value is again within its limits.

GREATER/LESS THAN: The actuator switches to "on" after exceeding a maximum programmable value (or after dropping below a minimum programmable value), for one or more configured quantities of the same programmable opcodee. The actuator returns to "off" when all the values are again in their limits.

TIMER: The actuator will periodically be turned “ON”, with programmable cycle duration and ”ON” duration. The start of this function may also be programmed to start within 24 hours after the time of programming.

Greater than, Less than and **Greater/Less than** actuator logic permits selection of a single input or multiple inputs with the same operating code, which may be selected from among those configured.

1.6.3. Needed operative codes for actuator logics

For activate the actuator logic is necessary to configurate the inputs with a suitable operative codes for their algorithm. Following is a list of the needed operative codes for each selected logic.

WIND ALARM
Must be there two configured inputs:

- ***Angle*** with operative code selected from 034, 036.
- ***Wind Speed*** with operative code selected from 035, 040, 097, 101.

EVAPORIMETRIC PAN TOP UP:
Must be there one configured ***Level*** input with operative code selected from 060, 062, 063.

PRECIPITATION START WARNING and **FLOOD WARNING**
Must be there one configured ***Rain fall*** input with operative code selected from 046, 099, 102.

GREATER THAN, **LESS THAN** and **GREATER/LESS THAN**
Must be there one configured input with any operative code.

TIMER:
Can be programmed without reference to any operative code.

1.6.4. Displaying and modifying actuator status

If "*ACTUATOR MANAGEMENT"* is selected from the main menu during a survey, it will appears three choices:

- "*DISPLAY ALARMS* ": automatically enables display of a list of all inputs which triggered the alarm. If a quantity is selected (by positioning the cursor on it and pressing *enter*), the actuator logic which triggered the alarm will be displayed.
- "*MODIFY CONFIG*.": if the number of the actuator logic to be modified is entered, it will be possible to modify the parameters configured. When the modification is confirmed, the associated actuator output will return to "OFF"; if ESC key is selected the actuators remain in the previous condition.
- "*DISPLAY CONFIG.*": can be used to display, one by one, all the configured actuator logics.

2. INSTRUMENT INSTALLATION

2.1. MECHANICAL MOUNTING

2.1.1. Mounting on 50 mm diam. pole

With reference to the drawings at §14.1. Installation with plinth and §14.2. Pole installation system:

1) Create foundation for pole base. The pole can be anchored to the ground in two ways:
   - A cement plinth on which a tripod, code DYA020, is fixed via expansion screws.
   - A tripod, mod. DYA021, directly anchored to the ground with pickets.
2) Anchor the tripod and insert the pole.
3) Fix the instrument on the pole via two mounting collars.

The sensor cables enter the pole via the fair-leads and exit via the central union. The pole's outgoing cables are inserted in a protective sheath that connects the central union to the instrument's cable input cone. The mains power lead enters the pole through a slot near the pole's base or directly through the bottom of the pole.

2.1.2. Wall mounting

With reference to the drawing at §14.3. Wall installation

1) Drill holes in the wall in correspondence to the 4 holes attached to the rear of the casing.
2) Fix the mounting brackets to the wall with expansion screws.

The cables must be inserted in a protective sheath that enters to the instrument's cable input cone. The mains power lead must also be inserted in a protective sheath entering the cable input cone; the cable is then plugged into the recessed female socket.

2.2. ELECTRICAL CONNECTIONS

2.2.1. Input connections

Caution: always make electrical connections while the instrument is turned off.
Connect the sensors according to the programmed configuration and the setup table normally present on the inside of the device lid. The current configuration can be printed (§7.1.1. Printout of current input and actuator configuration) or displayed on the screen at any time.

With reference to the drawing at §14.6. Input connections:

7 contacts terminal block for analogue inputs (N°1-N°8; N°11-N°18; N°21-N°28):

o 1	+Current generator
o 2	+Analogue signal
o 3	-Analogue signal
o 4	Common current generator/analogue signal
o 5	+Actuated feed (12Vdc)
o 6	-Actuated feed (12Vdc)
o 7	Ground

For mA inputs the user should mount a 15 Ohm 0,1% resistance across terminals 2 and 3.
Three units of this resistance are available into the BABUC ABC fuse case

5 contacts terminal block for impulse inputs (N°9 and N°10 (B2); N°19 and N°20 (D2); N°29 and N°30 (D2)).

o 1	+Eventual 25mA photodiode feed
o 2	+Impulse signal
o 3	Common impulse signal/ photodiode feed/12Vdc actuated feed
o 4	+12Vdc actuated feed
o 5	Ground

2 contacts terminal block for actuators (B, D, F) and (A, C, E) for output power supply.

o 1	+ Actuation power supply (12 Vdc)
o 2	- Actuation power supply (12 Vdc)

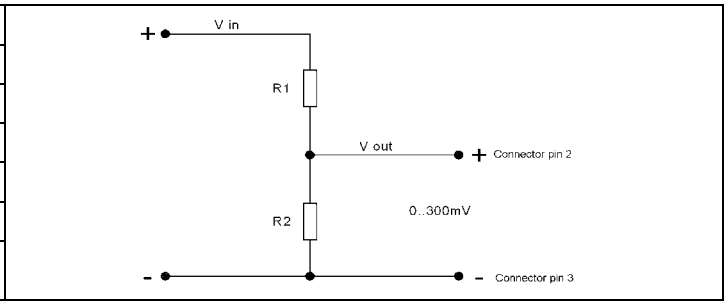
ATTENTION:
The maximum and total charge on the power supplied by the terminals 5,6 of the inputs 1-8 is of 250mA. So, it is NOT possible to connect to the same block of inputs (according to the data logger model: 1-5, 1-8, 11-18, 21-38, 41-48, 51-58) sensors that totally consume over 250mA. If this happens it is possible to damage the transistor controlling the actuation of the input terminals and the sensors won't be powered anymore.

2.2.2. Connection of the inputs of non LSI-LASTEM probes

2.2.2.1. Probes with output tension

When the tension signal coming from any kind of sensor is greater than 300 mV, it is necessary to arrange a voltage divider reducing the signal to this value. In the below table the ohm values of the most common voltage dividers are directly supplied.
Table of the voltage dividers Ohm values for input signals:

Vin signal	R1	R2
0 ÷ 10 V	32,3 kΩ	1 kΩ
0 ÷ 5 V	47 kΩ	3 kΩ
0 ÷ 2,5 V	22 kΩ	3 kΩ
0 ÷ 2 V	35,1 kΩ	6,2 kΩ
0 ÷ 1 V	23,3 kΩ	10 kΩ
0 ÷ 0,5 V	16 kΩ	24 kΩ



Connnect the voltage divider to the terminals of the interested input as per the scheme; if the sensor is not powered by BabucABC the terminal 3 has to be connected by a jumper with the terminal 4.

The values of the voltage dividers resistors have to be the most possible precise, anyway it will be necessary to calibrate the engineering parameters: set the value of end scale tension of the signal Vin. Read by the voltmeter the tension value at the ends of R2; enter into the menu of the chosen operative code and modifiy the value of the Param2i with the value read expressed in mV (see §3.3.3 Engineering unit modification)

2.2.2.2. Probe model HMP45CF from Vaisala or Campbell

The probe HMP45CF has a thermistor resistive sensitive element and can be connected to a BabucABC applying a resistor of 3k3 Ω (precision 0,5%) in parallel to the two sensors wires and connected on the terminals 1-2 and 3-4 of the connector of the desired input.
The sensors line resistance is not compensated for a cable length greater than 10 metres.

2.2.2.3. GILL sonic sensor

Babuc ABC can acquire data from the Gill sonic sensor in two ways:

- Connecting the current outputs of the sensor to the Babuc ABC inputs (see Sensor Manual)
- The connection of the Gill sensors has to take place by a 9 pins connector with the pins 5 and 9 connected by a jumper to the Babuc ABC serial port n.2. Leave the protocol default programming (Gill format, Polar continuous),transmission 9600 bps, no parity, 8 data bit, 1 stop bit.

The Gill sensor, when there is no wind, does not calculate the direction that, so, is indicated as an error in the Babuc ABC “Angle” channel. The channel “Direction” , anyway, shows in the correct way the value “Calm”. The compatibility has been tested with a Gill sensor model WindSonic.
The channel configuration takes place setting the operative codes dedicated according to the acquisition modalities. (vedi §Not Lastem Sensors).

2.2.2.4. Hydrolab multiparametric sensor

Babuc ABC can acquire instantaneous data from the multiparametric probe Hydrolab connecting the probe serial to the serial port number 2 of Babuc ABC.
The connection of the Hydrolab sensor takes place through the cable given with the sensor, using a 9 pin adaptor male/male. The sensor has to be programmed to generate data in spontaneous way in the format TTY, transmission 9600 bps, no parity, 8 data bit, 1 stop bit. The compatibility has been checked with a model Minisonde 4a. The channel configuration takes place setting the probe dedicated operative codes (vedi §Not Lastem Sensors).

2.2.3. Power connection

Babuc ABC standard version has 24 Vac power supply, the “ac” power cable is plugged into the instrument's socket. The circuit does not have a switch and is protected by a fuse. An additional external battery or solar panel can be connected to the socket marked 12Vdc. If the instrument has a Nichel-cadmium(NiCd) internal battery, the connection to the solar panel is direct (the solar panel mod. DYA202 can be used). If the internal accumulator is a lead battery (Pb), a regulator must be inserted in between (a solar panel with regulator, code DYA205, can be used).

2.2.4. Serial lines connection

The instrument has two RS232 serial lines. The RS232-1 (RS485-1) is dedicated to the connection to the PC; the RS232-2 (RS485-2) is dedicated to the connection with local serial printer or with sensors with serial output on RS232/RS485/radio line. For more information on the connection of this kind of sensors to the Babuc ABC, refer to the relative manuals of installation and use or Sensor Manual.
The connector is a standard 9 pin one. For acting serial lines the user should short circuit pins 9 and 5 for RS232-1 (RS485-1). In case of RS485 option, a 100 Ohm resistance should be mounted between terminals 4 and 7 of the input n.1 terminal

2.2.5. Actuator connections

The equipment to power via the actuator (digital output) is connected to the "B1", "B2", “D1”, “D2”, “F1”, “F2” terminal pair, from where actuated 12Vdc is available as programmed.

CORDLESS COMMUNICATORS INSTALLATION

2.2.6.Site features

There are many consumer devices that are using a radio frequency in the same band of the cordless communicators (433 MHz), and therefore they could cause trouble in the data transmissions. Fortunately these devices has short transmission time and, usually, makes transmissions rarely. The transmission protocol inside BABUC ABC adopt some solutions to limit the lost of data and, normally, the consumer's devices causes no problems.

To obtain a reliable data transmission it is better to avoid some installation situation, like these:

- Near buildings with alarm/security devices connected to infrared sensor via radio
- Industrial finding-people devices
- Metallic obstacles and metallic grids with sweaters smaller than 1 meter causes screen to the electromagnetic field
- Via radio HI-FI audio devices

Warning: before to start any building and electric connection works is opportune audit that the site is suitable for radio transmission in the 433 MHz band.

2.2.7. Setup the communication parameters

Setup or change in the Serial lines->Com 1 menu these parameters:

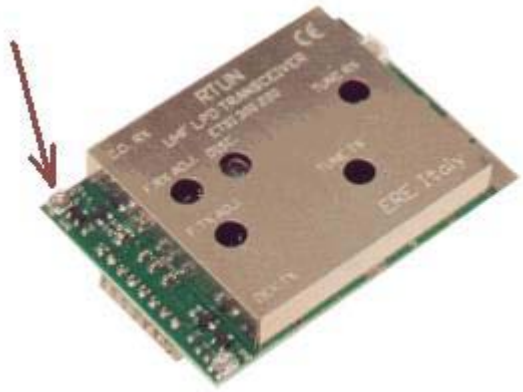
- *Identifier*, if more than one station exists in the radio network (choose a different identifier for each station)
- *TX frame size* = 256 byte
- *Bit rate* = 9600 bps
- *Line driver* = No
- *RTS anticipation* = 0.1
- *Modem type* = No modem

Follow the instructions on the GAP user guide for changing the transmission parameters on the PC.

2.2.8. Sensibility calibration

After the setup of the communication parameters, is necessary to calibrate the sensibility of the radio receiver device. Follow these steps:

1) Connect the cordless communicator DEC211 to the PC as reported in the §14.9. Unscrew and open the frontal panel of the cordless communicator unit.
2) Start the *Remote* module of the GAP programs and setup 3 second in *Option – Display update interval* menu. Start the communication between PC and BABUC ABC.
3) Adjust the receiver sensibility on the RTUN module, rotate the trimmer indicated in the next figure. To act on the trimmer, it is necessary to have a very small screw driver, similar to the clockmakers' ones. The sensitivity variation takes place rotating slightly and slowly the trimmer. Counterclockwise the sensitivity raises (the farthest signals are received better), clockwise the sensitivity decreases (the immunity to disturbs improves). Attention: do not change the position of the other trimmers; otherwise the working characteristics of the radio module will be compromised. The factory setting is for the maximum sensibility with the trimmer turned counterclockwise. If the green led (signal for data reception) is fix or it blinks continuosly in a random way, it means that the receiver is too sensitive to the radio noises, then it is better to decrease the sensibility turning the trimmer clockwise until the green led stop to blink. The red led (signal for data transmission) should blink every about 3 seconds, showing the PC transmission.



4) If more than one BABUC ABC are in the radio network, start with the calibration on the farthest Babuc ABC or on the instrument in the mostly adverse conditions (presence of obstacles).
5) Connect the cordless communicator DEC211 to the BABUC ABC as reported in the §14.9. Unscrew and open the frontal panel of the cordless communicator unit.
6) Adjust the transmission increasing or decreasing the sensibility on the receiver until, after the green led blinks, the red led blinks too. Red led indicates that BABUC ABC has recognized the message from PC and respond with its data. In this condition the communicator connected to the BABUC ABC is correctly adjusted.
7) Go back to the communicator connected to the PC and eventually adjust better the receiver sensibility until the red and green leds blinks alternatively. At the end it will possible to run the BABUC ABC from the PC by the *Remote* GAP module. Repeat these operations for all BABUC ABC in the radio network, leaving unchanged the calibration in the communicator connected to the PC.

3. INSTRUMENT PROGRAMMING

3.1. How to start up the instrument and begin to use it rapidly

These instructions will permit users to begin using the instrument within a short time period.

1. **Installing the instrument:** Perform mechanical and electrical assembly according to the instructions provided in chapter 2.
2. **Using the keyboard:** It is useful to know how to use the various keys to perform the various menu functions (§1.1.6. Use of keyboard).
3. **Turning on the instrument:** Press the On/Off switch on the panel underneath the keyboard, and wait until the introductory screen comes up after the instrument has been initialised; then press ENTER to go to the main menu. The most important programming features have already been set to default values which will satisfy the requirements of most users. In this section we take only a brief look at the functions available; we will later go into greater detail to find out more about the instrument's potential.

   By selecting the various menu functions, it is possible to display and edit initialisation parameters before beginning a survey. These parameters include:
   - Survey: to set up and start a survey.
   - Turning off: useful for memorising all data and measurements which have been obtained before the instrument is turned off with the On/Off switch.
   - Archive management: controls availability, display and/or deletion of contents of the archive.
   - Serial lines: checking and/or modification of communications parameters using serial transmission.
   - Change Memocard: addition or removal of a memocard.
   - Utilities: contains a scrolling menu of utility functions which are available and/or modifiable even during a survey.
   - System: contains a scrolling menu of functions which can be programmed before a survey.
4. **Input configuration:** The instrument is supplied with a factory configuration (§3.2. Factory programming). To modify it directly on the instrument, go into the "*SYSTEM"* menu, reset it using "*INPUT CONFIG.->RESET ALL*" and then follow the procedure for configuration of inputs and actuators (§3.4. PROGRAMMING PHYSICAL INPUT RELATED FUNCTIONS). To modify configuration from a Pc, use the Setup program (see GAP program).
5. **Start survey:** Select "*SURVEY"* from the main menu to begin taking measurements. A survey may be programmed with a start and end date and time and a comment, or it may be started immediately and ended manually.
6. **Data acquisition and processing:** When it starts a survey, the instrument begins performing a continuous measurement cycle. It turns on the power supply to probes with a separate power supply in advance, acquires the quantities configured with a sampling interval, checks whether these quantities fall within the acceptable limits that have been set, and linearises and engineers them, depending on which physical quantities are acquired (§3.3. PROGRAMMING QUANTITY RELATED FUNCTIONS). Instantaneous values may be displayed using "*DISPLAY DATA"* and updated in real time each time they are acquired. All values acquired are used to compile statistics, or records of events, for each of the configured quantities (§1.3. STATISTICAL CALCULATIONS) and then memorised in the mass memory available (§1.5. RESULT AND EVENT STORAGE). Processing times and types are programmed separately for each quantity and may be modified only using the Setup program on the PC.
7. **Reading and downloading reports:** Reports may be downloaded from the BABUC ABC using the appropriate Communication program (refer to GAP program), stored in the PC's memory and displayed in graphic or table form. The most common reports may be displayed on the BABUC ABC, using the function in the *"DISPLAY DATA->REPORTS*" function.
8. **Displaying various data:** During a survey, it is possible to display and modify the date/time, beeper, keyboard and display off parameters using the *"UTILITIES"* menu function.
9. **Stop survey:** To stop taking measurements, select "*END OF SURVEY*" and confirm the selection.
10. **Turning off the instrument:** Before turning off the instrument (On/Off switch), carry out the turning off procedure by selecting the appropriate item in the menu; if this is not done, all the reports generated during the measurement session will be lost.

3.2. Factory programming

BABUC ABC leaves the factory with a general purpose logic program as described in the configuration table normally located on the inner face of the equipment cover.
The user can use the original configuration or modify it as desired via a specific procedure (§3.4.1. Input assignment and sensor error corrections, §3.4.2. Actuator assignment, §3.7.2. Configuration of inputs, §3.7.3. Configuration of actuators). The not in use inputs should be deleted from the configuration.
Whenever the configuration is modified, it is always recommended to reprint the current configuration table using the relative function.

3.2.1. Factory configuration for 5 inputs BABUC ABC versions

Inp	Corr		Characteristics					Elaborations		
N°	A	B	Opcode	Rate	Input signal	Range	Name	Type	Base	Port.
1	1	0	077	1'	60÷300mV	-30+70°C	Temperature	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
2	1	0	031	1'	60÷300mV	0÷100%	Rel. Humidity	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
3	1	0	033	1'	0÷300mV	800÷1100 hPa	Atmospheric pressure	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
4	1	0	036	5"	Resistive 0..2 kohm	0÷360°<	Wind direction		1h 24h	1h 24h

3.2.2. Factory configuration for 10 inputs BABUC ABC versions

Inp	Corr		Characteristics					Elaborations		
N°	A	B	Opcode	Rate	Input signal	Range	Name	Type	Base	Port.
1	1	0	077	1'	60÷300mV	-30+70°C	Temperature	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
2	1	0	031	1'	60÷300mV	0÷100%	Rel. Humidity	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
3	1	0	033	1'	0÷300mV	800÷1100 kPa	Atmospheric pressure	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
4	1	0	036	5"	Resistive 0÷2 kohm	0÷360°<	Angle		1h 24h	1h 24h
5	1	0	047	10"	0÷20mV	0÷1500Wm^{-2}	Global radiation	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
6	1	0	049	10"	-10+15mV	-1000+1500 Wm^{-2}	Net radiation	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
7	1	0	078	1'	100/200mV	Yes/No	Presence	DurationMin DurationMin	1h 24h	1h 24h
8	1	0	009	1'	Pt100	-30+70°C	Temperature	AveMinMaxStDs AveMinMaxStDs	1h 24h	1h 24h
9	Not programmed									
10	1	0	099	1'	Impulsive	0,2mm	Rain quantity	Tot Tot	1h 24h	1h 24h

3.2.3. Factory configuration for over 10 inputs BABUC ABC versions:

First 10 inputs as 3.2.2, next not programmed.

Inp N°: Number of input.
Corr.: Terms A and B used in the linear equation for sensor error correction (y=Ax+B).
Opcodee: Operation code of quantity in output. This sums all of the process operating modes necessary to convert the sensor signal to the desired final quantity.
Rate: Scanning interval used by BABUC ABC for reading the sensor.
Input signal: Type of sensor or electrical input signal.
Range: Measurement range.
Name: Name of quantity in output.
Type: Type of calculated and stored results.
Base: Periodic time interval over which data is acquired for calculations and result registration.
Port.: Final portion of the periodic interval effectively used.

3.2.4. Alphabetic list of programmable functions

	Executable on		See
Description	**BABUC**	**PC**	**§**
Acquisition unit electrical input signal (type and field)	*	*	3.3.3.
Actuators (assignment)	*		3.4.2.
Actuators (algorithm and logic of actuation)	*		1.6.4.
Actuators (reset and configuration setup)	*		8.1.1.2.
Actuation for external users	*		1.6.1.
Battery (selection of Pb or NiCd)	*	*	
Baud rate	*		3.5.2.
Communications protocol (type)	*		3.5.5.
Data storage format (byte, word, float)		*	
Display (auto switch-off time after last key-press)	*	*	3.6.8.
Data statistic (resetting)	*		
Events (parameter specification)	*		
Events (types for which registration is requested)		*	
Input signal linearization		*	
Inputs (assignement)	*		3.4.1.
Instrument's user serial number (modifiable)	*	*	3.7.14.
Keyboard (password access protection)	*		3.6.7.
Keyboard beeper (enable, disable)	*	*	3.6.6.
Line driver (setup)	*	*	3.5.7.
Modem (modem type)	*	*	3.5.8.
Operator messages (entry)	*		4.3.
Operator messages (list preparation)		*	
Protocol (network protocol identifier)	*	*	3.5.3.
Quantity in output (descriptive name)		*	
Quantity in output (number of decimal places)		*	
Raw data acquisition rate	*	*	3.3.1.
RTS (Request to send) for radio communication	*		3.5.6.
Sensor error (correction)	*		3.4.1.
Sensor power feed (in advance of data acquisition)	*	*	3.3.2.
Standard quantity (specification)	*		3.7.5.
Standard quantity (specification during the survey)	*		8.1.1.1.
Statistical calculations		*	
Survey (close)	*		4.1.3.
Survey (programming and comment entry)	*	*	4.1.1.
Survey (start)	*		4.1.2.
Survey storage structure (linear or circular)	*	*	3.6.9.
System date/time	*		3.6.1.
Time base (terminal portion used for result calculations)		*	
Time base for preselected processing		*	

Transmission packet size (frame)	*	*	3.5.4.
Validation checks for accepting database in statistical calculations		*	
Validation checks for accepting raw data in the database		*	
Wind calm (assignment of threshold)		*	
Wind speed classes (assignment of class benchmarks)		*	

For PC options see SW GAP User manual

3.3. PROGRAMMING QUANTITY RELATED FUNCTIONS

The set of operational functions activated in order to obtain calculated results for a certain quantity from one or more input signals is synthesized in a specific code, known as the "Operation code" (Codop).
BABUC ABC has a library of opcodes suitable for treating the most varied of quantities. If the operating instructions contained within a chosen opcodee do not quite correspond to requirements, it is possible to modify and adapt them. Some instructions are locally modifiable on BABUC ABC, whilst others can be modified on PC. (See GAP manual).
BABUC ABC holds a library (*"SYSTEM->LIST&MODIF.OPCODEE"* menu) containing 200 operation codes, of which 150 are for primary quantities and 50 for derived quantities.
The functions synthesised in the "Opcodee" are:

	Executable on	
Description	**BABUC**	**PC**
Sensor power feed (in advance of data acquisition)	*	*
Time base for pre-selected processing		*
Time base, terminal portion used for result calculations		*
Wind calm (threshold assignment)		*
Wind speed classes (assignment of class benchmarks)		*
Decimal places used for quantity values		*
Description of quantity in output		*
Statistical calculations (type and rate)		*
Events, types for which registration is requested		*
Engineering units for quantity in output	*	*
Validation checks for accepting raw data in the database		*
Validation checks for accepting database in statistical calculations		*
Input signal linearization		*
Raw data acquisition rate	*	*
Electrical/serial input signal to the acquisition unit (type and field)		*

From the initial menu, choose *"SYSTEM->LIST&MODIF.OPCODEE"*. A list of the library's opcodes will be displayed on the §12. OPERATIVE CODES TABLE FOR LSI-LASTEM PROBES of this manual).
Select the Opcodee of the quantity to be modified; a sub-menu of parameters directly modifiable on BABUC ABC will be displayed for selection.

3.3.1. Acquisition rate modification

Select "SYSTEM->LIST&MODIF. OPCODEE->*ACQUISITION RATE*"
The acquisition rate is the interval of time between one data acquisition and another. The interval can be from 1 second to 12 hours. Correct setting of the acquisition rate permits a representative database to be built from which valid statistical results may be calculated. It is advised however to balance the demand for a large database against equipment energy savings; in fact, a faster data acquisition rate implies increased energy consumption.
The instrument's maximum sampling speed is 2 channels per second; the acquisition times for each sensor should therefore be chosen on the basis of the total number of connected sensors, so that enough time is available to interrogate all of them.
When acquisition rates are near the maximum permitted values, the system preferentially acquires the first channels programmed, but this does not preclude the acquisition of those that follow; this possibility depends upon the system load (user interactions via keyboard or operations, data transmission, large variances in sensor signals, etc.). When very fast channels (e.g. wind speed and direction) and slow channels (pressure, air temperature, ground temperature, etc.) are used together, during the "*INPUTS CONFIGURATION*" it is advised to insert the quantities with fast acquisition rates in the first channels and then the others; in this manner, the system gives "preference" to the faster quantities with respect to the slower ones.
To verify whether a quantity is acquired at the specified rate, using the "*DATA DISPLAY->STATISTICS*" option, check that the number of acquisitions made in a given period is as expected.
As regards the acquisition of LSI sensors with serial output, it is better to set the acquisition rate of the sensor that corresponds to the acquisition rate indicated on the sensor. The instant of acquisition of Babuc ABC and of the sensor are not necessarily synchronized; in this case the instrument could perform the reading of the quantity with a maximum delay that corresponds to the acquisition time of the sensor.
Babuc ABC doesn't give an error if the measure acquired from the sensor is wrong, but it uses for its acquisition the last correct measure received. That happens to three consecutively wrong measures at the

maximum; so the fourth measure determines the effective message of error from the instrument, that persists until it receives a new valid measure.

3.3.2. Advance powering of sensors with respect to acquisition

Select "SYSTEM->LIST&MODIF. OPCODEE->*ANTIC.SENSOR SUPPLY*"

Certain sensors need power to be supplied in advance of the moment in which they acquire data. Normally all sensors that are amplified and/or have normalized outputs must be powered. The available voltage is 12Vdc, un-stabilized, with a maximum current of 0.25 A for each sensor and a total maximum of 0.6 A.

If the power-on anticipation exceeds the acquisition rate, the sensor is powered without interruption. The instant when BABUC ABC powers a sensor, all of the others are simultaneously powered.

The advance period can vary from 0 seconds (no power supplied) to 12 hours.

3.3.3. Engineering unit modification

Select *"*SYSTEM->LIST&MODIF. OPCODEE->*IN->OUT PARAMETERS"*.

This function allows converter output values to be linearly converted. This is useful when an electrical signal (usually normalized) is available that is to be read and directly stored in the quantity that it represents.

This function is only active on BABUC ABC for codes assigned to normalized electrical signals. For other signals, it is necessary to use the PC program.

Note: The "-" (negative) sign may be set using the "F2/-" key; the decimal point using "F1/,".

Engineering of non-status operating codes:

```
P a r a m 1 i * 0 0 0 0 . 0 0 0 0 0
P a r a m 2 i * 0 0 0 0 . 0 0 0 0 0
P a r a m 1 o * 0 0 0 0 . 0 0 0 0 0
P a r a m 2 o * 0 0 0 0 . 0 0 0 0 0
```

Specify desired values

1i: input signal start of scale
2i: input signal end of scale
1u: start of scale for output in engineering units
2u: end of scale for output in engineering units

Example

Parameter 1i: 0	*Electric scale start (es. 0 mV)*
Parameter 2i: 300	*Electric scale end (es. 300 mV)*
Parameter 1u:-20	*Start range of the measured parameter (es. -20°C)*
Parameter 2u:100	*End scale of the measured parameter (es. 100°C)*

Example

2) A °F scale is required for a sensor with 0+70°C output.
Using the GAP software on PC, the desired engineering units are enabled by programming the following parameters:
Parameter 1i: 0
Parameter 2i:70
Parameter 1u:32
Parameter 2u:158

Engineering of status operating codes:

Modification of limits on operating codes indicating status or presence (73, 78, 79, 80).
The operator may programme the limits on the interval for the logical status signal (maximum amplitutde 0..+300 mV) and assign a threshold above or below which it is inverted.
Example:
OFF STATUS: + 00000.000 (accepts a value between 0 and 150 and displays NO).
ON STATUS: + 00300.000 (accepts a value between 150 and 300 and displays YES).
THRESHOLD: + 00150.000.

3.4. PROGRAMMING PHYSICAL INPUT RELATED FUNCTIONS

3.4.1. Input assignment and sensor error corrections

This function is used to assign the operation code or codes to each input for the quantities to acquired from the sensors; eventual error correction factors for the sensor can be assigned. If all inputs are already assigned, a warning is issued and it is necessary to free one with the "*RESET*" functions before continuing.
Select *"SYSTEM"CONFIG INPUT CHANS"* from the main menu and then:

- Select *"CONFIG. VIEW"* to display the current configuration.
- Select *"SINGLE RESET"* and specify number of the input for which the current assignment is to be cancelled. Or
- Select *"TOTAL RESET"* to cancel all current input assignments.
- Select *"CONFIGURE"* to assign free input, or modify the sensor correction factors. Then:
- Insert the Operation Code (Opcodee) of the desired quantity.
- Insert the input number (*INP*.) to which the sensor is to be connected.
- Insert the factors A and B for the eventual correction of sensor errors, according to the equation y=Ax+B. If the sensor is error-free, confirm the default values of A=1 and B=0.

Use the following formula to calculate A and B:

A:	Amplification =(FS-IS)/(fs-is)	is=	Start of scale value to be corrected
B:	Offset =[(ISxfs)-(FSxis)]/(fs-is)	fs=	End of scale value to be corrected
		IS=	Desired start of scale
		FS=	Desired end of scale

Example 1
A sensor has an error of +2°C over its entire range (-30... +70°C).When the probe signal 22°, in should in reality indicate 20°C:
A = 1 B = -2
Example 2
A temperature sensor has an error of -2° at 0° and +1° at 25°:
A= (25-0)/(26-(-2)) = 0.8929 B= [(26x0)-25x(-2)]/[26-(-2)] = 1.7857

At the end of paste the "primary quantities" (§13.1. PRIMARY QUANTITIES (codes from 001 to 149)) to their inputs and the probe correction, it is possible to start the setup of "derivated quantities", if required (Refer to table §13.1.1. DERIVATED QUANTITIES (codes from 151 to 198) for a complete list of available derived quantities) selecting the numbers of channels where the probe, from which the quantities should be derivates, are connected.
At the end of the setup, it is possible to check it with the option "*INPUTS CONFIGURATION > SEE CONFIGURATION*".
If Opcode. for thermocouple probes is selected (21...30, 115), a “cold connection” acquisition channel is automatically created and the value of the measurement is displayed in the *DISPLAY* screens; the value may be memorised by making the report generated by operating code n. 085 into a parameter using the *SETUP* in the GAP software.

3.4.2. Actuator assignment

This function is used to assign a mathematical operator code, the input number of the variable to be used and the variable's value for each actuator output. If all actuator outputs are already assigned, a warning message is issued. Select “YES” to continue with common output; to select (“NO”), first free one up using the "RESET ONE/ALL" function.
Select *"SYSTEM->CONFIG.ACTUATORS"* from the main menu and then:

- Select *"CONFIG.VIEW"* to display the current assignments.
- Select *"SINGLE RESET"* and specify number of the output for which the current assignment is to be deleted.
- Select *"TOTAL RESET"* to cancel all current actuator assignments.
- Select *"CONFIGURE"* to assign free output.

Then:

- Insert the actuator type and output number (1…6) to which the actuator is to be connected (B1=1, B2=2, D1=3, D2=4, F1=5, F2=6).
- Select the actuator type in the menu.
- Select the functioning parameter values for the selected actuator type.

3.4.3. Derivated quantities set-up

BABUC ABC measures, from the connected probes, primary quantities and it can calculate and recorder derivates quantities, starting from others primary or derivates or standard quantities. As other operative codes, the derivate quantity operative code could be changed to have the name and measure unit texts as the calculated measurement. Changing the name and the measure unit texts let to well understand what the channel calculates. For example, it is possible to change the text from “PRODuct” to “Power” of an operative code that multiply two measurements, current and voltage.

Examples:

- Relative psychrometric humidity: calculated from two acquired temperatures (primary quantities: dry bulb and wet bulb) and from atmospheric pressure (standard quantity); a psychometric constant 0.000823 which is correct for LSI probes (standard constant 0.00065) is employed in calculation.0
- Derivates from relative humidity (dew point, partial steam pressure, absolute humidity, specific humidity, mixing factor, heat content of humid air: these are calculated as described above, or using temperature and relative humidity).
- Wind speed with Pitot tube or Darcy: calculated with the primary quantities Differential pressure (Opcode. 037, 038, 039) and air temperature where the wind speed is taken. If the air temperature probe don’t exist it is possible to setup a fixed temperature in the standard quantities configuration; this operation is proposed automatically to the user during the channel setup phase.
- Wind direction: calculated from the primary quantities of angle and wind speed.
- Volumetric air delivery: calculated from a wind speed quantity (Opcode 035, 098, 106, 107, 159).
- Mass air delivery: calculated from a wind speed quantity (Opcode 035, 098, 106, 107, 159) ad an air temperature quantity (see *Wind speed with Pitot tube or Darcy*).
- Index WCI (Wind Chill Index) e TCH (Temperature chilling): They are calculated with the primary quantities environmental temperature and relative wind speed (referred to a standing person)
- Evaporation: calculated from the primary quantity Level (Opcode 060). Before this operating code may be used, the bottom of the scale in input and output of engineering parameters must be adjusted according to the level to which water has been topped up in the evaporimetric pan, measured by the level detector.
- Product: is calculated from acquired values of primary or derived quantities between two inputs of same or different operative codes, but with the same phisical mean. For example W=V*I: the power (W) is a product between voltage (V) and current (I).
- Average 1-2: this is the average calculated from the acquired primary or derivate quantities included between 2 assigned inputs with one to three different operating codes (but belonging to the same physical quantity). Primary quantities are acquired quantities; derivate quantities are horizontal averages, which may also be calculated for derivate quantities.
- Delta 1-2-3: the difference calculated between acquired values for primary or derivate quantities for two inputs with different operating codes (but belonging to the same physical quantity). The primary quantities are the acquired quantities; the derivate quantitiy is the delta, which may also be calculated for derivate quantities.
- Wind run: Calculated by means of wind speed value (CodOp 035, 040, 097, 098,101, 106, 107) described in km with the following formula: Instantaneous wind speed (m/s) X acquisition rate (s) /1000.
- Energy: Calculated by mean of radiation value (CodOp 047, 048, 049, 050, 051, 052, 054, 056, 057, 058, 059, 061) described in kj/m^2 with the following formula: Instantaneous radiation (W/m^2) X acquisition rate (s) /1000.
- UV index and exposure level: calculated with the primari quantities UVA and UVB.
- Heat Stress index and heat discomfort: calculated using an environmental temperature and an acquired or calculated relative humidity.

For a list of derivate quantities, refer to table 13.2. A list of primary quantities and standard quantities used in calculation appears in section ii, and the operating codes which may be used are listed below them.

3.4.4. Setup of the derived quantity “Wind Direction”

Wind direction is a derived quantity calculated by two BABUC ABC acquisition quantities: wind speed (measured by wind speed sensor) and angle (measured by wind direction sensor). In the factory configuration the parameters are already in; if the user wish to repeat it, find here below a description.

1) Go to SYSTEM -> CONFIG.INPUT CHANS-> CONFIGURE. Give to the input where the wind direction probe is connected (normally input n. 004) the Codop n. 36 “wind angle”.
2) Give to the input where the wind speed probe is connected (normally input n. 009) the Codop n. 97 “wind speed” using the C100S, C101S (or Codop n. 101 using the CombiSD sensor)

3) Create a new Codop n. 162 “Wind direction ” (derived quantity). BABUC ABC suggest to use inputs number 004 e 009 in order to calculate “wind direction”. Confirm if it is correct.
4) The BABUC ABC factory configuration is made in order to have EOLO3 elaboration every 1 hr. and EOLO4 elaboration every 24 Hrs. To modify this, it is possible to change the Operative code n. 162 on the SETUP module of the GAP software.

3.4.5. Solar radiometers configuration

Each radiometer has it own typical electrical output, it is on the calibration certificate
It is needed to modify the Codop of the radiometer because BABUC ABC need this information in order to trat the electrical signal from the probe to arrive to the correct measurement.
1) In the SYSTEM->LIST&MODIF.OPCODE->IN->OUT PARAMETERS select the used radiometer Codop.
2) Modify the Parameters n.1 and n. 2 as here described:
   a) Multiply the calibration factor (in $\mu V/Wm^2$) for the parameter n.3. Remove the parameter n.1 with the result (insert the mV value: μV/1000).
   b) Multiply the calibration factor (in $\mu V/Wm^2$) for the parameter n.4. Remove the parameter n.2 with the result (insert the mV value: μV/1000).

Examples

- Global radiometer
(Codop. n.47) Range 0-1500 Wm^2 Electrical output 12$\mu V/Wm^2$ from calibration certificate).

Parameters	Default	After modification
Parameter 1	+0000.000	+0000.000
Parameter 2	+0020.000	+0018.000
Parameter 3	+0000.000	+0000.000
Parameter 4	+1500.000	+1500.000

- Net radiometer
(Codop. n.49) Range -1000+1500 Wm^2 Electrical output 9$\mu V/Wm^2$ from calibration certificate).

Parameters	Default	After modification
Parameter 1	-0010.000	-0009.0000
Parameter 2	+0015.000	+0013.500
Parameter 3	-1000.000	-1000.000
Parameter 4	+1500.000	+1500.000

3.4.6. Atmospheric barometer CX111P (DQA240) configuration

For its calibration, CX111P has not adjustment trimmers
When it is needed calibrate the pressure conforming to a reference measurement or when it is needed to report the “see level pressure” see the following instructions:

(Codop. 033) Range 800+1100 hPa. 1 mV = 1 hPa

Parameter	Default
Parameter 1	0000.000
Parameter 2	+0300.000
Parameter 3	+0800.000
Parameter 4	+1100.000

Example 1: in case of adjustment of 20 hPa more than the measured pressure:
Example 2: in case of adjustment of 20 hPa less than the measured pressure:

Parameter	**After modification** (Example 1)	**After modification (**Example2)
Parameter 1	0000.000	0000.000
Parameter 2	+0300.000	+0300.000
Parameter 3	+0820.000	+780.000
Parameter 4	+1120.000	+1080.000

3.5. PROGRAMMING TRANSMISSION PARAMETERS

3.5.1. Tx/Rx status display

During data transfers between BABUC ABC and PC it is possible to display the status of both of BABUC ABC's serial ports. This option is activated by accessing the *"COMMUNICATIONS->ACTIVITY Tx/Rx "* sub-menu from the main menu or the on-line menu during a survey:
Data line 1: Data line serial port used for transferring data to PC.
Data line 2: Data line serial port used for acquiring LSI sensors with serial output or for printing data through serial printers.
During the data transfer or reception on BabucABC it is possibile to visualize the activity of both the serial ports. For this purpose select, from the start menu or from the on line menu during the survey:

- *"Serial lines->Com1->ACTIVITY Tx/Rx"*. Com(1) is the serial port used to transfer data elaborated from the PC.
- *"Serial lines->Com2->ACTIVITY Tx/Rx".* Com (2) is the serial port used for the acquisition of serial sensors with serial data output (LSI cordless sensors, Gill sonic sensors, Hydrolab or Wivis multiparametric sensors), or used for printing data on serial printers.

When the serial line 1 is active, a series of numbers with the following significance are continuously displayed:
The *Tx* and *Rx* columns indicate data transmitted and received by BABUC ABC. The *Frm* row indicates the number of *data packets* and the *Chr* row the number of characters (*Bytes*). Thus, to determine the number of packets received by BABUC ABC for example, it is sufficient to refer to the number at the intersection of the *Rx* column with the *Frm* row.
The displayed information, apart from supplying a series of data regarding BABUC ABC to PC communications, can also help in tracking down eventual malfunctions that can be encountered during data transmission. When the PC performs a data request, *Chr-Rx* must change, as must *Frm-Rx*; if *Chr-Rx* does not change, it means that BABUC ABC has not received any character from the PC; this indicates a cable problem, or incorrect serial port selection on the PC. If *Chr-Rx* changes, but not the same as *Frm-Rx,* it indicates that BABUC ABC receives certain characters but is unable to correctly interpret them: this signifies a probable difference in the programmed *Baud Rate* between the PC and the instrument, or a network protocol ID mismatch.
If *Chr-Rx* and *Frm-Rx* change, BABUC ABC has correctly received the request and thus also *Chr-Tx* and *Frm-Tx* must change for the reply. Should the data not arrive to the PC, the problem is due to a fault in the receiver of the PC's serial port, or to a break in the data transmission line.
The visualization of the information of the serial line 2 is useful for determining the real acquisition of data generated by the LSI sensor with serial output. Each time that the instrument acquires a data transmitted by this kind of sensor, the number of frames received and the correspondent number of bytes are increased. In comparison to what happens to the communications on the serial line 1, the instrument doesn't provide response to the frame of the received data; for this reason the number of transmitted frames (*Frm*) and the number of bytes will remain to zero.

3.5.2. Transmission speed (Bit rate)

For communications, the transmission rate (Bit rate) of both systems must be the same. To change the speed, select the *"BIT RATE"* option that displays a scrolled value list; the choices are from 1200, 2400, 4800, 9600, 19200, default is 9600 bps.
The acquisition of LSI sensors with serial output takes place at a standard speed of 9600 bps; the communication speed between serial port 1 and 2 must be the same, so when this kind of sensors are used the speed of serial port 1 will necessarily be 9600 bps.

3.5.3. Network protocol identifier

The protocol identifier allows to realize RS485 or radio connections (with cordless communicators mod. DEC201), between one master (PC) and one or more slaves (Babuc ABC). Each instrument must be a different protocol identifier. Only number in the range 2 to 255 can be used (1 corresponds to the PC).
In cases where the instrument functions in "stand alone", the protocol identifier can be left with the default value of (2). To change the ID, select the *"COMMUNICATIONS->IDENTIFIER"* option.

3.5.4. Data packet sizes

During a connection between BABUC ABC and a PC, the size of the data packet (frame) to be transmitted is programmable (32, 64, 256, 1024 bytes). The choice of size is tied to the amount of possible noise in the transmission media. The greater the noise, the smaller the packet size must be. The bigger the packet, the

quicker the transmission, but the probability of incorrect transmission also increases. The default size is 1024 bytes; to change the size, select the "*TX FRAME SIZE*" option and then specify the desired value.

3.5.5. Protocol types

BABUC ABC can use two types of protocol for PC communications selectable by *"COMMUNICATIONS->TYPE OF PROTOCOLS"*.:

- LSI-LASTEM protocol (factory default).
- MODBUS protocol.

The LSI-LASTEM proprietary protocol enables the instrument to be handled with the GAP program on PC, with access to all of the specialized functions developped by LSI-LASTEM (configuration, calculated results transmission, remote control, etc.).
The MODBUS protocol allows communications requests to be sent to BABUC ABC using a standard protocol; in this case, the available data is only a part of that controlled with the proprietary protocol. The greater diffusion of MODBUS facilitates the user implementation of applications capable of communicating with BABUC ABC.
The computer programmers who want to create their own software on the PC using one of the two protocols, can find more information in the "*Manuale del programmatore*" (written in Italian).

3.5.6. RTS signal advance switch-on

It Is used to specify how much time before the beginning of a Tx communication the RTS signal must be sent. This logical command to the RS232 line is employed particularly in radio communications (by the cordless communicators mod. DEC201 and mod. DEC211; in this case use a zero value), when the transmission carrier must be raised in advance to permit the two radios to connect properly, or when using RS485 serial lines or multiple line drivers. The time may be set at between 0 and 0.9 seconds. The factory setting is 0.0; when supplied with a radio (other than cordless communicators DEC201/211), it is set at 0.3, and when supplied with a line driver or RS485, it is set at 0.1.
***IMPORTANT*:** when RTS signal delay is activated, in the GAP setting should be activated *Serial line configuration – Advanced options*; radio transmission should be carried out with *advance carrier activation* =70 and delayed *carrier deactivation* = 50; with cordless communicators DEC201/211 set 0 ms; these values may be modified depending on the physical condition of the system.

3.5.7. Including two-point or multiple line drivers

Line drivers are units mounted on the heads of a serial line, the first on BABUC ABC RS232-1, the other on PC RS232. Line drivers adjusts the signal in order to have longer serial line connections. Normally a standard serial line could not be longer than 10-15 mt whereas, with line potentiometer, it can be 1500-2000 mt long, in function of the selected transmission speed.
If a line driver is installed on the BABUC ABC RS232-1 port, select *COMMUNICATIONS->LINE DRIVER* and then select *YES*, and adjust the RTS advice for multiple line drivers.

3.5.8. Modem start-up

Attention: Function for experts users.
The misuse of this function could transfer wrong settings to the modem
All modems supplied by Lastem exit from the factory already settled
The GSM modems are programmed in Non transparent modality
The programming of the GSM modems is valid only for the modems below:

Telephone modems can be used for data communication. Depending on the modem type, a different start-up command line is used. It may already be configured or may be chosen by the user.

- No modem: used when direct communication without modem is carry out
- Telephone modem: used when Remote Port 96 and SMF-36 modems are installed.
- GSM1 cellular modem: used when GSM for transmission ***transparen*t** mode.
- GSM2 cellular modem: used when GSM for transmission ***no transparent*** mode.
- Freely defined: default ATS0=1E0V0 (can be modified from keyboard; §1.1.7. Use of the alpha-numeric keyboard).

After programming the modem, leave the menu settled as **"No Modem"**

220 Vca power supply modems are not in the above list. They need to be initialized by PC.
For GSM modems, it is necessary to buy a ***SIM CARD*** abilitated for data transmission, and programmed by the telephone company as follows: ***9600 bps, Asynchronous, non transparent***. In case the SIM CARD is programmed in transparent mode, it is necessary to modify the GSM modem start-up into ***Transparent*** mode

3.5.9. Lastem modem configuration instructions

BABUC ABC can be connected to some modems available from Lastem. If a different modem must be used, BABUC ABC can be learned about the new modem with the help of the *Setup* module of GAP programs, or with the BABUC ABC menu “Modem setup - setup”

If a terminal program is used to configure the modem connected to BABUC ABC is necessary to setup the transmission speed of the terminal serial port to the same speed used by the calling modem connected to the PC. BABUC ABC must use the same speed also.

Here below are modems available from LSI Lastem. Where not different specified, each modem can be used with both BABUC ABC and PC:

1) **Digicom SNM46 – Modem/fax V.32bis 220 Vac (14400 bps)**
2) **Sysnet SMF- 81 – Modem/fax V.34 220 Vac (33600 bps)**
3) **Digicom Donatello 220 Vac – Modem ISDN**
   Only for PC.
4) **Sysnet Remote Port 96 – Pocket modem 9 Vdc V22bis (2400 bps)**
5) **Sysnet SMF - 36 – Pocket modem 9 Vdc V32bis (14400 bps)**
6) **Gsm Falcom A1, A2 – Cellular modem 12 Vdc (9600 bps)**
   Only for BABUC ABC.
7) **Gsm WM01, WM02 – Cellular modem 12 Vdc (9600 bps)**
   Only for BABUC ABC.
8) **Gsm Siemens M1 – Cellular modem a 12 Vdc (9600 bps)**
   Only for BABUC ABC.
9) **Gsm Industrial BASE 12 Vcc (9600 bps)**
   Only for BABUC ABC.

3.6. PROGRAMMING GENERIC PARAMETERS

3.6.1. System date/hour specification
Permits setting of the systems internal clock. This function cannot be activated if a survey is in course. Select *"UTILITY->SYSTEM DATE/HOUR"*.

3.6.2. Check available memory
Select "*UTILITIES->AVAILABLE MEMORY* ". For further information, §5.1.1. Display available memory

3.6.3. Check battery power level
Select "*UTILITIES'->BATTERY LEVEL* ".
In this function, BABUC ABC informs you of the battery power level (also giving its percentage of full charge), acquiring it automatically every minute. Depending on the type of battery in the instrument, the power level may be:
- Pb battery: 10.5...14V
- NiCd battery: 6.5....8.5V.

When the power level is detected at below the safe level for more than three acquisitions, BABUC ABC first stops the survey in course, giving an error message (to be removed using the "*DISPLAY ERRORS*" procedure) and then goes off. It will automatically start the survey again when the power level is returned to the correct value. The thresholds are as follows:

	Pb battery	NiCd battery
Survey is suspended and data is saved when the power level is too low.	10.5V	6.5V
The instrument goes off if the power level drops even lower:	9V	6V
The instrument comes back on automatically and resumes the survey at:	13V	7.5V

Battery power level may also be displayed in the instantaneous value display screen. It is possible to store battery power level trends in memory by setting a parameter of the processing generated by operating code n. 111 in the GAP software SETUP.

3.6.4. Error display
While BABUC ABC is in operation, it may display a flashing error message indicating that there is a problem of some kind. To identify the problem, select "*UTILITIES->DISPLAY ERRORS*".
The error message will appear only if the instrument is displaying a screen which is automatically updated (a screen in which information is automatically modified); if the instrument is left on a menu, the operator may not notice that a problem has arisen.

3.6.5. Display IPC activity
(Protected function)

3.6.6. "Beeper" specification
The *"Beep"* that indicates valid key-presses can be enabled or disabled. Select *"UTILITY->BEEPER"*.

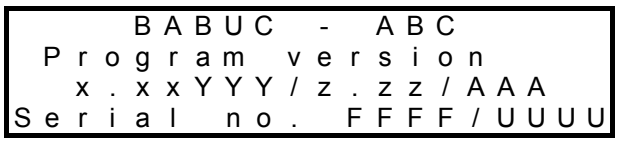
3.6.7. Keyboard security password
Select *"UTILITY->KEYBOARD PROTECTION"* to protect the keyboard from tampering or to remove the protection. The password consists of a 5 digit numeric code. The keyboard remains protected until the valid password is entered in reply to the *"INSERT PASSWORD"* request. User should type the password two times.

3.6.8. Display's auto switch-off specification
When it is necessary to save power, it can be useful to switch the display off between successive operator interactions. This does not affect BABUC ABC's normal functioning. To switch the display back on, it sufficient to press any key on the keyboard. To set the keyboard idle time after which the display is to be automatically switched off, select the *"UTILITY->DISPLAY EXTINCTION"* option and specify the time in minutes. To disable this function, set the time to "00". The energy savings when the display is switched off is approximately 2 mA on a total of 5.5 mA.

3.6.9. Display version and serial number

Select "*UTILITIES->VERSION/SERIAL NUMBER*". Each instrument is identified by a series of codes:

- Program version used by data acquisition processor (x.xx)
- Program language (YYY)
- Program version used by data processing processor (z.zz)
- Operating code library version (AAA)
- Instrument's factory serial number (FFFF)
- User's serial number for instrument (UUUU), which may be edited in "*SYSTEM->EDIT SERIAL NUMBER"* or using the Sw on the PC.



3.7. PROGRAMMING PARAMETERS IN SYSTEM MENU

3.7.1. Displaying and editing operating codes for quantities

Select "*SYSTEM->LIST&EDIT* CODOP". For further information, §3.3. PROGRAMMING QUANTITY RELATED FUNCTIONS.

3.7.2. Configuration of inputs

Select "*SYSTEM->CONFIG. INPUTS*". For further information §3.4.1. Input assignment and sensor error corrections.

3.7.3. Configuration of actuators

Select "*SYSTEM->CONFIG. ACTUATORS*". P For further information §3.4.2. Actuator assignment.

3.7.4. Circuit calibration

Protected function.

3.7.5. "Standard quantities" specification

For calculating certain derived quantities, apart from the primary quantities acquired by instrument, others are also needed. The values for standard quantities can also be modified; select the *"SYSTEM->STANDARD QUANTITIES"* option for this purpose (§8.6.4. Setup standard quantities), or during the running survey (§4.2.1.) The standard quantities are:

Description	Default	Range
Temperature	25 °C	-50 ÷ +1000 °C
K constant for Pitot or Darcy tubes	1.0	0.1 ÷ 10
Atmospheric pressure	1013.25 hPa	300 ÷ 1200 hPa
Altitude (above sea level)	0 m	-200 ÷ 8000 m
Latitude	45°00' N	-90° S ÷ 90° N
Longitude	09°00' E	-180 W ÷ 180° E
Threshold for sunshine duration	120 Wm^{-2}	-200 ÷ 1000 Wm^{-2}
Pipes dimension (Factor)	1.0	0.1 ÷ 1
Pipes dimension (Diameter/Side1)	1 cm	1 ÷ 999 cm

Standard quantities are used as follow::

1)Temperature:
- Used in the air speed measurements with Pitot tube when the temperature probe is not connected.
- Used in the temperature compensation in pH measurements.

2) K constant for Pitot or Darcy tubes:
- Used in the air speed measurements with Pitot (~1.0) and Darcy(~ 0.7) tube

3) Atmospheric pressure:
- Used in calculation of humidity and its derivates; can be modified together with altitude above sea level.

4) Altitude (above sea level):
- Used for the adjustment of the standard quantity "Atmospheric pressure" (does not affect pressure measurement from a pressure probe)

5) Latitude / Longitude
- Used for the day/night calculation used in invalidations

6) Threshold for sunshine duration
- Used in the sunshine duration calculation.

7) Pipes dimension
- Calculation of the volumetric and mass air delivery.

When calculating air speed using a Pitot or Darcy tube and when calculating atmospheric pressure using altitude above sea level (and vice versa), the Gravity quantity is used. It has a default value of 9.806 g, which cannot be modified directly from the BABUC ABC. To change this value, it is necessary to change the standard quantities that use gravity (that is, the K factor, for Pitot and Darcy, or pressure, for other quantities), changing the ratio between the new gravity and 9.806 g.

3.7.6. Linear or circular storage mode specification
BABUC ABC can store data in linear or circular structures:
- Linear: when all available memory is occupied, further acquisition data can no longer be stored.
- Circular: when all available memory is occupied, newly acquired data is written over the oldest, deleting it; in this manner only the most recent data is maintained in memory. Circular storage only regards the survey in course within the memory space left after the last survey made. To change the storage mode, select *"SYSTEM->STORAGE TYPE"*.

3.7.7. Selection of battery type
Protected function.

3.7.8. Formatting E^2Prom configuration memory
Protected function.

3.7.9. Test instrument memories
Protected function.

3.7.10. Restore survey
Select "*SYSTEM->RESTORE SURVEY*" to restore data from the last survey to the memocard if the extraction procedure has not been carried out for some reason.
Incorrect extraction may damage the last survey present in the memocard's memory; this problem will be recognised when the data is transferred to the PC.
For further information §4.4. USING THE MEMOCARD.

3.7.11. Test writing in data memory
Protected function.

3.7.12. Type of actuation
Select "*SYSTEM->TYPE OF ACTUATION*" to select the operating logic preferred by the "true" actuator.
- energy conservation logic: keeps actuator output turned off under normal operating conditions and turns it on only when there is an alarm;
- safety logic: keeps actuator output turned on under normal operating conditions and turns it off when there is an alarm or the instrument is malfunctioning or broken.

Once the operating logic has been selected, in the actuation logic, "*ON*" status will be used when the output is to go to the alarm, while "*OFF*" status will be used when output is to stay in regular operating condition.

3.7.13. Version/serial number
See §3.6.9.

3.7.14. Edit user's serial number for instrument
Select "*SYSTEM->EDIT SERIAL NUMBER* " to call up a screen in which the user's serial number may be modified. The default number is the same as the factory serial number.

4. PERFORMING A SURVEY

Once the sensors are connected and the various configuration programmed, the acquisition unit is ready for use. The execution of each measurement cycle, defined by the term "Survey", can also be programmed. Survey programming includes the following options:
- Start/Duration. - Identification number. - Eventual comment.
If the survey is not programmed, the previously programmed configuration of the last setup is used.

4.1. SURVEY START AND CLOSURE

4.1.1. Survey programming

Survey setup programming is not obligatory if it is desired to use the same setup as the preceding survey; in this case, select *"SURVEY->SURVEY START"* directly. Otherwise, first select *"SURVEY->SURVEY SETUP"*, program the new setup and, finally, select *"SURVEY->SURVEY START"*.

	D D / M M / Y Y H H : M M	Current date/time day/month/year hours:minutes
	d d / m m / y y h h : m m	
S t a r t :	y y / y y / y y y y : y y	Programmed date/time for start of survey
D u r a t i o n :	z z z z z : z z	Programmed duration in days hours:minutes

Leaving the start and duration values at zero implies that the survey will be started manually and will have an unlimited duration. A manual start is performed with the *"SURVEY START"* command, whilst a survey is closed with the *"END OF SURVEY"* command. By specifying a survey start date and/or time and duration, the instrument will start and terminate the survey as requested. The maximum programmable duration is 999 days 23 hours, 59 minutes.
Each survey is identified by a number and an alpha-numerical comment (§1.1.7. Use of the alpha-numeric keyboard). This is useful for successive handling of the survey by the PC. The instrument proposes the number of the last survey incremented by one. This number can be accepted or modified.
An alphanumeric comment field can be used to tag each survey. It serves, together with date/time information, to identify the survey in *"FILE MANAGEMENT"*. The last inserted comment remains in memory; this comment can be substituted or modified during the *"SURVEY SETUP"* phase.

4.1.2. Survey start

When a memocard is inserted, the acquisition unit permanently stores all of the surveys that it can on it. In the absence of mass memory, data is stored in temporary RAM memory and thus each new *"SURVEY START"* automatically cancels the previously performed survey.
During the survey, the instrument supplies a wide range of information as described in §4.2. SCREEN DISPLAYS DURING SURVEY, including the following default window:

S u r n n n I n p r o g r .		Survey number and status (RUNNING or WAITING)*
	d d / m m / a a h h : m m	Current date/time
S T A R T :	y y / y y / y y y y : y y	Programmed start date/time
E N D :	y y / y y / y y y y : y y	Programmed end date/time

*IN PROGRESS: indicates that the survey has started and is in course
*STARTED: indicates that the system is waiting to start the survey at the programmed start time.
The survey proceeds for specified duration (if programmed); in any case, it can be manually closed at any moment via the *"END OF SURVEY"* command.
Should the battery voltage drop below a safety threshold during a survey, BABUC ABC closes the survey and displays the message "BATTERY LOW" until a lower threshold is reached, at which point it switches off completely; when the voltage returns to normal levels, the survey is automatically re-opened (§3.6.3. Check battery power level).

4.1.3. Survey termination

To close the survey in course, call up the on-line menu and then select and confirm the *"END OF SURVEY"* option.

4.2. SCREEN DISPLAYS DURING SURVEY

A menu is active during a survey that, apart from displaying data in various formats, supplies information on the instrument's status and currently programmed functionality. The same menu also holds operating commands for changing memocards, inserting operator messages and closing the survey.

4.2.1. Data display and standard quantities

Data can be displayed in these formats:

- BRIEF: displays a scrollable list of the last acquired values for all quantities (primary and derivates quantites).
- STATISTICAL: displays statistical values calculated over the period from the last survey or last reset for each quantity. Statistical data is reset using a command available on the above mentioned menu. Statistical results can start to degenerate when the summation of basic acquired values exceeds 2^{24} (16.777.216).
- ELABORATIONS: of each survey stored in the memory it displays the elaboration's values (average, minimum, maximum, standard deviation, total, minimum duration, EOLO3, EOLO4) that are eventually presents into the memory in a hourly, daily and instantaneous form (§1.3. STATISTICAL CALCULATIONS).
- STANDARD QUANTITIES: it is possibile to check and, eventually, modify each standard quantity value.

4.2.2. Displaying input configuration

Displays current input configuration: Operating codes of quantity, input number, sensor correction factors.
The visualization also includes the LSI sensor with serial output programmed to be acquired from the serial line 2 of the instrument.

4.2.3. Actuator management

If selected while a survey is underway, this option will call up a menu offering three choices:

- "*DISPLAY ALARMS*": displays a scrollable list of the last values acquired for all primary and derivate quantities which have triggered an alarm. If a quantity is selected by positioning the cursor on it and pressing *enter*, the actuator logic which triggered the alarm will be displayed.
- "*EDIT CONFIG.*": if the number of the actuation logic to be edited is entered, a screen will be called up which can be used to edit the configured parameters. When the modification is confirmed, the output of the associated actuator will go "*OFF*".
- "*DISPLAY CONFIG.*": can be used to display all configurated actuation logics in order.

4.2.4. Communications

Displays current communications parameters: Tx/Rx activity, transmission speed, packet size, modem configuration.

4.2.5. Utilities

Displays the current status of the device: System date/time, Memory availability, Battery power level, Error control, Version and serial number. Can be used to set some system parameters: Activate keyboard beep, Lock keyboard, Time lapse before display goes off automatically.

4.3. OPERATOR MESSAGE INSERTION DURING SURVEY

During the course of the survey, the operator can enter alphanumeric messages that are saved in the same database. These can be chosen from a menu of 20 messages, predefined via PC. The first of these messages can be written directly on BABUC ABC and can be modified during the survey. Each message entered by the operator is stored in BABUC ABC's memory with a date/time tag.
Go to "MESSAGE" -> "CHOICE MESSAGE" during survey, select the request message and press IMMIS.
It is possible create/erase the first message in the list, by typing the alphanumeric keys (§1.1.7. Use of the alpha-numeric keyboard)
Select "WRITE TEXT MSG1" if the typing is request.
Select "ERASE TEXT MSG1" if the erasing is request.

4.4. USING THE MEMOCARD

4.4.1. Formatting the memocard

The memocard format operation must be performed on a new card, after substituting the internal backup battery, or in cases of "corruption". Its use is also advised whenever the entire contents are to be cancelled. Reformatting a already formatted memocard cancels its contents. When a memocard is inserted, the instrument detects whether formatting is necessary and, if so, proposes the relative interactive procedure.

4.4.2. Substituting the memocard

When the instrument is switched off, memocards can be inserted and removed without particular procedures.
BABUC ABC can also function without a memocard, with an autonomy represented by 64 kB of memory, In fact, while the instrument acquires data when no memocard is present, the new processed data is stored in RAM memory; when a memocard is inserted, the data present in RAM is automatically transferred to it. Thus, when a memocard is present no data is stored in RAM.
If the memocard is not deleted and the new data belongs to the last survey still held on the memocard, they will be "appended" to that survey. If the memocard is not deleted and the new data does not belongs to the last survey held on the memocard, they will be inserted as part of a new survey together with all the relative identification information.
Reformatting a memocard gives the maximum amount of free memory and thus the maximum autonomy.
After the “Extraction phase” or “Insertion phase” the instrument displays the RAM availability space, in case of “insertion phase” after 5 minutes the instrument displays the memocard availability space, if after 5 minutes it do not happen, it means that the memocard is not accepted by the instrument, repeat the procedure (§5.1.1. Display available memory for more details about memory availability).
By using the option “*SYSTEM->SURVEY RECOVER*” it is possible to recover on the memocard the last survey, in the case the extraction phase is not carry out in the correct way. The incorrect procedure could damage the last survey into the memocard; this problem can be recognize during the data connection to PC.

5. LOCAL FILE MANAGEMENT

"FILE MANAGEMENT", accessible from the main menu, provides the following functions:
- Display available memory.
- Display index of stored surveys and their qualifying characteristics.
- Display the elaboration values stored into the memory for each survey.
- Cancel the last stored survey.
- Cancel all stored surveys.
- Format memory.

5.1. FILE DISPLAY

5.1.1. Display available memory

BABUC ABC memory availability is shown as free bytes (b) out of total bytes (in the RAM memory = RAM, or in the memocard = MC) and as a percentage. This function is useful only if a memocard is included. If this is not the case, the percentage of available memory will always be 100%, and the number of free bytes will be 65535 out of a total of 65535. In case of memocard it displays also three status levels for the memocard's backup battery is also indicated: charged, low, discharged.
The position of the writer pointer (P=) of the memory is also displayed, it is useful during “circular storage” survey type, when the free bytes out of total bytes remain always at the same level, and it should be not clear if there is a values storage into the memory. This information is also available during the survey via the *"UTILITY"* menu and “INSERTION/EXTRACTION PHASE” of the memocard.

5.1.2. Display index of stored surveys

BABUC ABC supplies a paged list of the surveys stored in memory.
The following are indicated for each survey:
- Sur: Number of survey
- Init/End: Start and end date/time.
- Size: Size in bytes.

Use △ ▽ keys to display other surveys. Use the left/right arrow keys reach the alpha-numeric surveys comment (§4.1.1. Survey programming, §1.1.7. Use of the alpha-numeric keyboard).

5.1.3. Display the storage measurements into the memory

For each survey stored in the memory, BABUC ABC displays the elaboration’s values (average, minimum, maximum, standard deviation), that are eventually presents, in a hourly, daily and instantaneous form.

5.2. FILE CANCELLATION

5.2.1. Cancel last survey or all surveys in memory

These two commands are always executed with a confirmation request. It is possible to cancel the entire contents of memory or the last stored survey.
Select *"ERASE LAST SURVEY"* or *"ERASE ALL SURVEYS"* and press the IMMIS key.

5.2.2. Format memory

This command is used for "corrupted" memocards, whatever the reason, that generate error messages when it is attempted to use them or read their contents. The same option is also present in the memocard substitution function (§4.4.2. Substituting the memocard).

6. DATA TRANSFER TO PC

Communications between BABUC ABC and PC are controlled via the GAP software on PC. There is no special procedure for data transmission to follow whatever on BABUC ABC other than ensuring that the instrument is switched on, the LSI-LASTEM protocols is proper stetted and Ensure that the transmission speed (Baud rate) and ID number on BABUC ABC is the same as that used by the PC (normally 9600 Baud, ID = 002).the Baud rate and ID number are the same of which is stetted on PC (default 9600, 002).
If there is a direct connection the user could set the maximum packets size (2048b) in order to obtain the speediest data communication. If there is a radio or telephone modem communication the choice of the packet size should be in function of the line quality; for lines with high interference, small sizes must be used (64b).
To read the data held in memory, perform the following operations:
a) Connect the serial cable DEB515 to the BABUC ABC port (RS232-1) or (RS485-1).
b) Perform the data transfer (see GAP manual).

7. PRINT OUT

Acquisitions from BABUC ABC can be printed in “on-line” print out by mean a serial printer directly connected to the RS-232-2 port of the instrument. The printer configuration should be the following:

- Flow control: Xon/Xoff
- Interface: RS232 - DCE
- Data bits: 8
- Parity: None
- Stop bits: 1
- Bit rate: equal to the BABUC ABC one (*COMUNICATIONS -> BIT RATE)*

Select “S*erial Lines->Com 2->LOCAL PRINTOUTS*” from the main menu, and three options will appear:

- Print out input configuration.
- Instantaneous values.
- Page length.

Printing function and LSI sensors acquisition with serial output rule out each other.

7.1. Printing types

7.1.1. Printout of current input and actuator configuration

Every time that an assignment or parameter regarding the inputs or actuators is modified, it is recommended to print the new configuration and fix it to the inside of the acquisition unit's lid. In order to print, select *“PRINT->INPUTS CONFIGURATION*”.

7.1.2. Instantaneous values

Can be used to print out data acquired by the instrument at a printout interval set using the menu.
The following settings will be displayed in order for assignment to the instrument:
Enable automatic print-out: Enable the RS-232-2 port for the print out.
Automatic print rate hh:mm:ss: it is the time rate in which, each measurement value will be print.
Prints all channels: it is possible to print all the configured channels or a selection of them only; if the user selects “NO” the list of the available channels, configured during the “INPUTS CONFIGURATION”, is shown; each channels is listed with an “*” it give the option to print or not that channel; the “*” appears or disappears when the IMMIS key is pressed, select the ESC key to go out from this selection.
Sheet length: it is the rows number for each sheet of paper, to every new sheet the “legenda” is printed again. In case of continuous stationery, left the “00” number of rows, the “legenda” will be printed only on the head of the print out.

When the survey is running the printer will print the selected values with the programmed print rate.

8. PROGRAM MENUS

This section details all of the program's display screens, in the order in which they are appear.
The main menu, displayed when the instrument is switched on, lists the following options:

> Survey	§8.1.
Shutdown	
File management	§8.2.
Serial lines	§8.3.11.
Change memocard	§8.4.
Utility	§8.5.
System	§8.6.

8.1. SURVEY

Menu with options for starting a new survey with the previously programmed setup or of re-programming it:

Survey	
> Survey start	§8.1.1.
Survey setup	§8.1.2.

8.1.1. START SURVEY

a-After a brief moment, the details of the activated survey will be displayed

Sur rrr in progr.	Survey number, "is running" advise
dd/mm/yy hh:mm	System date/time
Init : yy/yy/yy yy:yy	Programmed date/time for start of survey, or “manual”
End : zz/zz/zz zz:zz	Programmed end of survey, or “manual”

b-Menu for displays and functions available during the survey

> Data view	§8.1.1.1.
Inputs config view.	§8.6.2.4.
Actuator management	§8.1.1.2.
End of survey	
Serial lines	§8.3.11.
Messages	§8.1.1.3.
Change memocard	§8.4.
Utility	§8.5.

8.1.1.1. Data view

a-Menu for data display mode and clear statistics command

Data view	
> Brief	
Statistical	
Elaborations	§8.2.3.
Restart statistics	Reset the statistical from this moment
Standard quantities	§8.6.4.

b-Brief display (<)

nn AAAAAA nnnnnn uuuuuu	Chan.numb./Parameter short description/Value/Unit

c-Brief display (>)

n n A A A A A A A A A A A A n n n n n n	Chan.numb./Parameter long description/Value

d-Statistical display of a generic parameter (<)

n n A A A A A u u u u u u *	Chan.number/parameter short description/Unit/warning light
I n s N N N N N N	Last value acquisition
M i n	Minimum value acquisition
M a x	Maximum value acquisition
A v e	Average
S t D	Standard deviation calculation
D i f	Difference between last two acquisition (Trend)

e-Statistical display of a generic parameter (>)

n n A A A A A A A A A A A A A *	Chan.number/parameter long description/warning light
I n s n n / n n	Numb.of acquisition from last reset statistic or survey start
M i n d d / m m / y y h h : m m : s s	Date/time of the minimum value measured
M a x d d / m m / y y h h : m m : s s	Date/time of the maximum value measured
A v e d d d h h : m m : s s	Time from reset statistical or survey start (dd/hh/mm/ss)
S t D	Empty row
D i f h h : m m : s s	Current acquisition rate (hh/mm/ss)

f-Statistical display of a impulse parameter (intensity updated every 1 minute) (>)

n n A A A A A u u u u u u *	Chan.number/parameter short description/Unit/warning light
I n s N N N N N N	Impulses number in the last statistical period time
M i n	Lessees impulses frequency into statistical periods time
M a x	Highest impulses frequency into statistical periods time
A v e	Average impulses number into statistical periods time
S t D	Standard deviation
D i f	Tot.impulses difference into last two statistical periods time
T o t	Tot.impulses from last reset or survey start (reset at 999999)

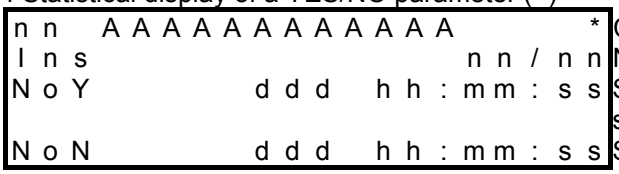
g-Statistical display of a impulse parameter (intensity updated every 1 minute) (>)

n n A A A A A A A A A *	Chan.number/parameter long description/Unit/warning light
I n s n n / n n	Impulses number in the last statistical period time
M a x d d / m m / y y h h : m m : s s	Date/time of the maximum value measured
T o t d d d h h : m m : s s	Date/time of last statistical period time

h-Statistical display of a YES/NO parameter (<)

n n A A A A A u u u u u u *	Chan.number/parameter short description/Unit/warning light
I n s A A A	YES/NO value in the last acquisition
N o Y N N N N N N	Number of YES values from the last reset or survey start
N o N N N N N N N	Number of NO values from the last reset or survey start

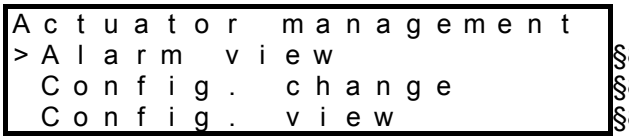
i-Statistical display of a YES/NO parameter (>)



Chan.number/parameter long description/warning light
Numb.of acquisition from last reset statistic or survey start
Summation time of YES state from last reset or survey start
Summation time of NO state from last reset or survey start

8.1.1.2. Actuator management

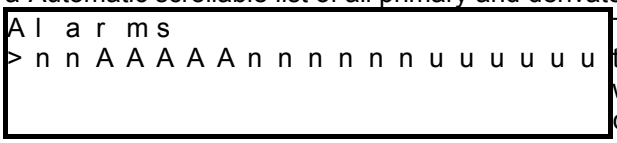
a-Menu



§8.1.1.2.1.
§8.1.1.2.2.
§8.6.3.3.

8.1.1.2.1. Display primary/derivate quantities which triggered alarm

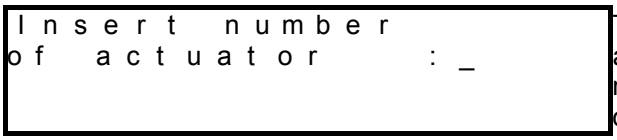
a-Automatic scrollable list of all primary and derivate quantities which triggered an alarm.



The number of inputs, a description of the opcodee, the instantaneous value and the unit of measurement will be displayed for each row. Select one of the alarm quantities with the cursor. Press ENTER to display the actuation logic linked to the selected quantity.

8.1.1.2.2. Edit configuration of programmed actuators

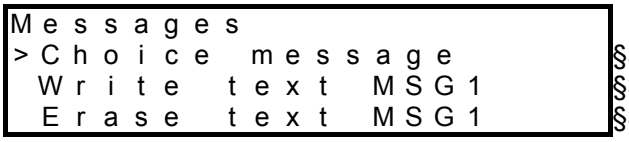
a-Enter the number of the actuator to be edited



The screen will display the actuation logic configured; actuation parameters and intervention times may be modified. When the modification is confirmed, the output of the associated actuator goes “OFF“

8.1.1.3. Operator messages

a-Function menu

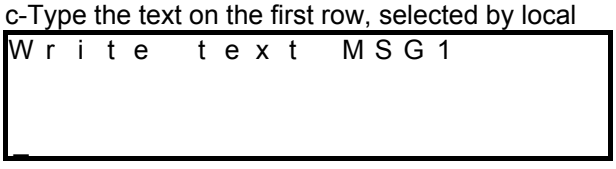


§8.1.1.3.b
§8.1.1.3.c
§8.1.1.3.d

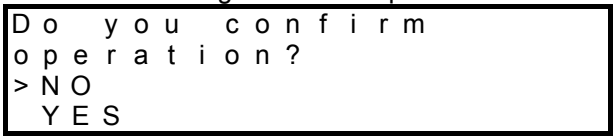
b-Message selection from the list of 19 messages made on PC

Message on the first row selected by local (MSG1)
List of 19 messages made on PC

c-Type the text on the first row, selected by local

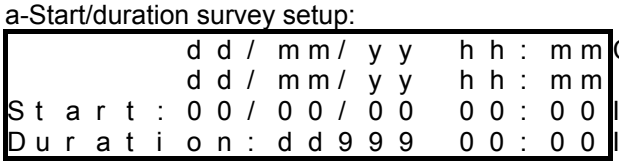


d-First row message deletion request



8.1.2. SURVEY SETUP

a-Start/duration survey setup:

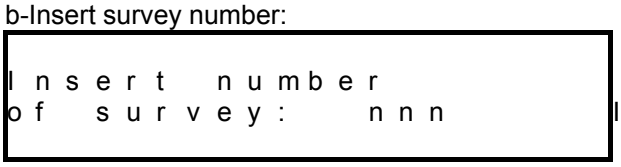


Current day/time

Insert survey start day/time

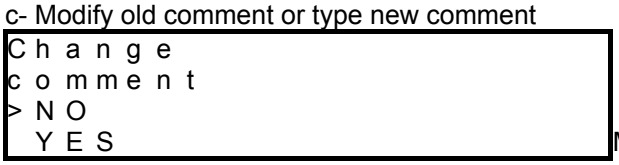
Insert survey duration

b-Insert survey number:



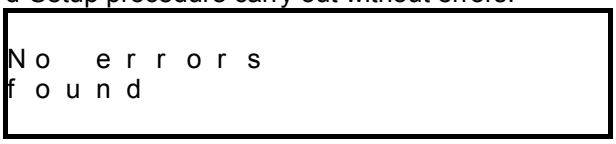
Insert survey number (3 units)

c- Modify old comment or type new comment

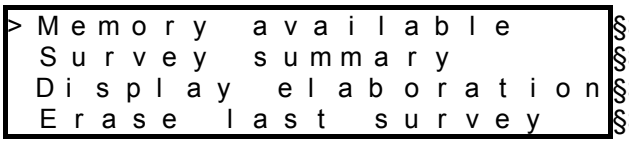


Modify old comment or type new comment

d-Setup procedure carry out without errors:



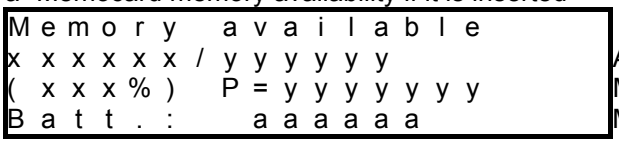
8.2. FILES MANAGEMENT



§8.2.1.
§8.2.2.
§8.2.3.
§8.2.4.
§8.2.4.
§8.4.2.c

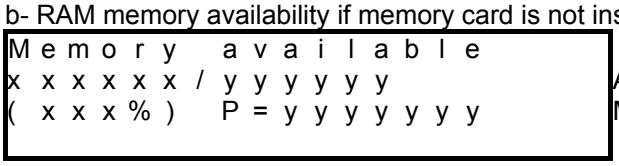
8.2.1. Display memory availability

a- Memocard memory availability if it is inserted



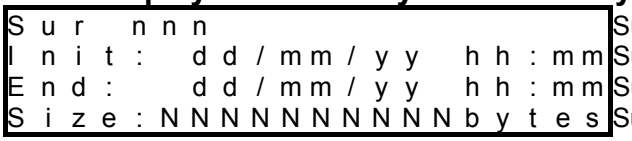
Actual memory availability/Total memory availability
Memory availability percentage, current pointer
Memory card battery level

b- RAM memory availability if memory card is not inserted.



Actual memory availability/Total memory availability
Memory availability percentage

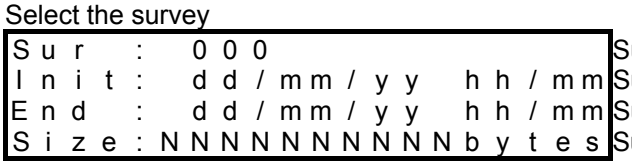
8.2.2. Display list of surveys into memory card (pages)



Survey number
Survey start (day/time)
Survey end (day/time)
Survey dimension (bytes)

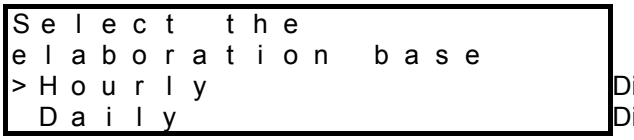
8.2.3. Display stored elaborations in memory

Select the survey



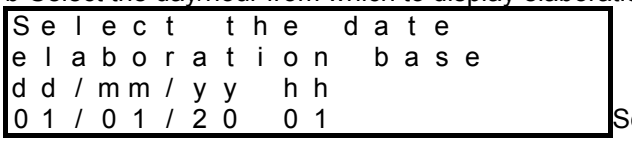
Survey number
Survey start (day/time)
Survey end (day/time)
Survey dimension (bytes)

a-Select the time base for the visualizations



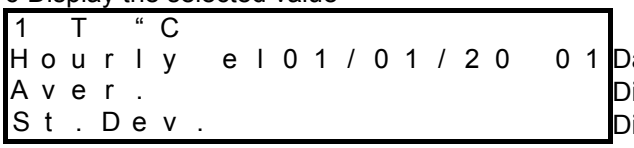
Display hourly elaboration
Display daily elaboration (24 hours)

b-Select the day/hour from which to display elaboration



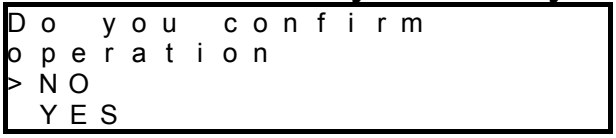
Select the day or/and hour from which to start

c-Display the selected value



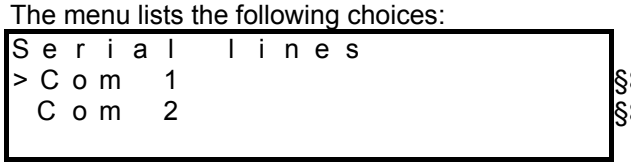
Day/time of the hourly elaboration
Display average, →: Minimum values
Display Standard deviation, →: Max. values

8.2.4. Delete last survey or all survey:



8.3. SERIAL LINES

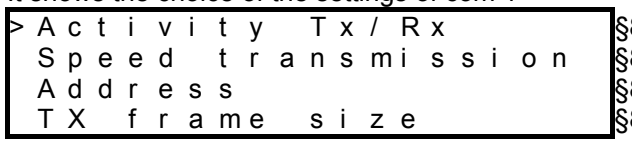
The menu lists the following choices:



§8.3.1.
§8.3.2.

8.3.1. COM 1

It shows the choice of the settings of com 1

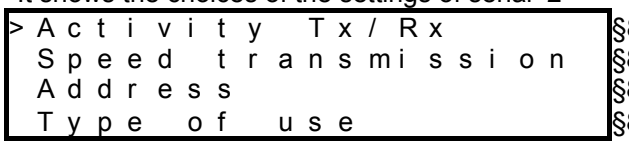


§8.3.3.
§8.3.4.
§8.3.5.
§8.3.6.

Type of use §8.3.7.
RTS anticipation §8.3.8.
Line driver §8.3.9.
Modem type §8.3.10.

8.3.2. COM 2

It shows the choices of the settings of serial 2

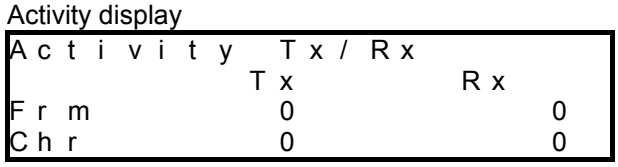


§8.3.3.
§8.3.4.
§8.3.5.
§8.3.11.

RTS anticipation §8.3.8.
Line driver §8.3.9.

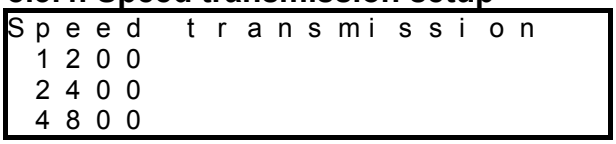
8.3.3. Tx/Rx serial lines activity

Activity display



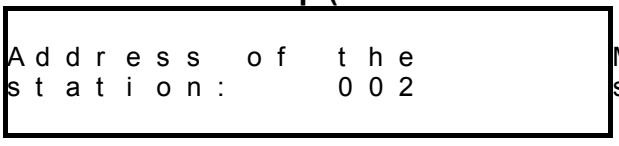
Tx = Transmitted; Rx = Received
Frm = Frame = Data packet
Chr = Characters

8.3.4. Speed transmission setup



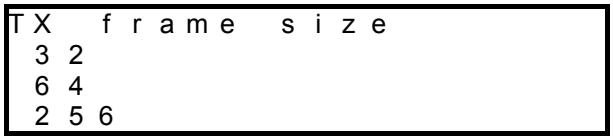
> 9600 Default 9600 bps
19200

8.3.5. Address setup (in case of stations network)



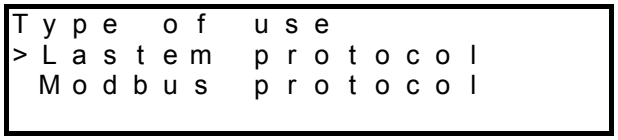
Modify or confirm address number of the station inside a network (default if single station=002)

8.3.6. Communication TX frame size selection:



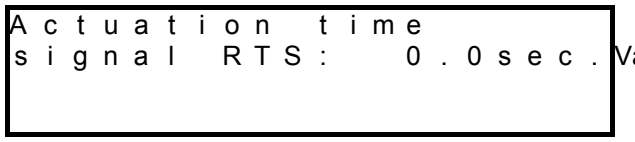
> 1024 Default 1024
2048

8.3.7. Setup of the kind of use for the communication of Com 1:



Used for communication with SW Gap and InfoGap
Used for communication with Modbus

8.3.8. RTS time selection



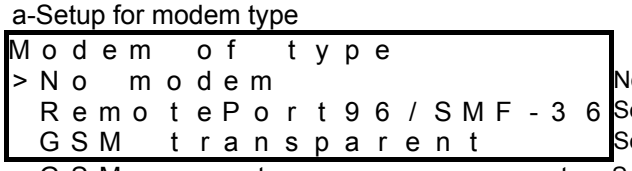
Value from 0,0 to 0,9 sec. (default 0,0)

8.3.9. Line driver use

Line driver not connected to BABUC ABC RS232-1
Line driver connected to BABUC ABC RS232-1

8.3.10. Modem of type

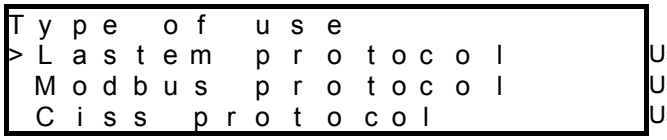
a-Setup for modem type



GSM no transparent
Free define

No modem in use
Select for setup Remote Port 96 or SMF_36
Select for setup GSM for transmission transparent mode
Select for setup GSM for transmission non transparent mode
Enter a free configuration for modem setup (see below)

8.3.11. Setup of the kind of use for the communication of Com 2



Gill protocol
Hydrolab protocol
Wivis protocol
Local print

Used for communication with SW Gap Remote and InfoPanel
Used for communication with Modbus
Used with Cordless receiver
Used to receive data from Gill ultrasonic sensors
Used to receive data from multiparametric sensors Hydrolab
Used to receive data from Wivis sensors
§8.3.12.

8.3.12. LOCAL PRINT-OUT

Main menu

```
Print type
> Config input chan.
  Inst. value
  Sheet length
```

Start the inputs configuration print-out
§8.3.13.a-b-c-d
§8.3.14.

8.3.13. Enable Com 2 to print out instantaneous values

```
Do you enable the
automatic print?
> NO
  YES
```

§8.3.13.
b

b- Select automatic print rate

```
Automatic
print rate:
hh:mm:ss
00:01:00
```

Print rate of the configure channels
(default 1 minute)

c- Request if to print all channel or a selection

```
Print all
channels?
  NO
> YES
```

§8.3.13.d
When the survey is started the print-out start

d- Select the list of the channels to be printed (example)

```
> *   I1          T(°C)
  *   I2     HREL(%Rel)
  *   I3          T(°C)
  *   I4     HREL(%Rel)
```

Press IMMIS to select or de-select the print-out of the channel corresponding to the arrow (>).
Press ESC wjen finish the selection
When the survey is started the print-out start

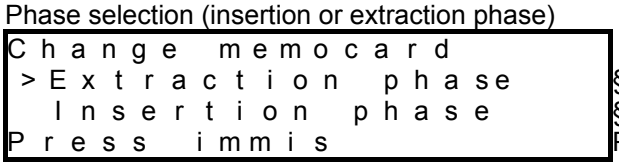
8.3.14. Select the number or rows printed for each sheet (form feed)

```
Rows number
for each sheet:    00
```

0 = one sheet without interruptions (continuous stationery)

8.4. CHANGE MEMORY CARD

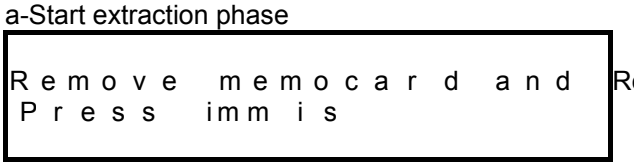
Phase selection (insertion or extraction phase)



§8.4.1.
§8.4.2.
Press IMMIS.

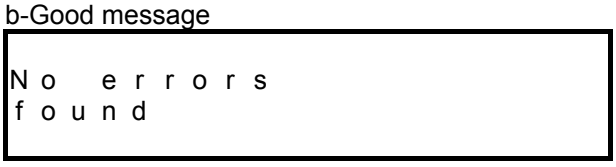
8.4.1. Extraction phase

a-Start extraction phase

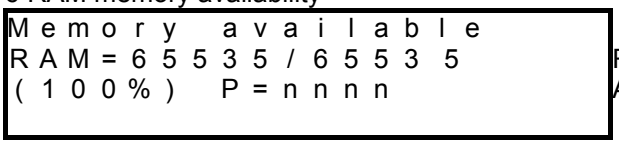


Remove memocard and then press enter

b-Good message



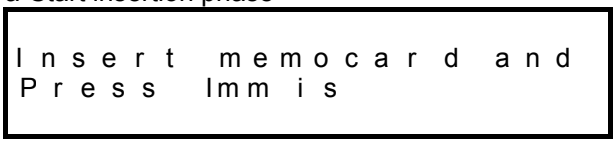
c-RAM memory availability



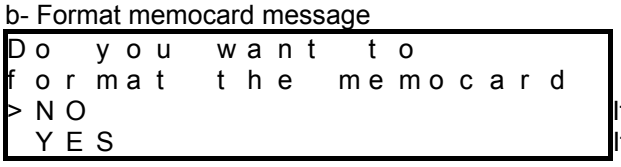
RAM memory availability (actual/first availability)
Availability in % and pointer position.

8.4.2. Insertion phase

a-Start insertion phase

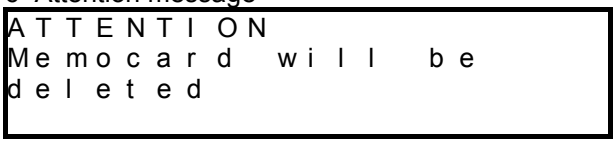


b- Format memocard message



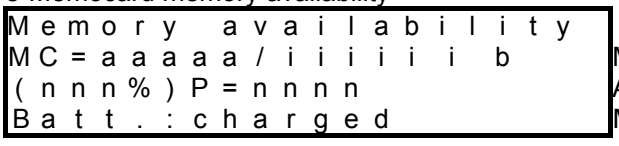
If NO, the data will be still present into the memocard
If YES, all the data will be erased into the memorcard

c- Attention message



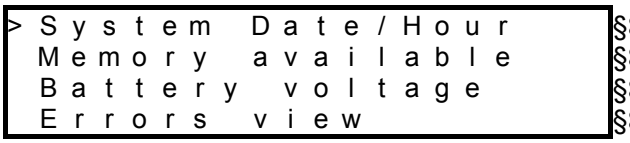
d-Good message

e-Memocard memory availability



MEMOCARD mem. availability (actual/first availability)
Availability in % and pointer position.
MEMOCARD battery charge situation

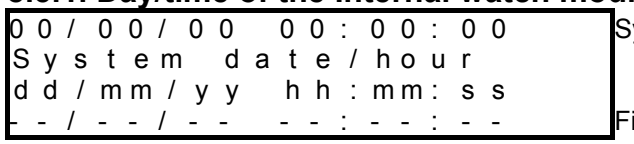
8.5. UTILITIES



§8.5.1.
§8.2.1.
§8.5.2.
§8.5.3.

Batt.probe status	§8.5.4.
Activity IPC	Protected by password. Only for authorized user
Beeper	§8.5.5.
Keyboard protection	§8.5.6.
Display extinction	§8.5.7.
Version/Serial No.	§8.5.8.

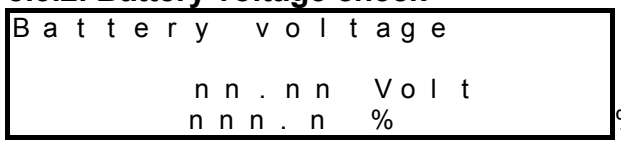
8.5.1. Day/time of the Internal watch modification



System day/time

Field where insert new day/time

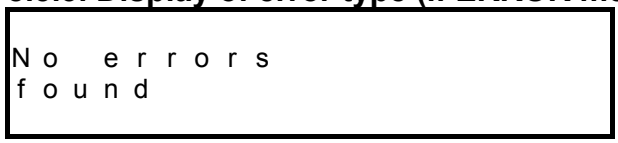
8.5.2. Battery voltage check



Battery voltage

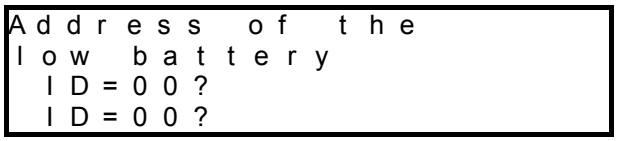
% charge state

8.5.3. Display of error type (if ERROR message flash)



8.5.4. Battery probe status

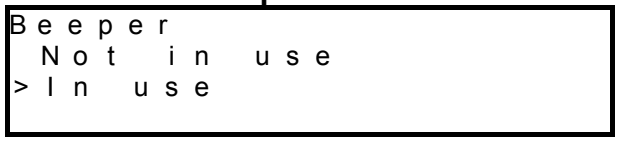
It shows the address of the serial probe or of the cordless with the battery below limit, the battery change deletes the error.



Id of the probe with the battery below limit.

If there are not batteries below limit, go to §8.5.3.

8.5.5. Sound beeper activation/disactivation

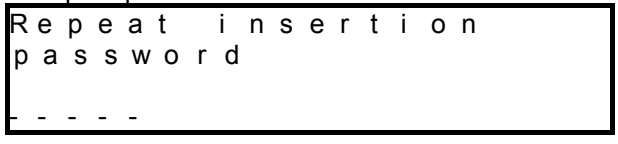


8.5.6. Keyboard protection by mean password

a-Password insertion

5car. numeric password (two times)

b-Repeat password insertion



c-Insertion message non correct

```
password
illegal!
```

d-Good message

```
Keyb.protected with
password
```

8.5.7. Insertion of display auto switch-off time after last button push

```
Display extinction
after minutes:    00
```

From 0 to 99 minutes

8.5.8. Serial number and program version display

```
     BABUC - ABC
   Program Version
 x.xxEng2/x.xx/Axx
Serial No. xxxx/xxxx
```

Acquisition/elaboration program versions/Codop library

Factory and user's serial numbers

8.6. SYSTEM

> List&Modif. OpCods	§8.6.1.
Config.input chan.	§8.6.2.
Config.actuators	§8.6.3.
Circuit calibr.	Protected by password. Only for authorized people
Standard quantities	§8.6.4.
Storage type	§8.6.5.
Battery selection	Protected by password. Only for authorized people
Reset memoconfig	Protected by password. Only for authorized people
Tests RAM/E2PROM	Protected by password. Only for authorized people
Survey recover	§8.6.6.
Writing data memory	Protected by password. Only for authorized people
Logic act. type	§8.6.7.
Version Serial No.	§8.6.8.
Change serial No.	§8.6.9.

8.6.1. Operative codes modification

a-Operative code selection (see list of Operative codes at the end of this user's manual):

```
> 1    TeDRYBULBfv
  2    TeWETBULBfv
  3    TeDRYBULBnv
  4    TeWETBULBnv
       etc.
```

b-Parameter selection:

> Acquisition rate	§8.6.1.1.
Antic.sensor supply	§8.6.1.2.
In>Out parameters	§8.6.1.3.(for status operating codes §8.6.1.4.)

8.6.1.1. Acquisition rate modification

```
Acquisition rate

hh:mm:ss
12:00:00
```

hh/mm/sec (max 12 hours).

8.6.1.2. Selection of the time from the acquisition in which the instrument feed the sensor.

```
Antic.sensor supply

hh:mm:ss
12:00:00
```

hh/mm/sec (max 12 hours).

8.6.1.3. Probe electrical output/measure range selection

Param1i:+0000.000000	Electric start scale
Param2i:+0000.000000	Electric end scale
Param1o:+0000.000000	Range of measurement (start)
Param2o:+0000.000000	Range of measurement (end)

8.6.1.4. Engineering of measurement range for status operating codes

Off status =+0280.00	Limit at the threshold for NO status
On status =+0060.00	Limit at the threshold for YES status
Threshold =+0150.00	Threshold value at which status is changed

8.6.2. Inputs configuration

Selection menu

```
Config input chan.
> Configure                §8.6.2.1.(primary quantity) 8.6.2.2.(derivate quantity)
  Single reset               §8.6.2.3.
  Total reset                §8.6.2.3.b
  Config view                §8.6.2.4.
```

8.6.2.1. Entering primary quantities and associating them with input numbers

a-Entering the operating code for a primary quantity to be acquired from the sensor

```
OpCod: - - -
```

b1 – Entering the input number to which the sensor is connected

```
OpCod: 001          Inp: 001

TeDRYBULBfv
```

c1 - "A" and "B" values insertion into the linear correction formula for the probe correction (if necessary)

```
OpCod: 001          Inp: 001

TDRYB      A = 1.0000          Default A=1
           B = 0000000         Default B=0
```

d - Confirm request

```
Confirm config
Inputs/Actuators
  NO
> YES
```

b2 - Sensor with serial output

```
OpCod: 009          Inp: 021   The number of input is defined automatically (*)
Serial       ID: ___   C: __   Sensor identifier number; sensor channel number (**)
Temperature
```

(*) The number is determined starting from the next number of the last physical input available (for instance for Babuc ABC mod. DGB205 with 20 inputs, the first sensor with serial output is connected at the fictitious input number 021) and from the first available number with respect to the sensor with serial output already programmed.

(**) The mask requires the insertion of the identifier of the sensor programmed by its dip-switch (see the relative user manual §Programming identifier) and of the channel number of the sensor that acquires the specified quantity; for instance if the sensor acquires only one quantity, it's necessary to set always 01; if the sensor acquires more than one quantity, it's necessary to set a number from 01 to the number of quantities acquired from the sensor.

c2 - "A" and "B" values insertion into the linear correction formula of the sensor error (if necessary)

```
OpCod: 009          Inp: 021
Serial       ID: 001   C: 01
T          A = +1.0000          Default A=1
           B = 0000000          Default B=0
```

8.6.2.2. Insertion of the derivate quantity to be associated to a input number

a1-Insertion of the Opcode for the derivate quantity

```
OpCod: ---
```

b1-Confirm or modify the input numbers of the primary quantity to be computed

```
OpCod: 151          Inp: ---
                    Inp: ---
RelHUMidity
```

a2-Entering the operating code of a derivate quantity PRODuct

```
OpCod: ---
```

Type in Opcode 178

b2- Entering the first operating code of a primary or derivate quantity

```
OpCod: 178     PRODuct
OpCod: ---
```

Enter the Opcode of the first used input from wich start the calculation and then press IMMISS

c2- Entering the second operating code of a primary or derivate quantity

```
OpCod: 178     PRODuct
OpCod: 087  088
SIG1
```

If the second quantity has the same Opcode as the first press Esc and go to e3
else insert the Opcode of the second used quantity and then press IMMIS

d2- Confirm or change the input numbers of the selected quantities

```
OpCod: 178     PRODuct
OpCod: 001  003
fr.Inp: 001  SIG1

to Inp: 002  SIG2
```

Opcodes used for the calculations
First physical input of the first Opcode
Second physical input of the second Opcode. Babuc ABC
will calculate 1°Input x 2°Input, press IMMIS and go to f3

e2- Confirm or modify the input numbers of the selected quantities

```
OpCod: 178     PRODuct
OpCod: 001
fr.Inp: 001  SIG1
to Inp: 002  SIG2
```

Are showed the Opcode used in the calculationd and the two first inputs using the selected Opcode.
The product will be calculated as 1°Input x 2°Input
e premere IMMIS

a3-Entering the operating code of a derivate quantity Average1-2

```
OpCod: ---
```

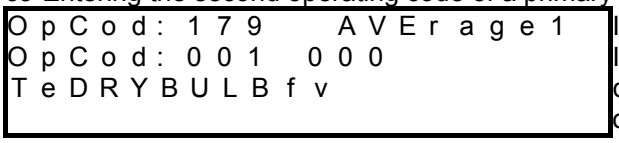
Type in Opcode 179 or 180

b3-Entering the first operating code of a primary or derivate quantity

```
OpCod: 179     AVErage1
OpCod: ---
```

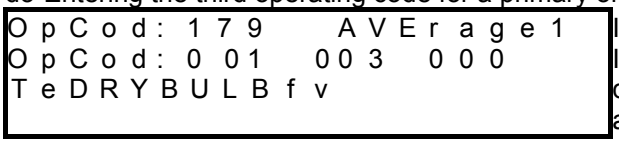
Type in the first Opcode for the primary or derivate quantity for all probes from which the average is to be calculated, and then press enter

c3-Entering the second operating code of a primary or derivate quantity



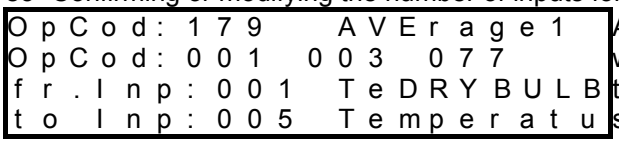
If there is only one code, press Esc to confirm.
If not, type in the second Opcode for the primary or derivate quantity for all probes to be used in calculation of the average, then press enter

d3-Entering the third operating code for a primary or derivate quantity



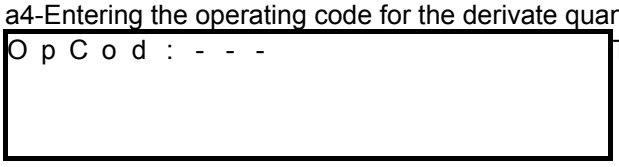
If there are only two codes, press Esc to confirm.
If not, type in the third Opcode for the primary or derivate quantity for all probes to be used in calculation of the average, then press enter

e3- Confirming or modifying the number of inputs for primary quantities to be calculated



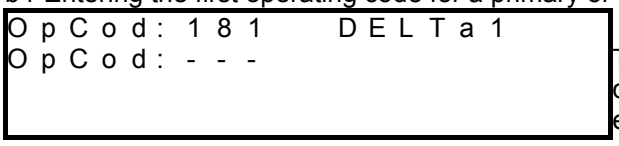
All the Opcode's to be used in calculation of the average will appear, along with the first and last physical input for the quantities, among which you may find the codes selected for calculation of the average.

a4-Entering the operating code for the derivate quantity Delta 1-2-3



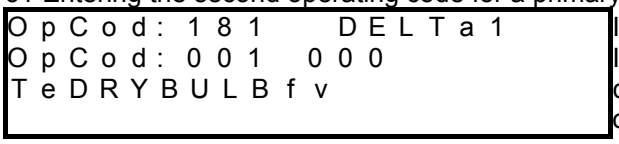
Type in Opcode 181 or 182 or 183

b4-Entering the first operating code for a primary or derivate quantity



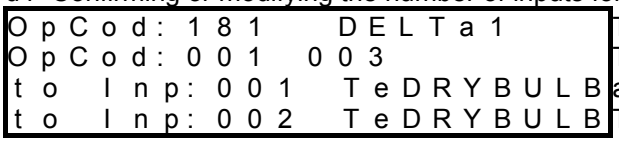
Type in the first Opcode for the primary or derivate quantity to be used for calculation of the delta and press enter.

c4-Entering the second operating code for a primary or derivate quantity



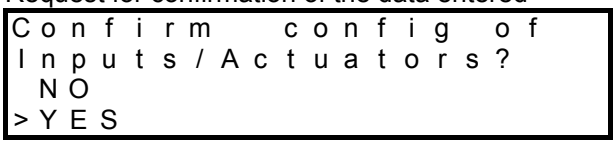
If there is only one code, press Esc to confirm.
If not, type in the second Opcode for the primary or derivate quantity for all probes to be used in calculation of the delta, then press enter

d4- Confirming or modifying the number of inputs for primary quantities to be calculated



The Opcode's to be used in calculating the delta appear.
The first physical input applies to the firstCodOp,
and the second physical input applies to the second.
The delta will be calculated with $1^{st} - 2^{nd}$

Request for confirmation of the data entered



8.6.2.3. Deleting (resetting) input programming

a-Entering the number of the selected input

```
Single reset
Inp.  : - - -
```

b-Request for confirmation

```
Confirm reset
Inputs/Actuators?
> NO
  YES
```

8.6.2.4. Display input configuration

If you press ENTER + Down Arrow, the configurations of all the programmed inputs will be displayed in the order in which they were programmed, as confirmed under point 8.7.2.2.; if you press Up Arrow, all the configurations will be displayed in inverse order.

8.6.3. Actuator configuration

```
Config actuators
> Configure                §8.6.3.1.
  Single reset             §8.6.3.2.
  Total reset              §8.6.3.2.b
  Config view              §8.6.3.3.
```

8.6.3.1. Configure

a-Display or modificaiton fo the actuator number and the numbers of its outputs

```
Configure
Act. :x in Out x(Bx)
```

This screen will not appear the first time configuration is performed.

b-Request for confirmation

```
Do you want to use it
with common output?
> Yes
  No
```

The actuator output is already being used by another logic. You are asked to confirm that you want to use the output in common with the newly entered logic

c-Actuation logic selection menu

```
> Eolic alarm              §8.6.3.1.1.
  Filling evapor. pan      §8.6.3.1.2.
  Rain notice              §8.6.3.1.3.
  Greater than...          §8.6.3.1.4.
  Less than...             §8.6.3.1.4.
  Greater/Less than..      §8.6.3.1.4.
  Timer                    §8.6.3.1.5.
```

8.6.3.1.1. Eolic alarm

a-

Act. :1onB1 Inp.:009	Available actuator B1 with availale probe input n.09
Eolic alarm (Speed)	Wind speed setup
ON :V>----- t>00m00s	Switch-on if speed>V(m/s) within time t (mm:ss)
OFF:V<----- t>00m00s	Switch-off if speed< V(m/s) within time t (mm:ss)

b-

Act. :1onB1 Inp :009	Automatic if the angle channel exists
Eolic alarm (Angle)	Wind direction setup
DIREC=180	Bisector of the direction angle setup
WIDTH=360	Angle setup (360: every direction)

8.6.3.1.2. Top up evaporation pan water

Act. :1onB1 Inp.:002	Available actuator B1 with available probe input n.02
Filling evapor. pan	Setup of topping up water in evaporation pan
LIV1=204mm H=06h00m	Switch on at H(hh:mm) only if level is less than LIV2
LIV2=150mm t< 0h15m	Switch off when level is LIV1 and anyway after t duration

8.6.3.1.3. Rain notice

Act. :1onB1 Inp.:009	Available actuator B1 with available probe input n.09
Rain notice	Rain start notice setup
RAIN =05mm t=15min	Switch on when a certain rain quantity is down and anyway after a time t from the first tipping. Switch-off after a time RESET from the first tipping of the rain gauge
RESET=48h	

8.6.3.1.4. Greater than.. , Less than.. , Greater/Less than....

a-Selecting the inputs to be used

```
Enable actuator on:

> One input channel
  All inputs channel
```

b-Entering single input and Opcode for primary / derivate quantity to be used

Act. :1onB1 Inp:---	Actuation 1 available on output B1 with sensor available in input.- - -
OpCod:---	Enter input number and sensor Opcode number.

c-Entering Opcode for primary / derivate quantity to be used for all inputs

Act. :1onB1 Inp:???	Actuation 1 available on output B1 with all sensors available on inputs.??? with Opcode - - -
OpCod:---	Enter the sensor Opcode number

d-Entering the value of Greater than

Act. :1onB1 Inp:---	
OpCod:---	
	xxx=Quantity name; - - - - - -=Enter limit on quantity;
xxx >--------um	um=unit of measurement.

e-Entering the value of Less than

```
Act.  : 1 on B1    Inp: - - -
OpCod: - - -

xxx   <  - - - - - - - - um
```

xxx=Quantity name; - - - - - -=Enter limit on quantity
um=unit of measurement.

f-Entering the value of Greater than / Less than

```
Act.  : 1 on B1    Inp: - - -
OpCod: - - -
xxx   >  - - - - - - - - um
xxx   <  - - - - - - - - um
```

xxx=Quantity name;
- - - - - -=Enter limit on quanitity
- - - - - -= Enter limit on quanitity

8.6.3.1.5. Timer

a-Entering the timing of actuator commands

```
Act.  : 1 on B1  Timer
Cycle  Time   h 2 4 m 0 0 s 0 0
ON  time      h 0 0 m 0 5 s 0 0
Start Cycle   h 0 0 m 0 0 s 0 0
```

Enter cycle length
Enter length for which cycle is ON
Enter time at which cycle begins (must be later than now)

8.6.3.2. Deleting (resetting) programming of an actuator and its outputs

a-Entering the number of the selected actuator and its outputs

```
Reset  single
Act.  : -  in  Out  - (    )
```

In "*RESET ALL*" this screen does not appear; the request for confirmation will appear immediately

b-Request for confirmation

```
Confirm  reset
Inputs/Actuators?
> NO
  YES
```

8.6.3.3. Displaying actuator configuration

a-If you press ENTER + Page Down or Down Arrow, all the configurations of programmed actuators will be displayed in the order in which they were programmed, as described in §8.6.3.1.1. through §8.6.3.1.5. If you press Page Up or Up Arrow, the configurations will be displayed in the reverse order.

8.6.4. Setup standard quantities

a-Selection of the quantity to view or modify (see ranges at §3.7.5.)

```
  Temperature
  Const.K  Pitot/Darcy
  Athm.  pressure
  Altitude  OSL
> Latitude
  Longitude
  Threshold  Sunshine
  Pipes  dimension
```

b-Change the value of the selected quantity (example)

```
Insert
Latitude
standard:    45,00°N
```

To change the value from N to S or vice versa, set a negative value (-45.00 N becomes 45.00 S).
This procedure also applies to longitudine.

8.6.5. Storage type setup

Select type of storage structure during survey

```
Storage type
  Linear storage
> Circular storage
```

8.6.6. Survey recovery

a-

```
The function trys to
recover in the
memocard the last
survey demaged
```

Use this function only if the memocard entered is actually present. The program will not check for its presence.

b-

```
Do you confirm
operation?
> No
  Yes
```

c-

```
Operation terminated
```

8.6.7. Selecting actuator operating logic

```
Type of actuation
> Low power logic
  Safety logic
```

8.6.8. Displaying resident program version and instrument serial number

```
      BABUC - ABC
   Program Version
 x.xxEng2/z.zz/Axx
Serial FFFF/UUUU
```

Version of:
Acquisition/processing device processor/Opcode lib. ver.
Factory serial number / User's serial number

8.6.9. Changing the user's serial number

```
Modify user's serial
number: UUUU
```

Enter user's serial number

9. FAULT DETECTION & CHECKING

9.1. INTRODUCTION

During a survey, it is possible check certain parameters that indicate the correct functioning of the acquisition unit. These parameters are:
- Battery voltage
- Available memory
- Correct display of values measured by the probes
- Correct setting of the clock

9.1.1. Battery voltage

Via the "UTILITY->BATTERY VOLTAGE" menu, it is possible to display the current voltage of the battery. Normally the battery will have a voltage in the range:
- Pb battery: 10... 14 V
- NiCd battery: 6.8... 11 V

If the battery voltage drops below a specified threshold a warning message is displayed via the "Error handling" procedure.

9.1.2. Available memory

During surveys with linear memory structures, it is possible to display the gradual reduction of free memory ("UTILITY ->MEMORY AVAILABLE"). This is an indicator of the acquisition unit's correct functioning and can be slow or quick depending on the specified functional parameters (number of sensors connected, statistical calculation rate, etc.).
Obviously, in cases where "Circular" memory storage is employed, the amount of available memory does not vary; but, in this case, it is possible to check a variation of the “P” pointer.

9.1.3. External power supply test

1) Remove connections of any external power supply.
2) Switch the instrument on and select "UTILITY->BATTERY VOLTAGE".
3) Check that the voltage is: from 10 to 13V if the battery type is Pb and from 6.8 to 8V if it is NiCd.
4) Insert the mains plug and wait a couple of minutes.
5) Check that the voltage has increased by at least 0.5V with respect to the previous reading.
6) Check the fuse if the red indicator lamp does light when unit is plugged into the mains.

9.1.4. Memocard and internal RAM memory test

1) Insert a memocard already formatted using the *CHANGE MEMOCARD->INSERTION STAGE* procedure
2) Check that the number of free bytes on the memocard is almost that of its nominal value.
3) Switch the instrument off and remove the memocard.
4) Turn the instrument on again and select *CHANGE MEMOCARD->INSERTION STAGE* once again
5) Check that the amount of free RAM is approximately 65000 bytes.

ATTENTION:
The maximum and total charge on the power supplied by the terminals 5,6 of the inputs 1-8 is of 250mA. So, it is NOT possible to connect to the same block of inputs (according to the data logger model: 1-5, 1-8, 11-18, 21-38, 41-48, 51-58) sensors that totally consume over 250mA. If this happens it is possible to damage the transistor controlling the actuation of the input terminals and the sensors won’t be powered anymore.

10. CALCULATION DESCRIPTION

A) Ave CALCULATION (AVERAGE)
BABUC ABC calculates the Average summing the instantaneous values acquired during the processing period and divides them by the number of acquisitions performed in that period.
B) MIN CALCULATION (MINIMUM)
BABUC ABC stores the minimum values acquired during the processing period.
C) MAX CALCULATION (MAXIMUM)
BABUC ABC stores the maximum values acquired during the processing period.
D) DTMINMAX CALCULATION
BABUC ABC stores the date and time in which the minimum and maximum values occurred during the processing period and the respective values.
E) DVST CALCULATION (STANDARD DEVIATION)
BABUC ABC calculates the Standard Deviation with the instantaneous values acquired during the processing period.
F) IST CALCULATION (INSTANTANEOUS)
BABUC ABC stores the last value acquired during the processing period.
G) TOT CALCULATION (TOTAL)
BABUC ABC stores the sum of the values acquired during the processing period.
H) DURATAMIN CALCULATION (DURATION IN MINUTES)
Process used for logic status or presence parameters.
BABUC ABC stores the sum of the times in which the status value is YES.
I) 1IST CALCULATION (INSTANTANEOUS)
BABUC ABC stores the last value acquired during the processing period.
J) 10IST CALCULATION (INSTANTANEOUS)
BABUC ABC stores 10 values taken during the processing period.
K) 60IST CALCULATION (INSTANTANEOUS)
BABUC ABC stores 60 values taken during the processing period.
L) EVMIN EVENT (MINIMUM EVENT)
BABUC ABC stores the value and the date/time in which such a value dropped below the minimum value.
M) EVMAX EVENT (MAXIMUM EVENT)
BABUC ABC stores the value and the date/time in which such a value exceeded the maximum value.
N) EVDELTA EVENT (DEVIATION EVENT)
BABUC ABC stores the value and the date/time in which the value increased or decreased more than a pre-assigned value. The deviation is defined as the difference with respect to the first value measured and from the subsequent stored deviations.
O) EVPULSE EVENT (PULSE EVENT)
BABUC ABC stores the value and the date/time in which the pulse occurred.
P) EVMESSAGE EVENT (MESSAGE EVENT)
BABUC ABC stores the date/time and the message inserted by the operator.

WIND PARAMETERS

A) SPEED CLASS VALUES (DEFAULT)
USED TO DOCUMENT: EOLO 0/1, EOLO 0/16 - EOLO 0/18 - EOLO 0/32 - EOLO 0/36.
Calm value: 0.3 m/s
Class 1 (0.3 - 2.0 m/s), Class 2 (2.0 - 4.0 m/s), Class 3 (4.0 - 6.0 m/s),
Class 4 (6.0 - 9.0 m/s), Class 5 (9.0 - 12.0 m/s), Class 6 (12.0 - 50.0 m/s).
The amplitude of each class can be changed by using the GAP Software on a PC.
B) EOLO 0/1 CALCULATION
BABUC ABC stores the values of the percentage distributions of the events on (6 + calm) speed classes and 1 direction sector + calm. In addition, it stores the average speed out of 360° and in each of the 6 preset speed classes.

C) EOLO 0/16 - EOLO 0/18 - EOLO 0/32 - EOLO 0/36 CALCULATION

BABUC ABC stores the values of the percentage distributions of the events on (6 + calm) speed classes and 16-18-32-36 (depending on the type of EOLO 0 process selected) direction sectors + calm. In addition, it stores the average wind speed for each sector (16-18-32-36) and for each speed class (6). The sector is an arc with a variable amplitude (depending on the number of sectors selected) whose bisector corresponds to its normal value. Example: out or 36 sectors, sector 0° of 10°, begins at 355° and ends at 5°.

D) EOLO 1 CALCULATION

BABUC ABC stores the characteristics of the main sector:

- amplitude: angle of the main sector
- bisector: angle that divides the main sector into two parts
- weighted average direction: average of all the direction acquisitions in the main sector
- average speed: average of all the speed acquisitions in the main sector
- standard deviation: of the direction in the main sector

THE MAIN SECTOR EXISTS IF IT COMPLIES WITH THE FOLLOWING REQUIREMENTS

The smallest of the arcs is defined as the one that has the following requirements:

- that its amplitude ranges from 30° to 135°
- that it includes at least 68% of all the acquisitions valid in the period.

If the main sector does not exist, BABUC ABC retains in memory the average speed calculated out of 360°, while the value "VARIABLE" with numeric value = 1000 is attributed for the amplitude, bisector and average weighted direction of the main sector; the value 0 is attributed to the standard deviation.

E) EOLO 2 CALCULATION

BABUC ABC calculates and stores:

- speed and direction resultant: These are the vectorial sum of the wind speed and direction components: speed (modules), direction (angle). Example: If the wind blows for one hour from the NORTH at 5 m/sec and for the next hour from the WEST at 7 m/sec; after two hours the speed vector of the "wind resultant" will have a NORTH-WEST angle (direction resultant) and modules (speed resultant) 4.3 m/sec.
- direction standard deviation: out of 360°

From this information it will be possible to obtain:
Path resultant = Speed result. (in m/sec.) x Time (in sec.).

F) EOLO 3 CALCULATION

HOURLY DOCUMENT COMPATIBLE WITH THE ANADATA CLIMA32 PROGRAM

BABUC ABC stores the characteristics of the main sector with the EOLO 1 characteristics:

- main sector bisector
- weighted average direction of the main sector
- average speed of the main sector
- main sector standard deviation
- speed/direction resultant.
- standard deviation of the direction out of 360°
- optional standard deviation of direction (according to Nelson);
- distribution in percentage of the direction frequencies out of 16 sectors
- calm percentage: (default: speed < 0.3 m/sec.)

G) EOLO 4 CALCULATION

DAILY DOCUMENT COMPATIBLE WITH THE ANADATA CLIMA32 PROGRAM

BABUC ABC stores the values of:

- sector bisector with greader distribution in terms of direction frequency percentage, out of 16 sectors;
- weighted average direction of the prevalent sector: NOT CALCULATED;
- average speed in prevalent sector: NOT CALCULATED;
- standard deviation of prevalent sector: NOT CALCULATED;
- speed and direction resultant
- standard deviation of the direction out of 360°
- percentage distribution of direction frequencies over 16 sectors;
- calm percentage: (default: speed < 0.3 m/sec.).

Processes which are not calculated have no place in the daily report. There are included only to maintain compatibility with Anadata Eolo 3 and Clima32.

11. ERROR MESSAGES

Error messages can appear whilst the instrument is running; they may signal internal malfunctions or erroneous operator actions. Errors must be acknowledged and removed from memory with the "UTILITY" -> "ERROR VIEW" function.
A table of the error messages with the causes and possible remedies is given below. The table is divided into two sections: minor errors that are easily fixed by the user and system errors that generally imply a more critical problem requiring the attention of LASTEM technicians; in the latter case, contact LASTEM after accurately noting the instrument's operating conditions (connected probes, programmed calculations, survey type and any other information that may aid a rapid diagnosis of the problem and provide a solution).

Minor errors:

Message	Description	Action
Battery down	At the start of a survey, the instrument checks if the battery voltage is sufficient to continue.	Check that mains power reaches the instrument or that the solar panel is working and correctly connected; if the instrument is powered from another source, check for voltage on the source's output terminals.
Acquisition freq. too high	The acquisition frequency for the connected sensors exceeds the instruments capacity.	The fastest rate allows the acquisition of two channels per second. Increase the ACQUISITION RATE for the codes of the programmed sensors.
Insuff. data memory	The dynamic RAM memory used for temporary storage of acquired data is insufficient to cover the programmed requirements.	Reduce the number of programmed inputs to the minimum indispensable (only sensors that are actually connected); program only the calculations necessary for each sensor via the GAP SW on PC.
Memory full	The current survey, or the last one performed, attempted to store acquired data beyond the physical limits of memory. This message can only appear in cases of linear storage.	Eliminate the error via the appropriate menu. Before proceeding with a new survey, cancel one or more surveys from memory
No probe connected	The operator is attempting to perform a survey without having programmed any inputs.	Use the "SYSTEM-CONFIG. INPUT CHANS" function to program the inputs.
Password incorrect	Use of instrument blocked by previous insertion of a password.	If the password inserted by the user is not known, the only way out of this situation is to remove power from the instrument with the main switch; this operation may compromise stored data and thus should only be performed in cases of necessity. If no password has been inserted by the user, then the operator has entered a part of the program that can only be used by LASTEM technicians.
Memocard not connected	The system has unsuccessfully attempted to read or write to the memocard.	Check that the memocard is properly inserted. Repeat the insertion procedure.
Config. memory unformatted	This error can occur when the instrument is switched on. It indicates that primary information has been lost from the configuration memory area. The program asks whether to format the memory or continue. Formatting memory cancels all data and renders the instrument inoperative until it is subsequently re-programming.	Re-program the instrument via the GAP SW. Use the factory configuration file or a derivation created by the user.

Memocard battery discharged	The memocard has lost its data due to battery failure.	Substitute the memocard battery, consulting the relative manual. Format the memocard and start a new survey.
Virgin data memory	The system does not recognize the contents of the memocard. This normally occurs on an unformatted memocard.	Format the memocard.
Too many log chan.	The total number of sensors and calculations defined for the survey exceed the capacity of the instrument.	Reduce the number of connected sensors or, via the Setup program on PC, reduce the number of calculations for the connected sensors.
Write time-out	Indicates that information has not been correctly written to the configuration or data memory areas. There is therefore a misalignment between memory contents and programmed information.	In such cases, it is necessary to transfer the file to PC and then cancel it on BABUC ABC using the "FILE MANAGEMENT-DELETE LAST SURVEY/ALL SURVEYS" function. Due to erroneous data in memory, transfer is not always possible. After this operation, it is advised to transfer the full LASTEM configuration from PC to BABUC ABC using the GAP SW. The basic factory setup information is thus restored on BABUC ABC. If the problem repeats itself, it indicates that the memory or some other related component is malfunctioning; in this case BABUC ABC should be returned to the factory.
Read after write	See write time-out	See write time-out
Pointer inconsistency	See write time-out	See write time-out
Data not found	See write time-out	See write time-out
Operation not allowed	See write time-out	See write time-out

System errors:
Errors of this kind require assistance from the manufacturer's service representatives. The user must report conditions prior to the error.

Value out of scale	request unavailable	incorrect index
Invalid IPC requested	RAW error on RAM data	Erroneous dim. frame TX
Invalid context	Incorrrect RAW RDP	Overflow IPC in acq.
Invald IPC index	RAW error in RAM data	

12. OPERATIVE CODES TABLE FOR LSI-LASTEM PROBES

12.1. LSI-LASTEM Sensors

Code	Name	Probe description	Quantity description	Operative code
a-Temperature & Humidity probes				
CLO001	TT130/J	Immersion temperature probe	Temperature	023
CLO002	TT130/K	Immersion temperature probe	Temperature	025
CLO021	TT140/J	Immersion temperature probe	Temperature	023
CLO022	TT140/K	Immersion temperature probe	Temperature	025
CLO031	TT162/J	Immersion temperature probe	Temperature	023
CLO032	TT162/K	Immersion temperature probe	Temperature	025
CLO052	TT165/J	Immersion temperature probe	Temperature	023
CLO071	TT224/J	Contact temperature probe	TeSURFACE	024
CLO091	TT226/J	Contact temperature probe	TeSURFACE	024
CLO102	TT260/J	Contact temperature probe	TeSURFACE	024
CLO103	TT260/K	Contact temperature probe	TeSURFACE	026
CLO109	TT320/K	Air temperarure probe	Temperature	025
CLO110	TT320/J	Air temperarure probe	Temperature	023
CLO142	TT520/K	Mineral insulted temperature probe	Temperature	025
CLO145	TT521/J	Mineral insulted temperature probe	Temperature	023
CLO146	TT521/K	Mineral insulted temperature probe	Temperature	025
CLO151	TT561/J	Mineral insulted temperature probe	Temperature	023
CLO152	TT561/K	Mineral insulted temperature probe	Temperature	025
DLA400	TT150/Pt	Geothermometer	Temperature	009
DLE003	TT130/Pt	Immersion temperature probe	Temperature	009
DLE004	TT130/TS1	Immersion temperature probe	Temperature	(**)
DLE023	TT140/Pt	Immersion temperature probe	Temperature	009
DLE033	TT162/Pt	Immersion temperature probe	Temperature	009
DLE041	TT164/Pt	Immersion temperature probe	Temperature	009
DLE055	TT171/Pt	Immersion temperature probe	Temperature	009
DLE058	TT180/Pt	Immersion temperature probe	Temperature	009
DLE063	TT221/Pt	Contact temperature probe	TeSURFACE	013
DLE073	TT224/Pt	Contact temperature probe	TeSURFACE	013
DLE083	TT225/Pt	Contact temperature probe	TeSURFACE	013
DLE090	TT227/Pt	Contact temperature probe	TeSURFACE	013
DLE111	TT320/Pt	Air temperature probe	TeDRYnv	003
DLE115	TT325/Pt	Air temperature probe	TeDRYnv	003
DLE116	TT325ts1	Air temperature probe	TeDRYnv	(**)
DLE120	TT350/Pt	Air temperature probe	TeDRYnv	003
DLE121	TT350/Pt	Air temperature probe	TeDRYnv	003
DLE122	TT350TS1	Air temperature probe	TeDRYnv	(**)
DLE130	TT360/Pt	Air temperature probe	TeDRYnv	003
DLE166	TT02/Pt	Temperature probe	Temperature	009
DLE167	TT03/Pt	Temperature probe	Temperature	009
DLE168	TT04/Pt	Temperature probe	Temperature	009
DLE202	Special	Pt100 temperature probe (different forms)	Temperature	014
DLE203	Special	NI100 temperature probe (different forms)	Temperature	009
DLE204	Special	TS-1 temperature probes (different forms)	Temperature	(**)
DLI011	TTG10/Pt	Sheltered temperature probe	Temperature	009
DMA018	C311T/Pt	Forced ventilation shielted temperature probe	TeDRYBULBfv	001
DMA020	C311T/Pt	Forced ventilation shielted temperature probe	TeDRYBULBfv	001
DMA022	C301T/Pt	Sheltered temperature probe	TeDRYBULBfv	003
DMA028	C312T/Pt	Forced ventilation sheltered temp. probe	TeDRYBULBfv	001
DMA032	C302T/Pt	Sheltered temperature probe	TeDRYBULBfv	003
DMA528	C512T	Forced ventilation sheltered probe,4..20mA 24Vca (temperature)	Temperature	077

DMA529	C512TH	Forced ventilation sheltered probe, 4..20mA 24Vca (temperature) (humidity)	Temperature RelHMIdity	077 031

1) Modify the output scale of the engineering parameters

* Use a resistance value 15 ohm to transform 0/4..20mA in 0/60..300mV

Code	Name	Probe description	Quantity description	Operative code
DMA532	C5102T	Forced ventilation sheltered probe, 4..20mA 24Vca (temperature)	Temperature	077
DMA533	C502TH	Sheltered probe, 4..20mA 24Vca (temperature)(Humidity)	Temperature RelHMIdity	077 031
DMA561	C512TH	Forced ventilation sheltered probe, 60.300mV 12Vcc (temperature) (humidity)	Temperature RelHMIdity	077 031
DMA563	C502TH	Sheltered probe, 60.300mV 12Vcc (temperature)(humidity)	Temperature RelHMIdity	077 031
DME005	TT305/PT	Psychrometric natural ventilation probe (dry bulb) (wet bulb)	TeDRYBULBnv TeWETBULBnv	003 004
DME010	TT310/PT	Psychrometric natural ventilation probe (dry bulb) (wet bulb)	TeDRYBULBNv TeWETBULBnv	003 004
DME020	TT314/PT	Psychrometric probe (dry bulb) (wet bulb)	TeDRYBULBfv TeWETBULBfv	001 002
DME150	HD300	Humidity probe UR% 4..20mA	RelHMIdity	031
DME162	HD300	Thermohygrometer, (Pt100 temperature) (0..20mA humidity)	TeDRYBULBnv RelHMIdity	003 032
DME164	HD320	Thermohygrometer, (Pt100 temperature) (4..20mA humidity)	TeDRYBULBnv RelHMIdity	003 031
DME570	C500	Thermohygrometer, (Pt100 temperature) (4..20mA humidity)	Temperature RelHMIdity	077 031
DME579	C500	Thermohygrometer, (60..300mV Temperature)(60..300mV humidity)	Temperature RelHMIdity	077 031
DME580	C500	Thermohygrometer, (4..20mA temperature) (4..20mA humidity)	Temperature RelHMIdity	077 031
DME589	C500	Thermohygrometer, (60..300mV Temperature)(60..300mV humidity)	Temperature RelHMIdity	077 031
DME801 DME810 DME811		Cordless probe	TeAIRnv RelHMIdity TeDew Point ILLUMINAtion Temperature TeSURFACE RadUVB PressDIFfer.al AcqRate 10sec	007 032 108 041 091 092 093 095 096
DME831		Cordless sensor for compost heaps	Temperature Conc-gasO2 AcqRate10sec	091 094 096
b-Wind speed & direction sensors				
DNA001	C100S	Wind speed sensor	VelWIND	097
DNA002	C101S	Heated wind speed sensor	VelWIND	097
DNA004	C100S	Wind speed sensor low power consumption	VelWIND	097
DNA010	C100D	Wind direction sensor (angle)	ANGLE	036
DNA011	C101D	Heated wind direction sensor (angle)	ANGLE	036
DNA021		Direct speed and direction sensor speed direction	VelWIND ANGLE	101 036
DNA022		Direct energy conservation speed and direction sensor speed direction	VelWIND ANGLE	101 036
DNA022		Heated speed probe	VelWIND	097

Code	Name	Probe description	Quantity description	Operative code
DNA501	C500S	Wind speed sensor 4..20mA 24Vca	VelWIND	035
DNA502	C501S	Heated wind speed sensor 4..20mA 24Vca	VelWIND	035
DNA510	C500D	Wind direction sensor 4..20mA 24Vca	ANGLE	034
DNA511	C501D	Heated wind direction sensor 4..20mA 24Vca	ANGLE	034
DNA521		Speed and direction sensor:Speed 4..20mA 12Vcc Direction 4..20mA 12Vcc	VelWIND ANGLE	040 034
DNA541		Speed and direction sensor absolute with compass and inclinometer Speed 4..20mA 12Vcc Direction 4..20mA 12Vcc	VelWIND ANGLE	040 034
DNA542		Speed and direction sensor absolute with compass Speed 4..20mA 12Vcc Direction 4..20mA 12Vcc	VelWIND ANGLE	040 034
DNA61x		Encoder direction sensor	ANGLE	034
d- Solar radiation and illumination probes				
DPA047	C102R	LSI photovoltaic cell global radiometer	RadGLOBAL	047
DPA230	C201R	K&Z net radiometer	RadNET	049
DPA240	C201R	LSI net radiometer	RadNET	049
DPA251	C112R	K&Z CM11 thermopile global radiometer	RadGLOBAL	047
DPA253	C111R	K&Z CM6B thermopile global radiometer	RadGLOBAL	047
DPA255	C111R	K&Z CM3 thermopile global radiometer	RadGLOBAL	047
DPA260	C111R	K&Z CM21 thermopile global radiometer	RadGLOBAL	047
DPA265	C111R	K&Z CNR1 thermopile net radiometer	RadGLOBAL	049
DPA507	C500	PAR radiation probe, 0..20mA	RadPAR	056
DPA509	C500	PAR radiation probe, 0..300mV	RadPAR	056
DPA512	C500	VIR radiation probe, 0..20mA	RadVIR	054
DPA514	C500	VIR radiation probe, 0..300mV	RadVIR	054
DPA517	C500	UVA radiation probe, 0..20mA	RadUVA	058
DPA519	C500	UVA radiation probe, 0..300mV	RadUVA	058
DPA522	C500	UVB radiation probe, 0..20mA	RadUVB	059
DPA524	C500	UVB radiation probe, 0..300mV	RadUVB	059
DPA554	C511R	K&Z CM6B global radiometer, 0..20mA	RadGLOBAL	048
DPA564	C500	Global radiometer, 0..20mA	RadGLOBAL	048
DPA502	C500	Luxmeter, 0..20mA	ILLUMINATION	044
DPA504	C500	Luxmeter, 0..300mV	ILLUMINATION	044
DPD501		Direct radiometer, 4..20mA	RadDIRect	050
DPD504		Direct radiometer, 0..300mV	RadDIRect	051
DPE240		Thermal flux probe surface	FLUX THermal	061
DPE260		Thermal flux probe earth	FLUX THermal	061
c-Precipitation, rain presence and wetness presence probes				
DQA030	C100A	Rain gauge, 333cq , 0,2 mm	QuantPRECIP.ON	099
DQA031	C100A	Heated rain gauge, 333cq , 0,2 mm	QuantPRECIP.ON	099
DQA035	C100A	Rain gauge, 1000cq , 0,2 mm	QuantPRECIP.ON	099
DQA036	C100A	Heated rain gauge, 1000cq , 0,2 mm	QuantPRECIP.ON	099
DQA050	C401A	Rain presence probe, 220Vca	PresPRECIP.ON	079
DQA052	C401A	Rain presence probe, 12Vcc	PresPRECIP.ON	079
DQA057	C601A	Wetness presence probe 12Vcc	PresnWETTING	080
DQA059	C601A	Wetness presence probe 220Vca	PresnWETTING	080

Code	Name	Probe description	Quantity description	Operative code
e-Level probes				
DQC004		Piezometric water level probe, 4.20mA (2m)	LEVEL	062
DQC007		Piezometric water level probe 4.20mA (10m)	LEVEL	062
DQC014		Piezometric water level probe 4.20mA (20m)	LEVEL	063
DQC021		Piezometric water level probe 4.20mA (30m)	LEVEL(modify param.)	063
DQC102		Piezometric water level probe4.20mA (200mm)	LEVEL (12Vcc)	060
DQC105		Piezometric water level probe 4.20mA (200mm)	LEVEL (24Vca)	060
g-Pressure				
DQA240		Atm. pressure probe 800.1100 0..300mV	PressAtmosphe.	033
DQA510		Pressure diff. probe 0.1.0 hPa 4..20mA 8..15Vcc	PressDIFfer.le	037 (2)
DQA511		Pressure diff. probe 0.2,54hPa 4..20mA 8..15Vcc	PressDIFfer.le	037
DQA514		Pressure diff. probe 0.12,5hPa 4..20mA 8..15Vcc	PressDIFfer.le	038
DQA515		Pressure diff. probe 0..70 hPa 4..20mA 8..15Vcc	PressDIFfer.le	039
DQA516		Pressure diff. probe 0.330 hPa 4..20mA 8..15Vcc	PressDIFfer.le	039 (2)
f-Gas concentration probes				
DSO091		Gas concentration probe CO 60..300mV 8..15Vcc	Conc-gasCO	064 (2)
DSO101		Gas concentration probe CO 60..300mV 8..15Vcc	Conc-gasCO	064
DSO102		Gas concentration probe CO 4..20mA 8..15Vcc	Conc-gasCO	064
DSO104		Gas concentration probe NO 60..300mV 8..15Vcc	Conc-gasNO	065
DSO105		Gas concentration probe NO 4..20mA 8..15Vcc	Conc-gasNO	065
DSO108		Gas concentrat.probe NO2 60..300mV 8..15Vcc	Conc-gasNO2	066
DSO109		Gas concentrat.probe NO2 4..20mA 8..15Vcc	Conc-gasNO2	066
DSO111		Gas concentrat.probe SO2 60..300mV 8..15Vcc	Conc-gasSO2	067
DSO112		Gas concentrat.probe SO2 4..20mA 8..15Vcc	Conc-gasSO2	067
DSO115		Gas concentrat.probe NH3 60..300mV 8..15Vcc	Conc-gasNH3	068
DSO116		Gas concentrat.probe NH3 4..20mA 8..15Vcc	Conc-gasNH3	068
DSO119		Gas concentrat. Probe H2S 60..300mV 8..15Vcc	Conc-gasH2S	069
DSO120		Gas concentrat.probe H2S 4..20mA 8..15Vcc	Conc-gasH2S	069
DSO123		Gas concentrat. Probe HCl 60..300m 8..15Vcc	Conc-gasHCl	071
DSO124		Gas concentrat. probe HCl 4..20mA 8..15Vcc	Conc-gasHCl	071
DSO126		Gas concentrat. probe HCN 60..300mV 8..15Vcc	Conc-gasHCN	074
DSO127		Gas concentrat. probe HCN 4..20mA 8..15Vcc	Conc-gasHCN	074
DSO129		Gas concentrat. probe Cl2 60..300mV 8..15Vcc	Conc-gasCl2	075
DSO130		Gas concentrat. probe Cl2 4..20mA 8..15Vcc	Conc-gasCl2	075
DSO132		Gas concentrat. probe H2 60..300mV 8..15Vcc	Conc-gasH2	076
DSO133		Gas concentrat.probe H2 4..20mA 8..15Vcc	Conc-gasH2	076
DSO140		Gas concentrat. probe O2 60..300mV 8..15Vcc	Conc-gasO2	072
DSO146		Gas concentrat. probe O3 60..300mV 8..15Vcc	Conc-gasO3	116
DSO179		Gas concentrat. probe CO2 4..20mA 8..15Vcc	Conc-gasCO2	070
DSO180		Gas concentrat. probe CO2 60..300mV 8..15Vcc	Conc-gasCO2	070
DSO181		Gas concentrat. probe CO2 60..300mV 8..15Vcc	Conc-gasCO2	070
DSO182		Gas concentrat. probe CO2 60..300mV 8..15Vcc	Conc-gasCO2	070
DSO400		Gas concentrat. probe 8..15Vcc	Conc-gas	???

12.2. Sensor not developped by LSI-LASTEM

Probe	Name	Probe description	Quantity description	Operative code
		a-Sensor		
Vaisala	HMP45CF	Temperature with signal resistive Relative humidity with signal 0..1V	Temperature RelHMIdity	135 031
GILL		Sonic Wind speed (output 4÷20mA) Sonic Wind direction (output 4÷20mA) Sonic temperature (output 4÷20mA) Sonic Wind speed (serial output ID 001) Sonic Wind direction (serial output ID 001) Sonic temperature (serial output ID 001)	VelWIND ANGLE Temperature VelWIND ANGLE Tempearture	040 034 077 107 109 110
Hydrolab		Temperature (serial output ID 001) pH (serial output ID 001) Salinity (serial output ID 001) Depth (serial output ID 001) Conductance (serial output ID 001) Turbidity (serial output ID 001) Ammonium (serial output ID 001) Nitrate (serial output ID 001) Chloride (serial output ID 001) Chlorophyll (serial output ID 001) Dissolved Oxygen (serial output ID 001) ORP Redox (serial output ID 001) Total Dissolved Gas (serial output ID 001)	Temperature pH SALINity DEPTH CONDUctance TURBIdity AMMONium NITRaTe CHLORide CHLORophyll DissOXYGen ORP Redox TotalDissGas	136 137 138 139 140 141 142 143 144 145 146 147 148

13. OPERATING CODES DESCRIPTION

13.1. PRIMARY QUANTITIES (codes from 001 to 149)

i: Operating code which includes the functions described below.
ii: Usual name of the primary sensor or signal, usual abbreviation, linearization applied, reference standards.
iii: Extended text and unit of measurement appearing on the printer and, in abbreviated form, on the display.
iv: Sensor acquisition interval and time in advance that sensor power is turned on prior to acquisition (in hours:minutes:seconds).
v: Measurement field.
vi: Linear engineering, or input values and corresponding output values.
vii: Types of report, timing basis, final portions of timing used (in hours:minutes).
viii: Types of events.

i	ii			iii		iv		v	vi		vii				viii
Op.	Probe or signal output			Text		Acquisition		Range	In-Out		Elaboration				Event
Code	Type	Lineariz.	Stand.	Description	Unit	Time	Actuation		Input	Output	No	Type	Time	Used	Type
001	Thermoresistance			TeDRYBULBfv	°C	00:00:10	00:01:30	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
002	Thermoresistance			TeWETBULBfv	°C	00:00:10	00:01:30	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
003	Thermoresistance			TeDRYBULBnv	°C	00:01:00	00:00:00	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
004	Thermoresistance			TeWETBULBnv	°C	00:01:00	00:00:00	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
005	CISS Serial			TeDRYBULBfv	°C	00:05:00	00:00:00	-30+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
006	CISS Serial			TeWETBULBfv	°C	00:05:00	00:00:00	-30+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
007	CISS Serial			TeAIRnv	°C	00:05:00	00:00:00	-30+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
008	CISS Serial			TeWETBULBnv	°C	00:05:00	00:00:00	-30+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
009	Thermoresistance			Temperature	°C	00:01:00	00:00:00	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
010	Thermoresistance			TeGLOBETH.nv	°C	00:01:00	00:00:00	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
011	Thermoresistance extended field			Temperature	°C	00:01:00	00:01:00	-50+500°C			I:	AveMinMaxStDvW	01:00	01:00	
	TRextend.	Pt100									II:	AveMinMaxStDvW	24:00	24:00	
012	Thermoresistance extended field			TeWETBULBnv	°C	00:01:00	00:00:00	-50+500°C			I:	AveMinMaxStDvW	01:00	01:00	
	TRextend.	Pt100									II:	AveMinMaxStDvW	24:00	24:00	
013	Thermoresistance			TeSURFACE.	°C	00:01:00	00:00:00	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
014	Thermoresistance			Temperature	°C	00:01:00	00:00:00	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	NI100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	

i	Ii			iii		Iv		v	vi		vii				viii
Op.	Probe or signal output			Text		Acquisition		Range	In-Out		Elaboration				Event
Code	Type	Linearizz.	Stand.	Description	Unit	Time	Actuation		Input	Output	No	Type	Time	Used	Type
015		Analogue signal		TePHYSIOLOG	°C	00:01:00	00:00:00	0+44°C			I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear									II:	AveMinMaxStDvW	24:00	24:00	
016		Analogue signal		Conc-gasCO	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	4000	II:	AveMinMaxStDvW	24:00	24:00	
017		Analogue signal		Conc-gasSO2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	1000	II:	AveMinMaxStDvW	24:00	24:00	
018		Analogue signal		Conc-gasCO2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	30000	II:	AveMinMaxStDvW	24:00	24:00	
019		Thermoresistance		TeANKles	°C	00:01:00	00:00:00	-50+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
020		Thermoresistance		TeFLOor	°C	00:01:00	00:00:00	-50+70°c			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Pt100									II:	AveMinMaxStDvW	24:00	24:00	
021		Thermocouple		Temperature	°C	00:01:00	00:00:00	-50+600°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCJ	MC961								II:	AveMinMaxStDvW	24:00	24:00	
022		Thermocouple		TeSURFACE.	°C	00:01:00	00:00:00	-50+600°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCJ	MC961								II:	AveMinMaxStDvW	24:00	24:00	
023		Thermocouple		Temperature	°C	00:01:00	00:00:00	-50+600°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCJ	NBS125								II:	AveMinMaxStDvW	24:00	24:00	
024		Thermocouple		TeSURFACE.	°C	00:01:00	00:00:00	-50+600°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCJ	NBS125								II:	AveMinMaxStDvW	24:00	24:00	
025		Thermocouple		Temperature	°C	00:01:00	00:00:00	-200/1300°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCK	MC961								II:	AveMinMaxStDvW	24:00	24:00	
026		Thermocouple		TeSURFACE.	°C	00:01:00	00:00:00	-200/1300°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCK	MC961								II:	AveMinMaxStDvW	24:00	24:00	
027		Thermocouple		Temperature	°C	00:01:00	00:00:00	0+1600°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCS	MC961								II:	AveMinMaxStDvW	24:00	24:00	
028		Thermocouple		TeSURFACE.	°C	00:01:00	00:00:00	0+1600°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCS	MC961								II:	AveMinMaxStDvW	24:00	24:00	
029		Thermocouple		Temperature	°C	00:01:00	00:00:00	-200+200C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCT	MC961								II:	AveMinMaxStDvW	24:00	24:00	
030		Thermocouple		TeSURFACE.	°C	00:01:00	00:00:00	-200+200C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCT	MC961								II:	AveMinMaxStDvW	24:00	24:00	
031		Analogue signal		RelHMIdity	%	00:01:00	00:00:02	60+300mV			I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear									II:	AveMinMaxStDvW	24:00	24:00	
032		CISS Serial		RelHMIdity	%	00:05:00	00:00:00	0+100%			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
033		Analogue signal		PressAtmosphe.	hPa	00:01:00	00:00:02	0+300mV	0	800	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	1100	II:	AveMinMaxStDvW	24:00	24:00	
034		Analogue signal		ANGLE	<	00:00:05	00:00:02	60+300mV	60	0	I:				
	mV	Linear							300	360	II:				

i	ii			iii		iv		v	vi		vii				viii
Op.	Probe or signal output			Text		Acquisition		Range	In-Out		Elaboration				Event
Code	Type	Lineariz.	Stand.	Description	Unit	Time	Actuation		Input	Output	No	Type	Time	Used	Type
035	Analogue signal			VelWIND	m/s	00:00:05	00:00:02	60+300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	50	II:	AveMinMaxStDvW	24:00	24:00	
036	Resistance Variation			ANGLE	<	00:00:05	00:00:00	0+2000 (	0	0	I:				
	Ohm	Linear							2000	360	II:				
037	Analogue signal			PressDIFfer.al	hPa	00:01:00	00:00:02	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	2,54	II:	AveMinMaxStDvW	24:00	24:00	
038	Analogue signal			PressDIFfer.al	hPa	00:01:00	00:00:02	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	12,5	II:	AveMinMaxStDvW	24:00	24:00	
039	Analogue signal			PressDIFfer.al	hPa	00:01:00	00:00:02	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	70	II:	AveMinMaxStDvW	24:00	24:00	
040	Analogue signal			VelWIND	m/s	00:00:05	00:00:02	60 +300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	60	II:	AveMinMaxStDvW	24:00	24:00	
041	CISS Serial			ILLUMINAtion	Lux	00:05:00	00:00:00	Sensor			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
042	Analogue signal			ILLUMINAtion	Lux	00:00:10	00:00:02	0+300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	25000	II:	AveMinMaxStDvW	24:00	24:00	
043	Analogue signal			ILLUMINAtion	kLux	00:00:10	00:00:00	0+100mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							100	100	II:	AveMinMaxStDvW	24:00	24:00	
044	Analogue signal			ILLUMINAtion	kLux	00:00:10	00:00:02	0+300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	100	II:	AveMinMaxStDvW	24:00	24:00	
045	Analogue signal			SOILResist	kohm	00:01:00	00:10:00	60+300mV	60	0.1	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Log10							300	1000.0	II:	AveMinMaxStDvW	24:00	24:00	
046	Analogue signal			QuantPRECIP.ON	mm	00:00:10	00:00:02	60+300mV	60	0	I:	TOT	01:00	01:00	EVPulse
	mV	Linear							300	20.0	II:	TOT	24:00	24:00	
047	Analogue signal			RadGLOBAL	W/m^2	00:00:10	00:00:00	0+20mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							20	1500	II:	AveMinMaxStDvW	24:00	24:00	
048	Analogue signal			RadGLOBAL	W/m^2	00:00:10	00:00:02	0+300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	1500	II:	AveMinMaxStDvW	24:00	24:00	
049	Analogue signal			RadNET	W/m^2	00:00:10	00:00:00	-10+15mV	-10	-1000	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							15	1500	II:	AveMinMaxStDvW	24:00	24:00	
050	Analogue signal			RadDIRect	W/m^2	00:00:10	00:00:02	0+300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	1500	II:	AveMinMaxStDvW	24:00	24:00	
051	Analogue signal			RadDIRect	W/m^2	00:00:10	00:00:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	1500	II:	AveMinMaxStDvW	24:00	24:00	
052	Analogue signal			RadSCATTerd	W/m^2	00:00:10	00:00:00	0+20mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							20	1500	II:	AveMinMaxStDvW	24:00	24:00	
053	Analogue signal			RadVIR	W/m^2	00:00:10	00:00:00	0+20mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							20	200	II:	AveMinMaxStDvW	24:00	24:00	
054	Analogue signal			RadVIR	W/m^2	00:00:10	00:00:02	0+300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	200	II:	AveMinMaxStDvW	24:00	24:00	

i	ii			iii		iv		v	vi		vii				viii
Op.	Probe or signal output			Text		Acquisition		Range	In-Out		Elaboration				Event
Code	Type	Lineariz.	Stand.	Description	Unit	Time	Actuation		Input	Output	NO	Type	Time	Used	Type
055		Analogue signal		RadPAR	W/m²	00:00:10	00:00:00	0+20mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							20	1500	II:	AveMinMaxStDvW	24:00	24:00	
056		Analogue signal		RadPAR	W/m²	00:00:10	00:00:02	0+300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	1500	II:	AveMinMaxStDvW	24:00	24:00	
057		Analogue signal		RadUVA	W/m²	00:00:10	00:00:00	0+20mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							20	200	II:	AveMinMaxStDvW	24:00	24:00	
058		Analogue signal		RadUVA	W/m²	00:00:10	00:00:02	0 +300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	200	II:	AveMinMaxStDvW	24:00	24:00	
059		Analogue signal		RadUVB	W/m²	00:00:10	00:00:02	0 +300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	5	II:	AveMinMaxStDvW	24:00	24:00	
060		Analogue signal		LEVEL	mm	00:01:00	00:00:02	60 +300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	204,4	II:	AveMinMaxStDvW	24:00	24:00	
061		Analogue signal		FLUX THermal	W/m²	00:00:10	00:00:00	-10+10mV	-10	-100	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							10	100	II:	AveMinMaxStDvW	24:00	24:00	
062		Analogue signal		LEVEL	m	00:01:00	00:00:02	60 +300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	10,22	II:	AveMinMaxStDvW	24:00	24:00	
063		Analogue signal		LEVEL	m	00:01:00	00:00:02	60 +300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	20,44	II:	AveMinMaxStDvW	24:00	24:00	
064		Analogue signal		Conc-gasCO	ppm	00:01:00	00:05:00	60 +300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	1000	II:	AveMinMaxStDvW	24:00	24:00	
065		Analogue signal		Conc-gasNO	ppm	00:01:00	00:05:00	60 +300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	100	II:	AveMinMaxStDvW	24:00	24:00	
066		Analogue signal		Conc-gasNO2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	20	II:	AveMinMaxStDvW	24:00	24:00	
067		Analogue signal		Conc-gasSO2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	20	II:	AveMinMaxStDvW	24:00	24:00	
068		Analogue signal		Conc-gasNH3	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	50	II:	AveMinMaxStDvW	24:00	24:00	
069		Analogue signal		Conc-gasH2S	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	50	II:	AveMinMaxStDvW	24:00	24:00	
070		Analogue signal		Conc-gasCO2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	CO2 LSI							300	3000	II:	AveMinMaxStDvW	24:00	24:00	
071		Analogue signal		Conc-gasHCl	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	100	II:	AveMinMaxStDvW	24:00	24:00	
072		Analogue signal		Conc-gasO2	%	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	25	II:	AveMinMaxStDvW	24:00	24:00	
073		Analogue signal		ASPIRation		00:01:00	00:00:30	100/200mV							
	mV	YES/NO													
074		Analogue signal		Conc-gas CO2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	3000	II:	AveMinMaxStDvW	24:00	24:00	

i	ii			iii		iv		v	vi		vii				viii
Op.	Probe or signal output			Text		Acquisition		Range	In-Out		Elaboration				Event
Code	Type	Lineariz.	Stand.	Description	Unit	Time	Actuation		Input	Output	NO	Type	Time	Used	Type
075		Analogue signal		Conc-gasCl2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	20	II:	AveMinMaxStDvW	24:00	24:00	
076		Analogue signal		Conc-gasH2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	200	II:	AveMinMaxStDvW	24:00	24:00	
077		Analogue signal		Temperature	°C	00:01:00	00:00:02	60+300mV	60	-30	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	70	II:	AveMinMaxStDvW	24:00	24:00	
078		Analogue signal		Presence		00:01:00	00:00:00	100/200mV			I:	DurationMINW	01:00	01:00	
	mV	YES/NO									II:	DurationMINW	24:00	24:00	
079		Analogue signal		PresPRECIP.ON		00:01:00	00:00:00	100/200mV			I:	DurationMINW	01:00	01:00	
	mV	YES/NO									II:	DurationMINW	24:00	24:00	
080		Analogue signal		PresnWETTING		00:01:00	00:01:00	100/200mV			I:	DurationMINW	01:00	01:00	
	mV	YES/NO									II:	DurationMINW	24:00	24:00	
081		Analogue signal		PressDIFfer.al	hPa	00:01:00	00:00:02	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	1,00	II:	AveMinMaxStDvW	24:00	24:00	
082		Analogue signal		PressDIFfer.al	hPa	00:01:00	00:00:02	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	330,0	II:	AveMinMaxStDvW	24:00	24:00	
083		Analogue signal		PressDIFfer.al	hPa	00:01:00	00:00:02	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	25,00	II:	AveMinMaxStDvW	24:00	24:00	
084		Analogue signal		Conc-gas CO2	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	5000	II:	AveMinMaxStDvW	24:00	24:00	
085		Internal cold joint		Cold Joint	°C	00:01:00	00:00:00	-50 + 70°C			I:	AveMinMaxStDvW	01:00	01:00	
	TR	Cold J.	IEC751								II:	AveMinMaxStDvW	24:00	24:00	
086		Analogue signal		SIGZ:	mV	00:00:05	00:00:00	-300/300mV	-300	-300	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	300	II:	AveMinMaxStDvW	24:00	24:00	
087		Analogue signal		DIELPERmet.		00:10:00	00:00:20	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	40	II:	AveMinMaxStDvW	24:00	24:00	
088		Analogue signal		SOILTemp	%	00: 10:00	00:00:20	60+300mV	60	-10	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	54	II:	AveMinMaxStDvW	24:00	24:00	
089		Analogue signal		SIG3:	%	00:01:00	00:00:02	0+300mV	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	100	II:	AveMinMaxStDvW	24:00	24:00	
090		Analogue signal		SIG4:	%	00:01:00	00:00:02	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	100	II:	AveMinMaxStDvW	24:00	24:00	
091		CISS Serial		Temperature	°C	00:05:00	00:00:00	-30+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
092		CISS Serial		TeSURFACE	°C	00:05:00	00:00:00	-30+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
093		CISS Serial		RadUVB	W/m²	00:05:00	00:00:00	0..5 W/m²			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
094		CISS Serial		Conc-gas O2	%	00:15:00	00:00:00	0..100%			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
095		CISS Serial		PressDIFfer.al	hPa	00:05:00	00:00:00	0..2,54 hPa			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
096		CISS Serial		RateAcq10sec	--	00:00:10	00:00:00				I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	

i	Ii			iii		iv		v	vi		vii				viii
Op.	Probe or signal output			Text		Acquisition		Range	In-Out		Elaboration				Event
Code	Type	Lineariz.	Stand.	Description	Unit	Time	Actuation		Input	Output	NO	Type	Time	Used	Type
097		Pulse signal		VelWIND	m/s	00:00:05	00:00:00	0..50 m/s	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	Impulse	TacoC100S							50	50	II:	AveMinMaxStDvW	24:00	24:00	
098		Pulse signal		VelAIRabsolute	m/s	00:00:05	00:00:00	0./ 2560 Hz	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	Impulse	Linear							2560	20	II:	AveMinMaxStDvW	24:00	24:00	
099		Pulse signal		QuantPRECIP.ON	mm	00:01:00	00:00:00	0/1000 Hz	0	0	I:	TotW	01:00	01:00	
	Impulse	Linear							1000	200	II	TotW	24:00	24:00	
100		Pulse signal		FREQuency	kHz	00:00:02	00:00:02	0/100 kHz	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	Impulse	Linear							100k	100k	II:	AveMinMaxStDvW	24:00	24:00	
101		Pulse signal		VelVENTO	m/s	00:00:05	00:00:00	0..60 m/s	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	Impulse	TacoAnem							60	60	II:	AveMinMaxStDvW	24:00	24:00	
102		Pulse signal		QuantPRECIP.ON	mm	00:01:00	00:00:00	0 / 1000 Hz	0	0	I:	TotW	01:00	01:00	
	Impulse	Pluviom.							1000	200	II	TotW	24:00	24:00	
103		Pulse signal		VelAIRabsolute	m/s	00:00:05	00:00:00	0./ 25 m/s	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	Impulse	LinBsv202							25	25	II:	AveMinMaxStDvW	24:00	24:00	
104		Pulse signal		VelWIND	m/s	00:00:05	00:00:00	0..60 m/s	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	Impulse	LinBsv001							60	60	II:	AveMinMaxStDvW	24:00	24:00	
105		Pulse signal		VelAIRabsolute	m/s	00:00:02	00:00:02	0 / 40 m/s			I:	AveMinMaxStDvW	01:00	01:00	
	Impulse	Minair40m									II:	AveMinMaxStDvW	24:00	24:00	
106		Pulse signal		VelAIRabsolute	m/s	00:00:02	00:00:02	0 / 20 m/s			I:	AveMinMaxStDvW	01:00	01:00	
	Impulse	Minair20m									II:	AveMinMaxStDvW	24:00	24:00	
107		Gill-Serial		VelWIND	m/s	00:00:05	00:00:00	0..60 m/s			I:	AveMinMaxStDvW	01:00	01:00	
	GILL	Linear									II:	AveMinMaxStDvW	24:00	24:00	
108		CISS Serial		TeDewPoint	°C	00:05:00	00:00:00	-30+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	CISS	Linear									II:	AveMinMaxStDvW	24:00	24:00	
109		Gill-Serial		ANGLE	°<	00:00:05	00:00:00	0..360°<			I:				
	GILL	Linear									II:				
108		Gill-Serial		Temperature	°C	00:05:00	00:00:00	-40+70°C			I:	AveMinMaxStDvW	01:00	01:00	
	GILL	Linear									II:	AveMinMaxStDvW	24:00	24:00	
111		Internal battery level		BATTlevel	%	00:01:00	00:00:00	0....100 %			I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear									II:	AveMinMaxStDvW	24:00	24:00	
112		Resistor		RESistance	ohm	00:01:00	00:00:00	0..11 kΩ	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	Ohm	Linear							11000	11000	II:	AveMinMaxStDvW	24:00	24:00	
113		Analogue signal		PH	pH	00:01:00	00:00:02	0/7 pH			I:	AveMinMaxStDvW	01:00	01:00	
	mV	pH									II:	AveMinMaxStDvW	24:00	24:00	
114		Thermistor		Temperature	°C	00:01:00	00:00:00	-50+50°C			I:	AveMinMaxStDvW	01:00	01:00	
	TS1	TS1-LSI									II:	AveMinMaxStDvW	24:00	24:00	
115		Thermocouple		Temperature	°C	00:01:00	00:00:00	-200/1000°C			I:	AveMinMaxStDvW	01:00	01:00	
	TC	TCE	MC961								II:	AveMinMaxStDvW	24:00	24:00	
116		Analogue signal		Conc-gasO3	ppm	00:01:00	00:05:00	60+300mV	60	0.0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	3.0	II:	AveMinMaxStDvW	24:00	24:00	
117		Analogue signal		DISPLacement	mm	00:01:00	00:00:05	60+300mV	60	-2.0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	+2.0	II:	AveMinMaxStDvW	24:00	24:00	

i	Ii			iii		iv		v	vi		vii				viii
Op.	Probe or signal output			Text		Acquisition		Range	In-Out		Elaboration				Event
Code	Type	Lineariz.	Stand.	Description	Unit	Time	Actuation		Input	Output	NO	Type	Time	Used	Type
130	Analogue signal			PRESSure	Bar	00:00:10	00:00:02	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	30,00	II:	AveMinMaxStDvW	24:00	24:00	
131	Analogue signal			VelAIRHR	m/s	00:00:10	00:00:10	60+300mV	60	0	I:	AveMinMaxStDvW	01:00	01:00	
	mV	Linear							300	20,00	II:	AveMinMaxStDvW	24:00	24:00	
132	Analogue signal			Turbolence	%	00:00:10	00:00:10	60+300mV	60	0	I:	MedMinMaxDvStW	01:00	01:00	
	mV	Linear							300	30,00	II:	MedMinMaxDvStW	24:00	24:00	
133	Analogue signal			Conc-gas CH4	ppm	00:01:00	00:05:00	60+300mV	60	300	I:	MedMinMaxDvStW	01:00	01:00	
	mV	Linear							300	10000	II:	MedMinMaxDvStW	24:00	24:00	
134	Analogue signal			Conc-gas COV	ppm	00:01:00	00:05:00	60+300mV	60	0	I:	MedMinMaxDvStW	01:00	01:00	
	mV	Linear							300	500	II:	MedMinMaxDvStW	24:00	24:00	
135	Thermistor Campbell			Temperature	°C	00:01:00	00:00:00	-50+50°C			I:	MedMinMaxDvStW	01:00	01:00	
	Ohm	HMP45CF									II:	MedMinMaxDvStW	24:00	24:00	
136	SerialHydrolab			Temperature	°C	00:01:00	00:00:00	-5+50 °C			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
137	SerialHydrolab			pH	unit	00:01:00	00:00:00	0÷14 unit			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
138	SerialeHydrolab			SALINity	ppt	00:01:00	00:00:00	0÷70 ppt			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
139	SerialHydrolab			DEPTH	m	00:01:00	00:00:00	Sensor			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
140	SerialHydrolab			CONDUctance	mS/cm	00:01:00	00:00:00	0÷100 mS/cm			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
141	SerialHydrolab			TURBIdity	NTU	00:01:00	00:00:00	Sensor			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
142	SerialHydrolab			AMMONium	mg/l-N	00:01:00	00:00:00	0÷100 mg/l-N			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
143	SerialHydrolab			NITRaTe	mg/l-N	00:01:00	00:00:00	0÷100 mg/l-N			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
144	SerialHydrolab			CHLORide	mg/l	00:01:00	00:00:00	0,5÷18000 mg/l			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
145	SerialHydrolab			CHLORophyll	ug/l	00:01:00	00:00:00	0,02÷ 150 ug/l			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
146	SerialHydrolab			DissOXYGen	mg/L	00:01:00	00:00:00	0÷50 mg/L			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
147	SerialHydrolab			ORP Redox	mv	00:01:00	00:00:00	-999+999 mv			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	
148	SerialHydrolab			TOTalDissolvedGas	mmHg	00:01:00	00:00:00	200+1400mmHg			I:	MedMinMaxDvStW	01:00	01:00	
	Hydrolab	Linear									II:	MedMinMaxDvStW	24:00	24:00	

13.1.1. DERIVATED QUANTITIES (codes from 151 to 198)

i: Operating code which includes functions described below.
ii: Calculated derived quantity and applicable standards. Description and Opcode of primary quantities required for calculation.
iii: Extended text and unit of measurement appearing on the printer and, in abbreviated form, on the display.
iv: Sensor acquisition interval and time in advance that sensor power is turned on prior to acquisition (in hours:minutes:seconds).
v: Measurement field.
vi: Linear engineering, or input values and corresponding output values.
vii: Types of report, timing basis, final portions of timing used (in hours:minutes).
viii: Types of events.

NB: Use of these codes will prevent them from being deleted once the purpose for which they were entered is no longer valid. To delete them, at least one of the inputs used by the Opcode must be deleted from the instrument and then entered again.

i	ii			iii		v	vi		vii				viii
Op. Code	Derivate quantity description Need quantities (primary or standard)			Text Description	Unit	Range	In-Out Input	Output	Elaborations NO	Type	Time	Used	Event Type
151	Psychrometry relative humidity			RelHMIdity	%	0..100%			I:	AveMinMaxStDvW	01:00	01:00	
	Environ.temp. *	Wet bulb 002,004,006,008	Atmosh.press. Stand.Quantities						II:	AveMinMaxStDvW	24:00	24:00	
152	Dew point			TeDewPoint	°C	-50 + 70 °C			I:	AveMinMaxStDvW	01:00	01:00	
	Environ.temp. *	Wet temp. 002,004,006,008	Atmosh.press Stand.Quantities						II:	AveMinMaxStDvW	24:00	24:00	
153	Mean radiant temperature ISO7726			TeMeanRadiant	°C	-50 + 70 °C			I:	AveMinMaxStDvW	01:00	01:00	
	Globe temp. 010,011,017,018	Environ.temp. *	Air speed 035, 098, 106						II:	AveMinMaxStDvW	24:00	24:00	
154	Partial vapour pressure			PressPartVapor.	hPa	0 1000 hPa			I:	AveMinMaxStDvW	01:00	01:00	
	Environ.temp. *	RelHUMidity 031, 032 (***)	Atmosh.press. Stand.Quantities						II:	AveMinMaxStDvW	24:00	24:00	
155	Planar asymetry ISO7726			TeAsymRadPln	°C	-50 + 70 °C			I:	AveMinMaxStDvW	01:00	01:00	
	Net radiation 049	Inter.probe.temp 029, 030	Environ.Temp. *						II:	AveMinMaxStDvW	24:00	24:00	
156	Planar average radiant temperaure ISO7726			TeMeanRadPln.	°C	-50 + 70 °C			I:	AveMinMaxStDvW	01:00	01:00	
	Net radiation 049	Inter.probe.temp 029, 030	Environ.Temp. *						II:	AveMinMaxStDvW	24:00	24:00	
157	Wall temperature 1 ISO7726			TeWall1	°C	-50 + 70 °C			I:	AveMinMaxStDvW	01:00	01:00	
	Net radiation 049	Inter.probe.temp 029, 030	Environ.Temp. *						II:	AveMinMaxStDvW	24:00	24:00	
158	Wall temperature 2 ISO7726			TeWall2	°C	-50 + 70 °C			I:	AveMinMaxStDvW	01:00	01:00	
	Net radiation 049	Inter.probe.temp 029, 030	Environ.Temp. *						II:	AveMinMaxStDvW	24:00	24:00	
159	Air speed with Pitot tube			VelAIRabsolute	m/s	0 +109 m/s	0 109	0 109	I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	Diff. pressure 037, 038, 039	Environ.Temp. *	Gravity,Patm Stand.Quantities										
160	Impulse counter into acquisition rate			CouNTeRPartial	No	0/999999	0 999999	0 999999	I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	Frequency 100												

i	ii			iii		v	vi		vii				viii
Op. Code	Derivate quantity description Need quantities (primary or standard)			Text Description	Unit	Range	In-Out Input	Output	Elaborations NO	Type	Time	Used	Event Type
161	Impulse counter from beging survey/reset statistic			CouNTeRTotal	No	0/999999	0	0	I:	AveMinMaxStDvW	01:00	01:00	
	Frequency 100						999999	999999	II:	AveMinMaxStDvW	24:00	24:00	
162	Wind direction			DirWIND	Sect. °<	Wind 0 / 360			I: II:	EOLO3 EOLO4	01:00 24:00	01:00 24:00	
	Wind angle 034, 036	Wind speed 035, 097											
163	Sunshine duration			SunSHINE		>125 W/m^2			I: II:	TotMinute TotMinute	01:00 24:00	01:00 24:00	
	Direct radiation 050, 051	Threshold sunsh Stand.Quantities											
164	Dew point			TeDewPoint	°C	-50 + 70 °C			I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	Environ.Temp. *	RelHUMidity 031, 032											
165	Wind direction2			DirWIND2	Sect. °<	Wind 0 / 360 °			I: II:	EOLO3 EOLO4	01:00 24:00	01:00 24:00	
	Wind angle 034, 036	Wind speed 035, 097	Atmosph. press.										
168	Air Delivery Vol.			AirDELiveryVol	m^3/s.				I: II:	EOLO3 EOLO4	01:00 24:00	01:00 24:00	
	Wind speed 35,98,106,107,159	Pipes dimension Standard quant.											
169	Delivery Mass			AirDELiveryMas	kg/s.				I: II:	EOLO3 EOLO4	01:00 24:00	01:00 24:00	
	Wind speed 35,98,106,107,159	Air Temp. *	Pipes dimension Standard quant.										
175	Wind Chill Index			WindChillIndex	W/m^2				I: II:	MedMinMaxDvStW MedMinMaxDvStW	01:00 24:00	01:00 24:00	
	Wind speed 35, 40, 97, 98, 101	106,107,130	Air Temp *										
176	Temperature Chilling			TempCHilling	°C				I: II:	MedMinMaxDvStW MedMinMaxDvStW	01:00 24:00	01:00 24:00	
	Wind speed 35, 40, 97, 98, 101	106,107,130	Air Temp *										
177	Evaporation			EVAPOration	mm	0/ 184,2 mm Set ->	0 184,2 h top up	0 184,2 h top up	I: II:	TotW TotW	01:00 24:00	01:00 24:00	
	Pan level 060, 062, 063												
178	PRODuct			PRODuct					I: II:	MedMinMaxDvStW MedMinMaxDvStW	01:00 24:00	01:00 24:00	
	between 2 inputs **	primary or derived	Input N° X Input N°										
179	MEAN1			Text and Unit Programmable		Range selected Opcodee			I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	3 selectable Opcodee	primary or derivates	from input No to input No										
180	MEAN2			Text and Unit Programmable		Range selected Opcodee			I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	3 selectable Opcodee	primary or derivates	from input No to input No										

I	ii			iii		v	vi		vii				viii
Op. Code	Calculated derived quantity Description and Opcode of primary and standard quantities required for calculation			Text on printer Description	U.M.	Measurement field	Engineering Input	Output	Elaborations No	Type	Time	Used	Event Type
181	DELTA1			Text and Unit Programmable		Range selected Opcodee			I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	2 selectable Opcodee	primary or derivates	Input No?? minus Input No ???										
182	DELTA2			Text and Unit Programmable		Range selected Opcodee			I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	2 selectable Opcodee	primary or derivates	Input No?? minus Input No ???										
183	DELTA3			Text and Unit Programmable		Range selected Opcodee			I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	2 selectable Opcodee	primary or derivative	Input No ?? minus Input No ???										
184	Absolute humidity			ABSoluteHumid	g/m^3				I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	Ambient temp. *	RelHUMidity 031, 032 (***)	Atm. pressure Standard quant.										
185	Specific humidity			SPECificHumid	g/kg				I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	Ambient temp. *	RelHUMidity 031, 032 (***)	Atm. pressure Standard quant.										
186	Mix Factor (Ratio)			MixFACTor	g/kg				I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	Ambient temp. *	RelHUMidity 031, 032 (***)	Atm. pressure Standard quant.										
187	Enthalpy of humid air			ENTHALpy	kJ/kg				I: II:	AveMinMaxStDvW AveMinMaxStDvW	01:00 24:00	01:00 24:00	
	Ambient temp. *	RelHUMidity 031, 032 (***)	Atm. pressure Standard quant.										
188	Wind run			WINDRun	km				I: II:	TotF TotF	01:00 24:00	01:00 24:00	
	Wind speed 035, 040, 097,101	98,106,107											
189	Energy			ENERGY	kJ/ m^2				I: II:	TotF TotF	01:00 24:00	01:00 24:00	
	Radiation 047,048,049,050,	051,052,054,056,	057,058,059,061										
194	Indice UV			IndiceUV					I: II:	MedMinMaxDvStW MedMinMaxDvStW	01:00 24:00	01:00 24:00	
	Radiaz.UVA 057, 058	Radiaz.UVB 059											
195	Livello di esposizione UV			LivelESposUV					I: II:	MedMinMaxDvStW MedMinMaxDvStW	01:00 24:00	01:00 24:00	
	Indice UV 194												
196	Indice di Calore			IndiceCALore	C°				I: II:	MedMinMaxDvStW MedMinMaxDvStW	01:00 24:00	01:00 24:00	
	Temp.ambiente *	UmidRELativa 031, 032 (***)	Pressione atm. Gr.standard										
197	Disagio da calore			DISAGcalore					I: II:	MedMinMaxDvStW MedMinMaxDvStW	01:00 24:00	01:00 24:00	
	IndiceCALore 196												

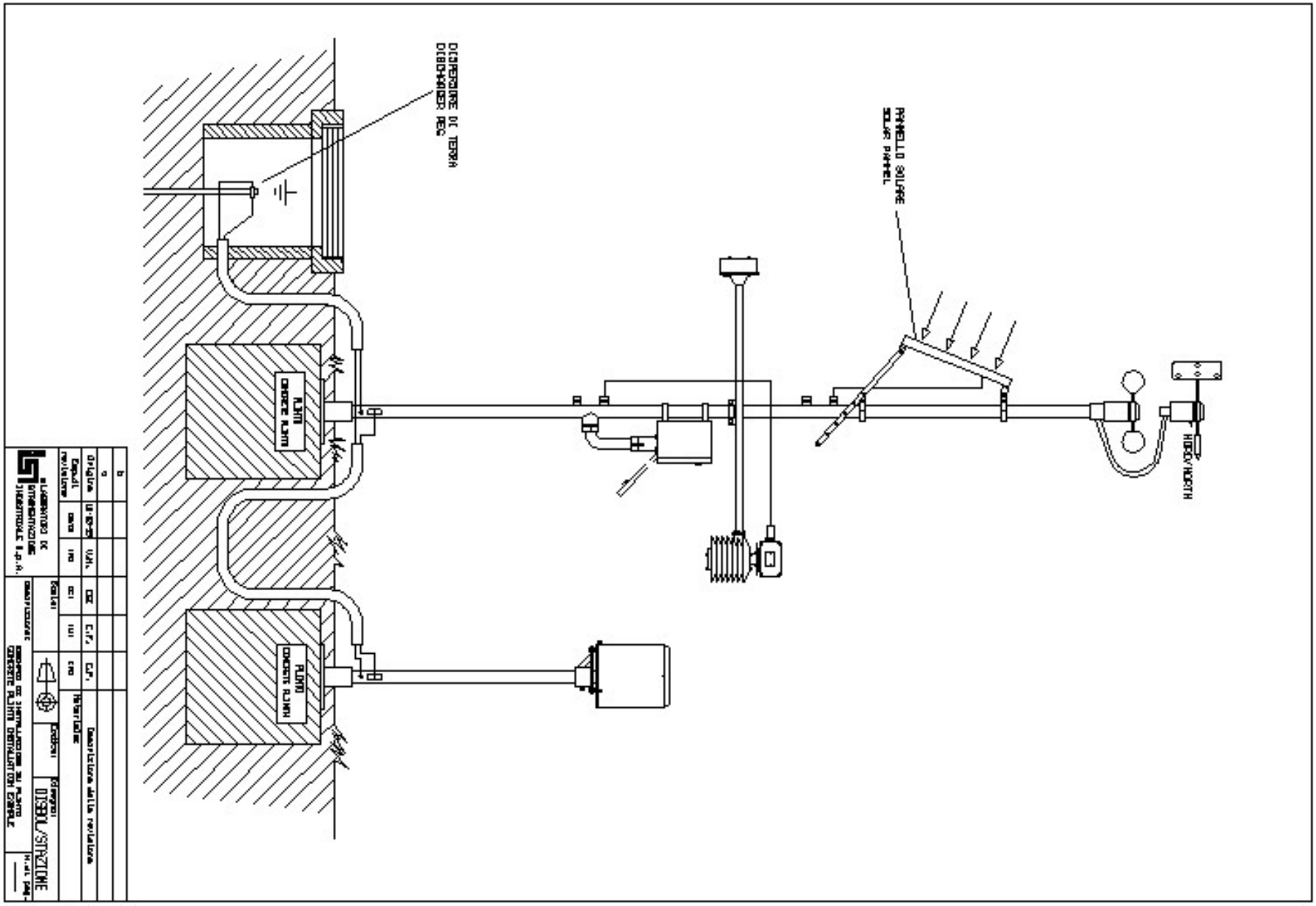
(*) Operative codes good to acuire environmental temperature: (001, 003, 005, 007, 009, 014, 021, 023, 025, 029, 077, 114, 115, 135).

(**) Operative codes may be different provide they are of the same physical type.

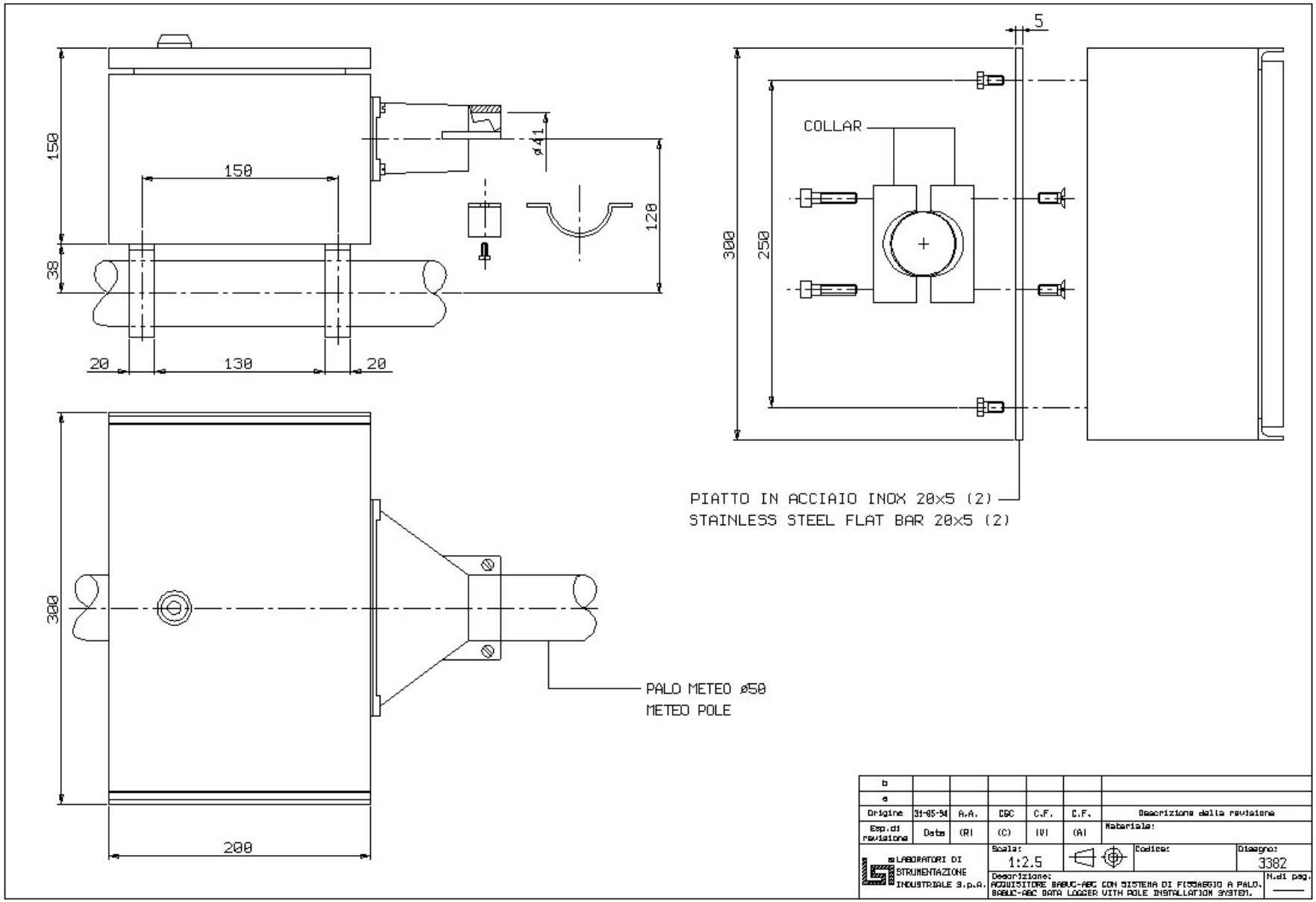
(***) If there is no relative humidity probe, psychrometric probes may be used; the algorithm will recognise operating codes for wet bulb forced ventilation temperatures (002, 004, 006, 008) and use them to calculate relative humidity.

14. Drawings and schemes

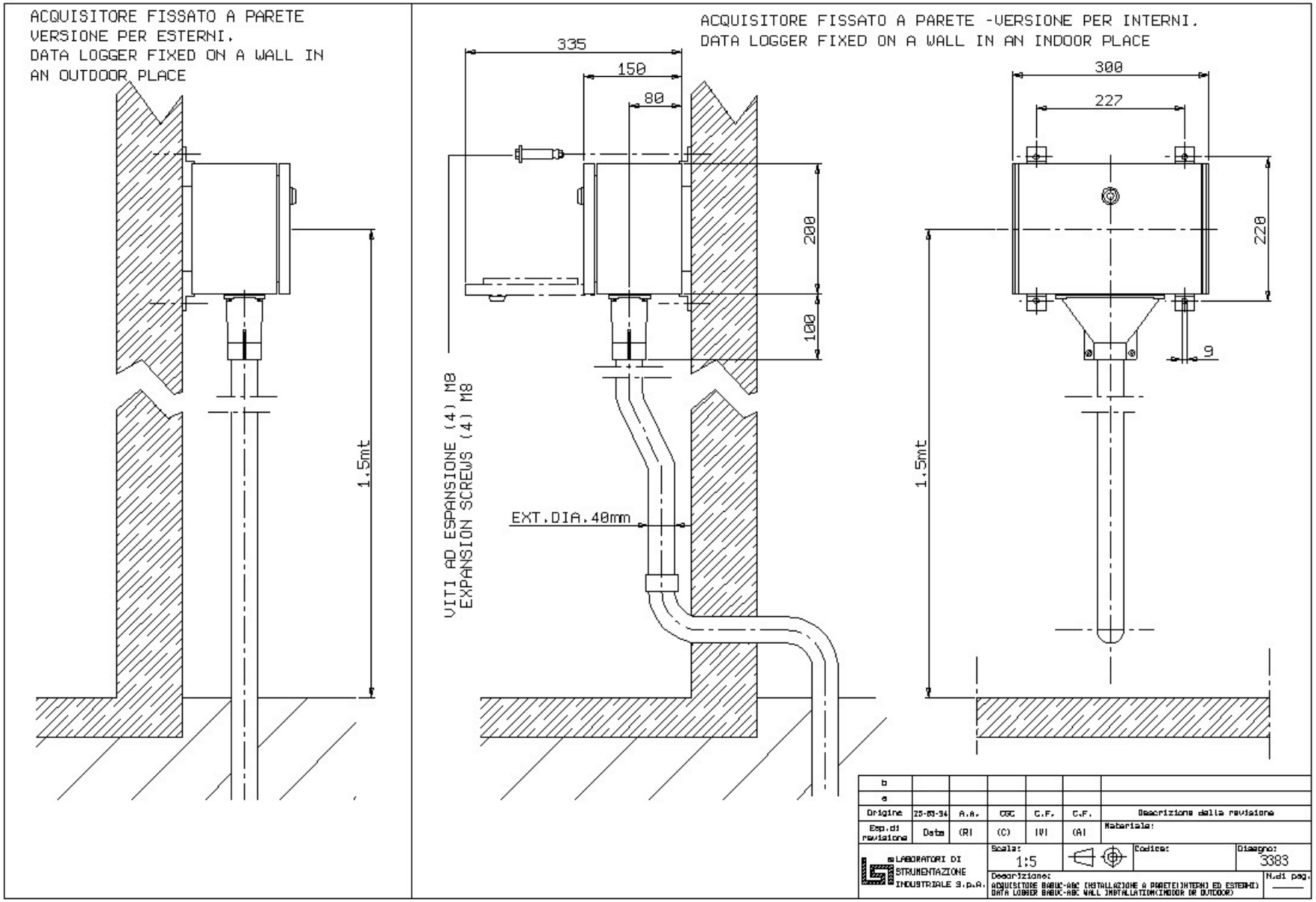
14.1. Installation with plinth



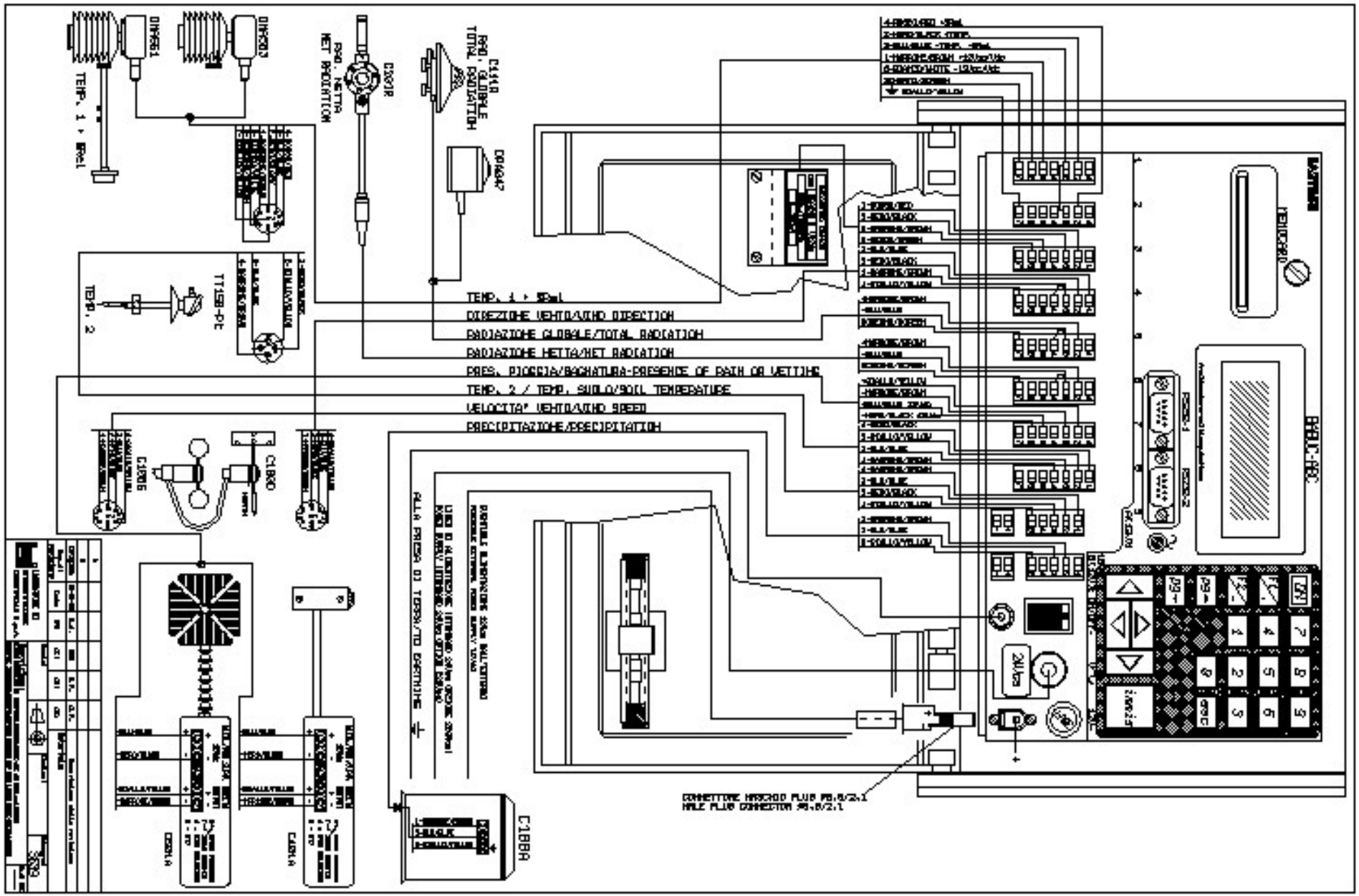
14.2. Pole installation system



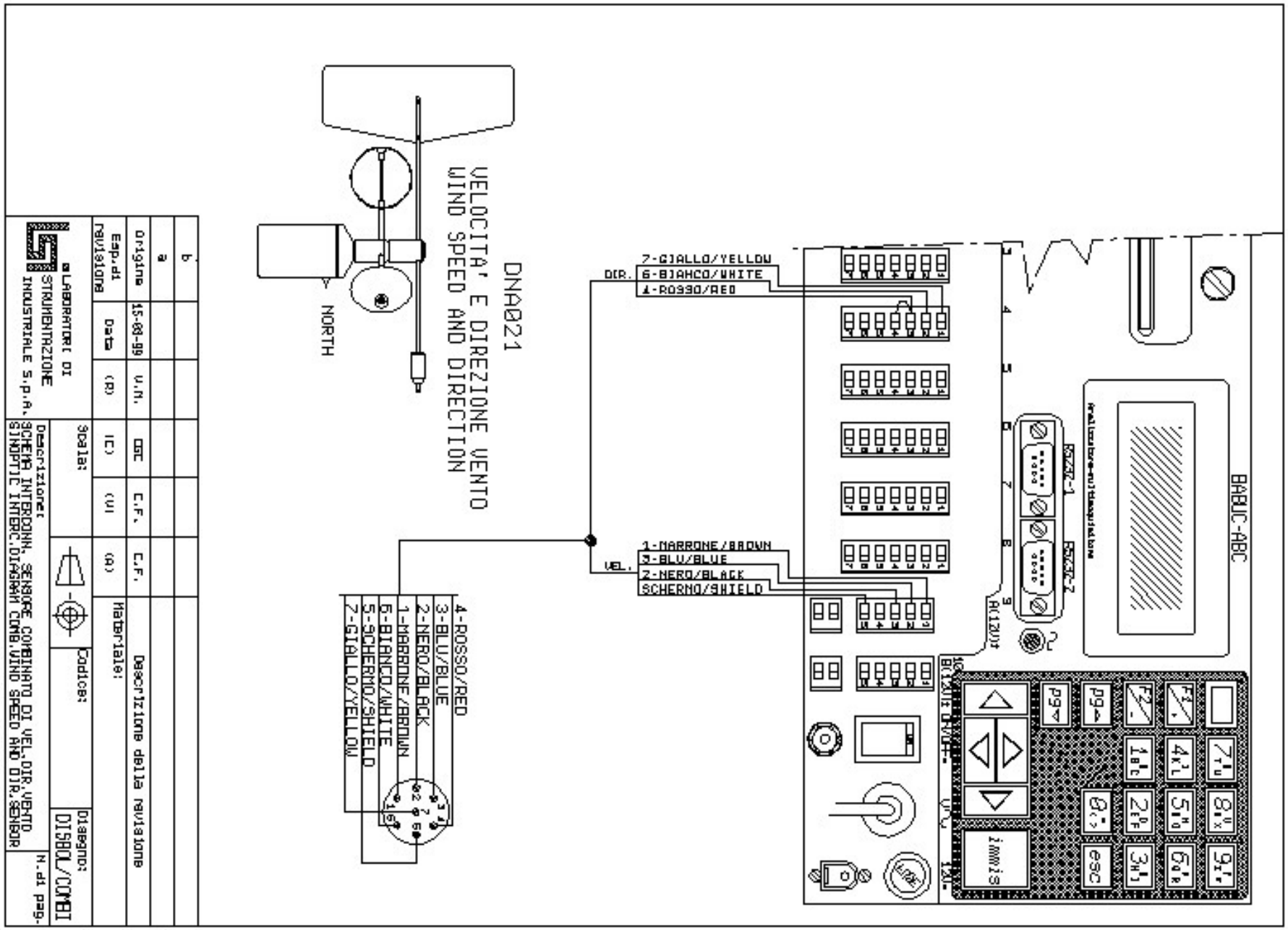
14.3. Wall installation



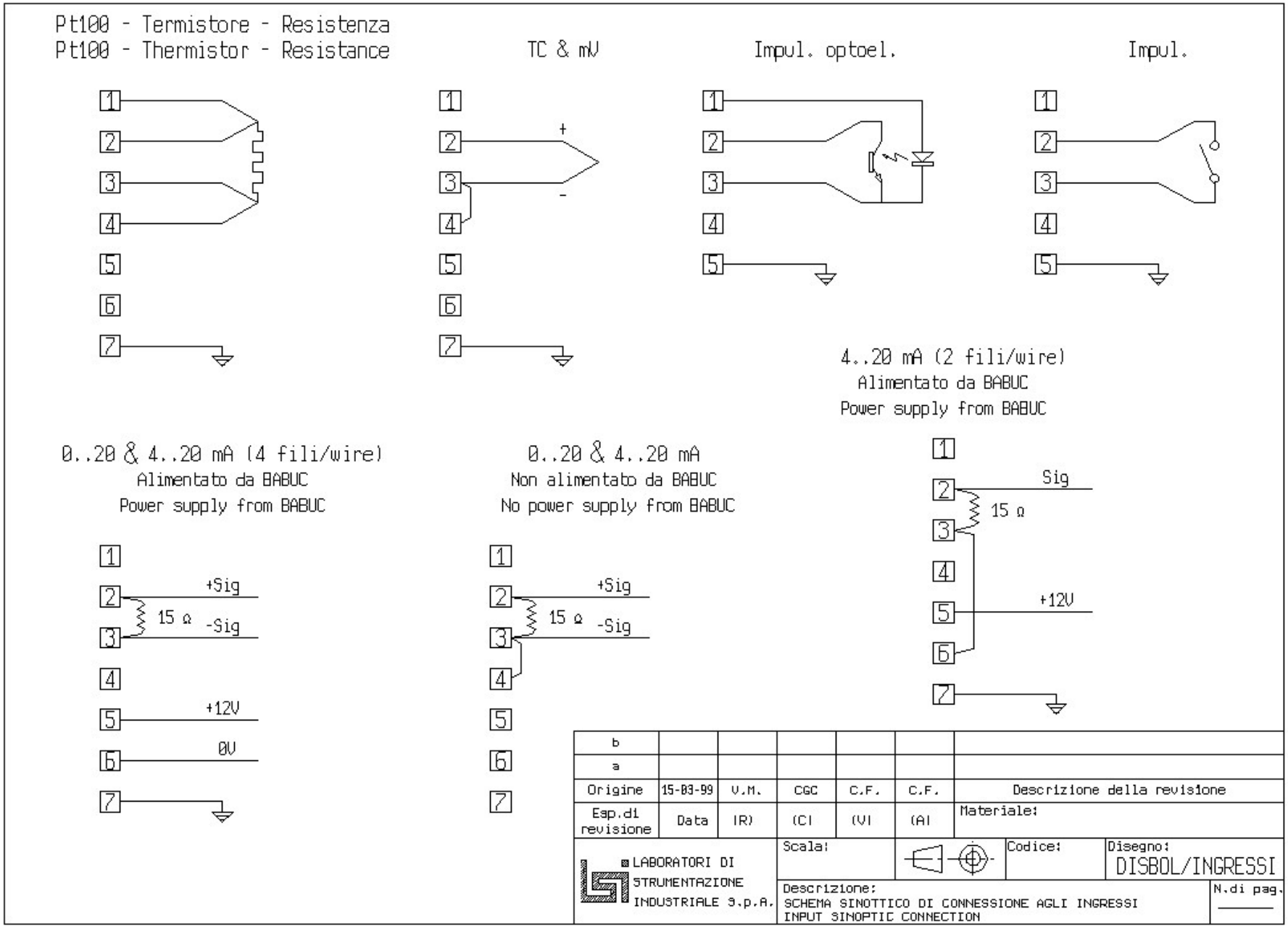
14.4. General connection scheme



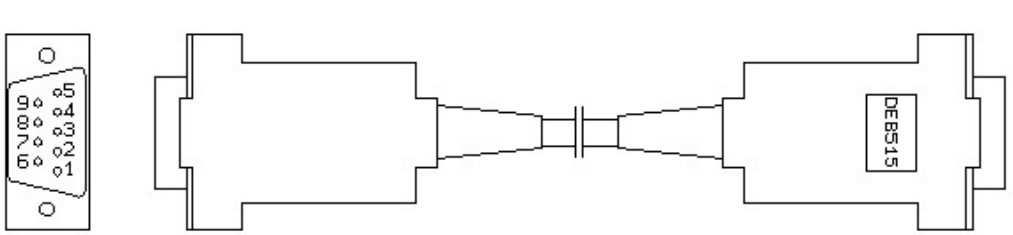
14.5. Connection scheme for combined probe DNA021



14.6. Input connections



14.7. Connection scheme for PC/Babuc ABC 9/9 cable



CAVO/CABLE MN1072
L-5mt

2	BLU/BLUE
3	MARRONE/BROWN
5	NERO/BLACK

2	MARRONE/BROWN
3	BLU/BLUE
5	NERO/BLACK

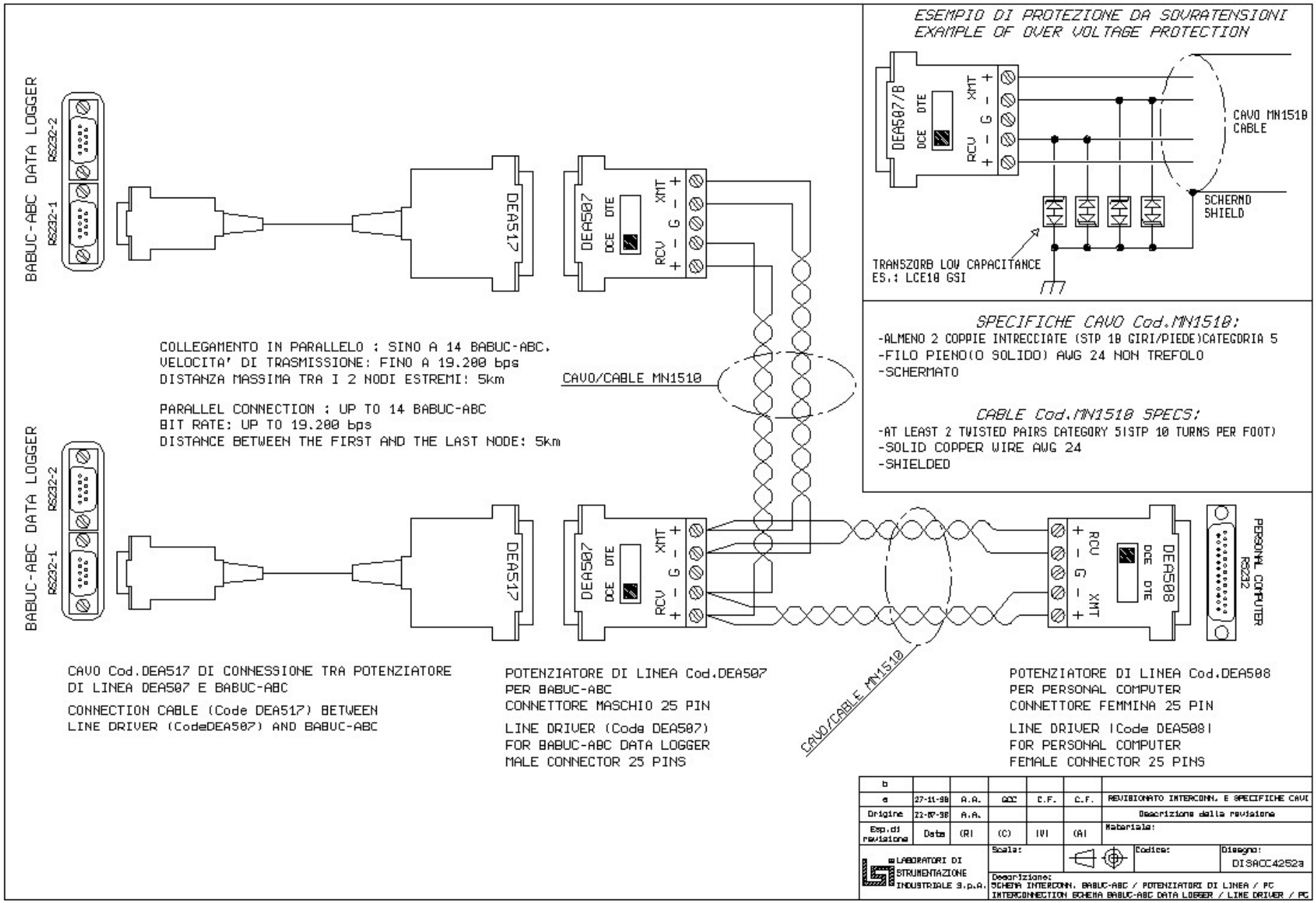
CONNETTORE FEMMINA MG2058
FEMALE CONNECTOR MG2058

CONNETTORE MASCHIO MG2059
MALE CONNECTOR MG2059

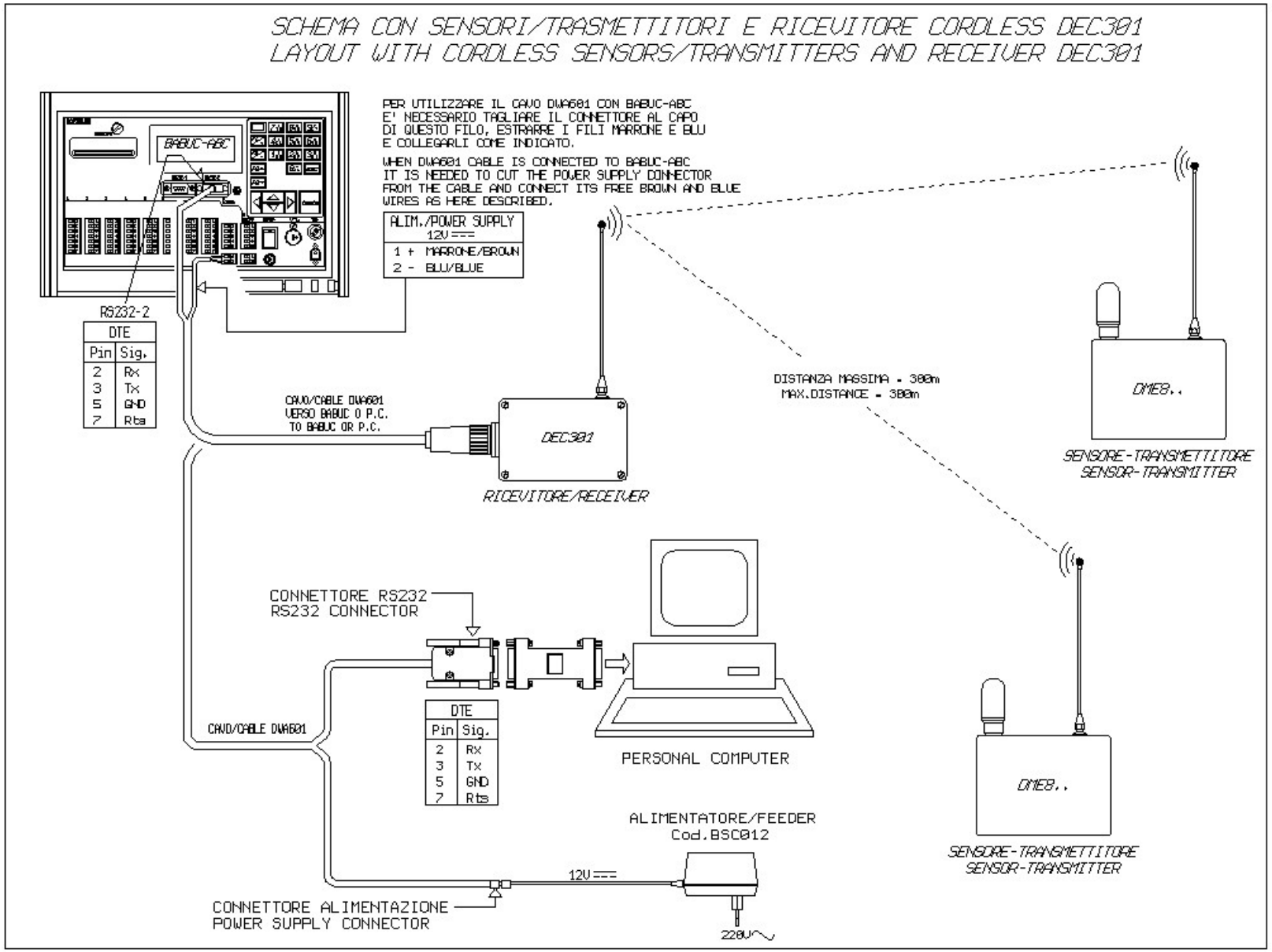
b						
a						
Origine	12-03-99	V.M.	CGC	C.F.	C.F.	Descrizione della revisione
Esp.di revisione	Data	IRI	(C)	(V)	IAI	Materiale:

LABORATORI DI STRUMENTAZIONE INDUSTRIALE S.p.A.	Scala:	Codice:	Disegno: DISBOL/DEB515
	Descrizione: SCHEMA CAVO SERIALE PC/BABUC-ABC 9/9 SERIAL CABLE PC/BABUC-ABC 9/9		N.di pag.

14.8. Connection schema with line driver



14.9. Connection schema with cordless adapters



14.10. Connection schema with RS485 devices