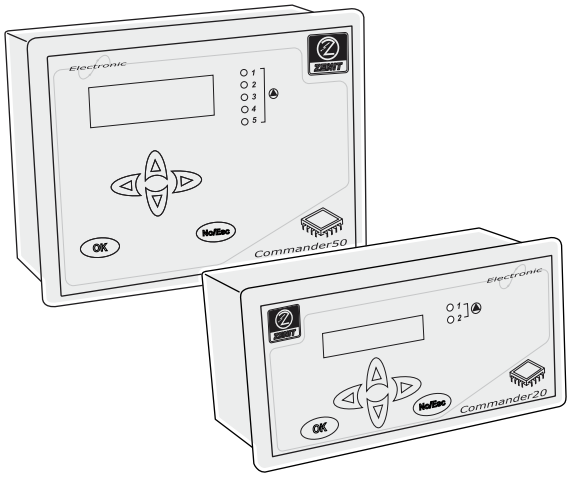
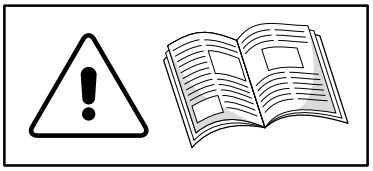
A TSURUMI PUMP COMPANY

Commander 50
Commander 20

Remote monitoring unit for managing of pumping stations and data recording





Use and maintenance manual

Graphic symbols adopted in the manual:

This symbol indicates instructions concerning risks of electric shocks

This symbol indicates instructions concerning the operators' safety

1. MANUFACTURER AND APPLIANCE IDENTIFICATION

Company: Zenit s.r.l.
Via Dell'Industria, 15
41018 S.Cesario sul Panaro (MO) - Italy

Appliance: *Commander20 / Commander50*

Power supply: 230V / 50-60Hz

Description: Remote control ECU for remote management of systems with up to 2 / 5 electric pumps

2. REFERENCE LEGISLATION

Conducted emissions ……..*Test method and limits:*
EN 61000-6-4 (2002/10)
Irradiated emissions :……. *Test method and limits:*
EN 61000-6-4 (2002/10)
Immunity to electrostatic discharges (ESD):……..*Reference:* CEI EN 61000-4-2 (1996/09)
Applicable standard: EN 61000-6-2 (2000/02)
RF-Irradiated immunity:……*Reference:* CEI EN 61000-4-3 (1997/11)
Applicable standard: EN 61000-6-2 (2000/02)
EFT-Burst immunity :.. *Reference:* CEI EN 61000-4-4 (1996/09)
Applicable standard: EN 61000-6-2 (2000/02)
Surge immunity:……..*Reference:* CEI EN 61000-4-5 (1997/06)
Applicable standard: EN 61000-6-2 (2000/02)
Immunity to conducted RF interference: ……..*Reference:* CEI EN 61000-4-6 (1997/11)
Applicable standard: EN 61000-6-2 (2000/02)
50Hz magnetic field immunity:……*Reference:* CEI EN 61000-4-8 (1997/06)
Applicable standard: EN 61000-6-2 (2000/02)
Power quality failure (PQF) immunity:……..*Reference:* CEI EN 61000-4-11 (1997/06)
Applicable standard: EN 61000-6-2 (2000/02)
Harmonic emissions:……*Test methods and limits:*
CEI EN 61000-3-2 (2002/04)
Voltage flicker emissions:……*Test methods and limits:*
CEI EN 61000-3-3 (1997/06)
Electrical safety: CEI EN 61010-1 (2001/11); EN 61010-1/A2
"Safety instructions for electrical appliances for measurement and control purposes and for laboratory use"

NOTE: *Please note that the contents of this manual refer, unless otherwise specified, to both the Commander 20 model and the Commander 50 model.*

DICHIARAZIONE DI CONFORMITÀ CE

EC STATEMENT OF COMPLIANCE
DECLARATION DE CONFORMITE CE
EG-KONFORMITÄTSERKLÄRUNG

Fabbricante: **ZENIT s.r.l**
(Producer/Producteur/Hersteller)
Indirizzo: Via dell'Industria, 15 I - 41018 S. Cesario sul Panaro (MO) - Italy
(Address/Adresse/Anschrift)

Dichiara che l'apparecchiatura:
Hereby states that the device known as:
Déclare que l'appareil :
Erklärt, daß das nachfolgend aufgeführte Gerät :

MODELLO : **COMMANDER 20**
(MODEL/MODEL/MODELL)

È conforme alle seguenti direttive CE:
73/23CE, 89/336CE, 92/31CE, 93/68CE,
come modificate e recepite dalla legislazione italiana
The machinery meets the requirements set by the following EEC Directives:
Directives 73/23EC, 89/336EC, 92/31CE, 93/68CE, as amended and implemented under Italian law
L'appareil est conforme aux Directives CE suivantes:
Directive 73/23EC, 89/336EC, 92/31CE, 93/68CE, telle que modifiée et accueillie formellement par la législation italienne.
Im entspricht das Gerät den folgenden EG-Richtlinien:
EG Richtlinie 73/23EC, 89/336EC, 92/31CE, 93/68CE, wie von der italienischen Rechtsprechung modifiziert und aufgefaßt

Sono state applicate le seguenti Norme Nazionali, che traspongono le Norme Armonizzate CE:
The following national standards and technical specifications, conforming to EEC Harmonized Regulations, were followed:
Les normes nationales transposant les normes harmonisées CE qui ont été appliquées sont les suivantes:
Folgende nationale Normen wurden angewandt, die den vereinheitlichten EG-Normen entsprechen:
EN 61000-6-4 (2002/10), EN 61000-6-2 (2002/02), EN 55011 (1999/05)
CEI EN 61000-3-2 (2002/04), CEI EN 61000-3-3 (1977/06), EN 61010-1 (2001/11)

S. Cesario sul Panaro (MO), 30 novembre 2003

CE

Firmato:
Davide Bottan
(amministratore Zenit s.r.l)

DICHIARAZIONE DI CONFORMITÀ CE

EC STATEMENT OF COMPLIANCE
DECLARATION DE CONFORMITE CE
EG-KONFORMITÄTSERKLÄRUNG

Fabbricante: **ZENIT s.r.l**
(Producer/Producteur/Hersteller)
Indirizzo: Via dell'Industria, 15 I - 41018 S. Cesario sul Panaro (MO) - Italy
(Address/Adresse/Anschrift)

Dichiara che l'apparecchiatura:
Hereby states that the device known as:
Déclare que l'appareil :
Erklärt, daß das nachfolgend aufgeführte Gerät :

MODELLO : **COMMANDER 50**
(MODEL/MODEL/MODELL)

È conforme alle seguenti direttive CE:
73/23CE, 89/336CE, 92/31CE, 93/68CE,
come modificate e recepite dalla legislazione italiana
The machinery meets the requirements set by the following EEC Directives:
Directives 73/23EC, 89/336EC, 92/31CE, 93/68CE, as amended and implemented under Italian law
L'appareil est conforme aux Directives CE suivantes:
Directive 73/23EC, 89/336EC, 92/31CE, 93/68CE, telle que modifiée et accueillie formellement par la législation italienne.
Im entspricht das Gerät den folgenden EG-Richtlinien:
EG Richtlinie 73/23EC, 89/336EC, 92/31CE, 93/68CE, wie von der italienischen Rechtsprechung modifiziert und aufgefaßt

Sono state applicate le seguenti Norme Nazionali, che traspongono le Norme Armonizzate CE:
The following national standards and technical specifications, conforming to EEC Harmonized Regulations, were followed:
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EN 61000-6-4 (2002/10), EN 61000-6-2 (2002/02), EN 55011 (1999/05)
CEI EN 61000-3-2 (2002/04), CEI EN 61000-3-3 (1977/06), EN 61010-1 (2001/11)

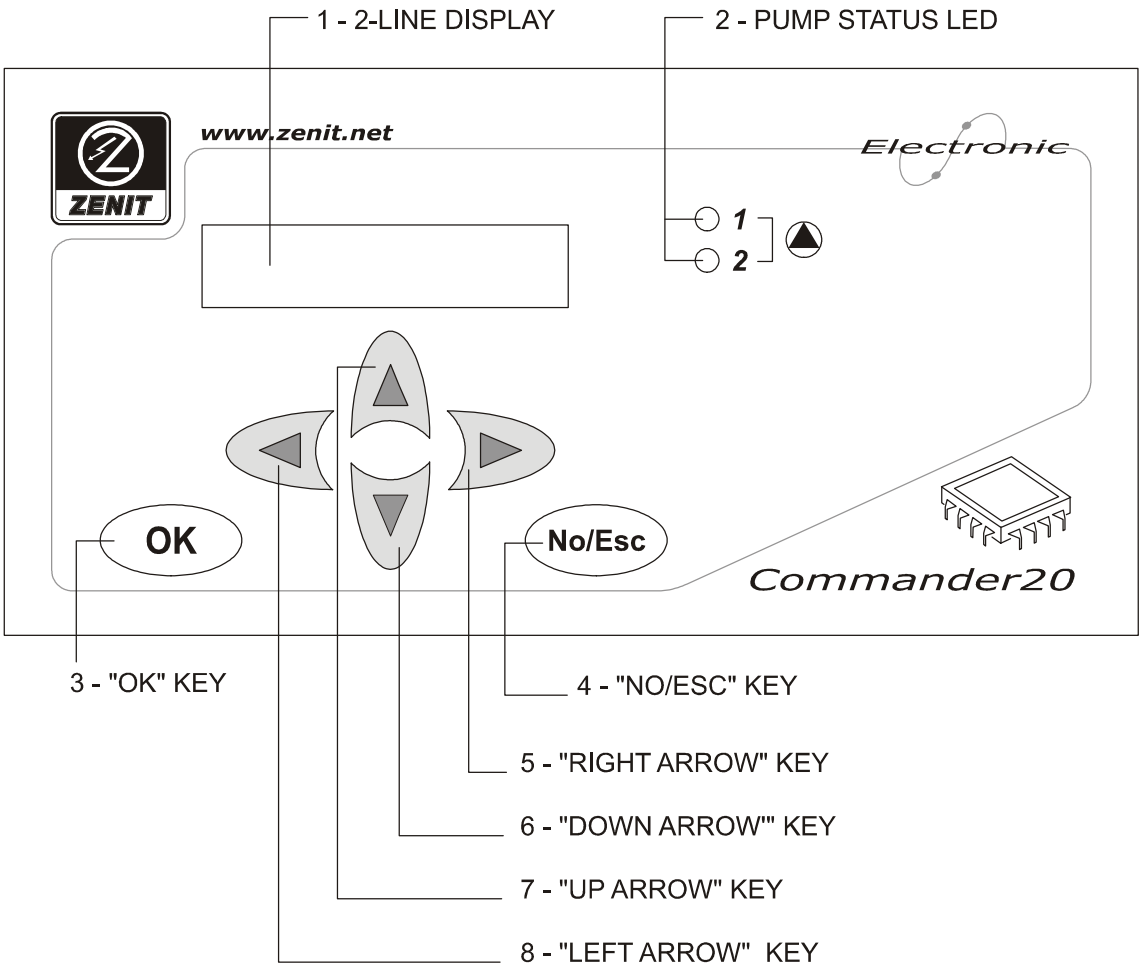
S. Cesario sul Panaro (MO), 30 novembre 2003

CE

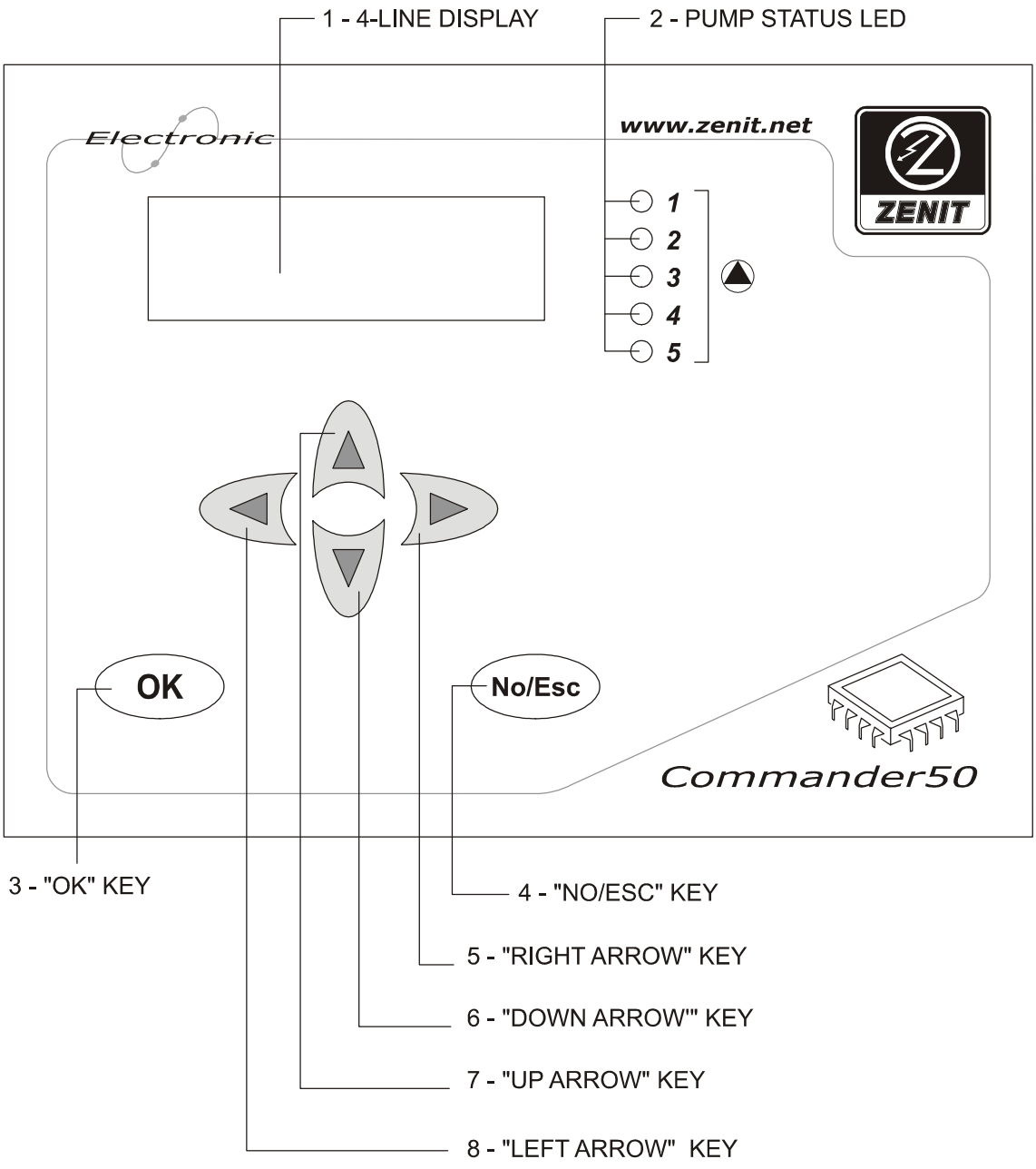
Firmato:
Davide Bottan
(amministratore Zenit s.r.l)

3. CONTROLS IDENTIFICATION

Commander20

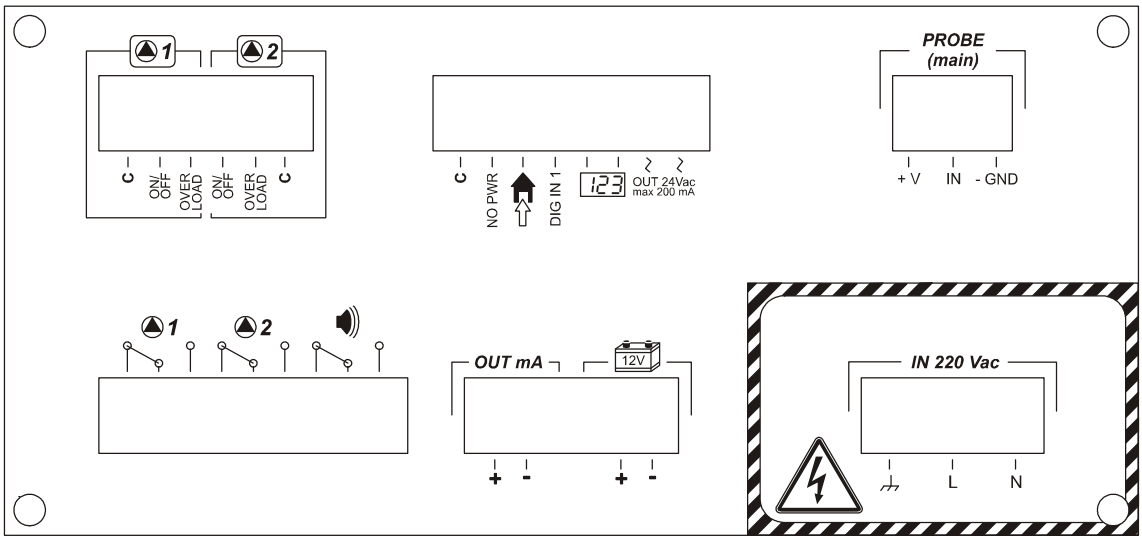


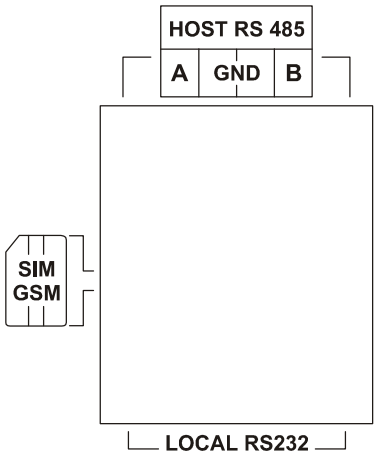
Commander50



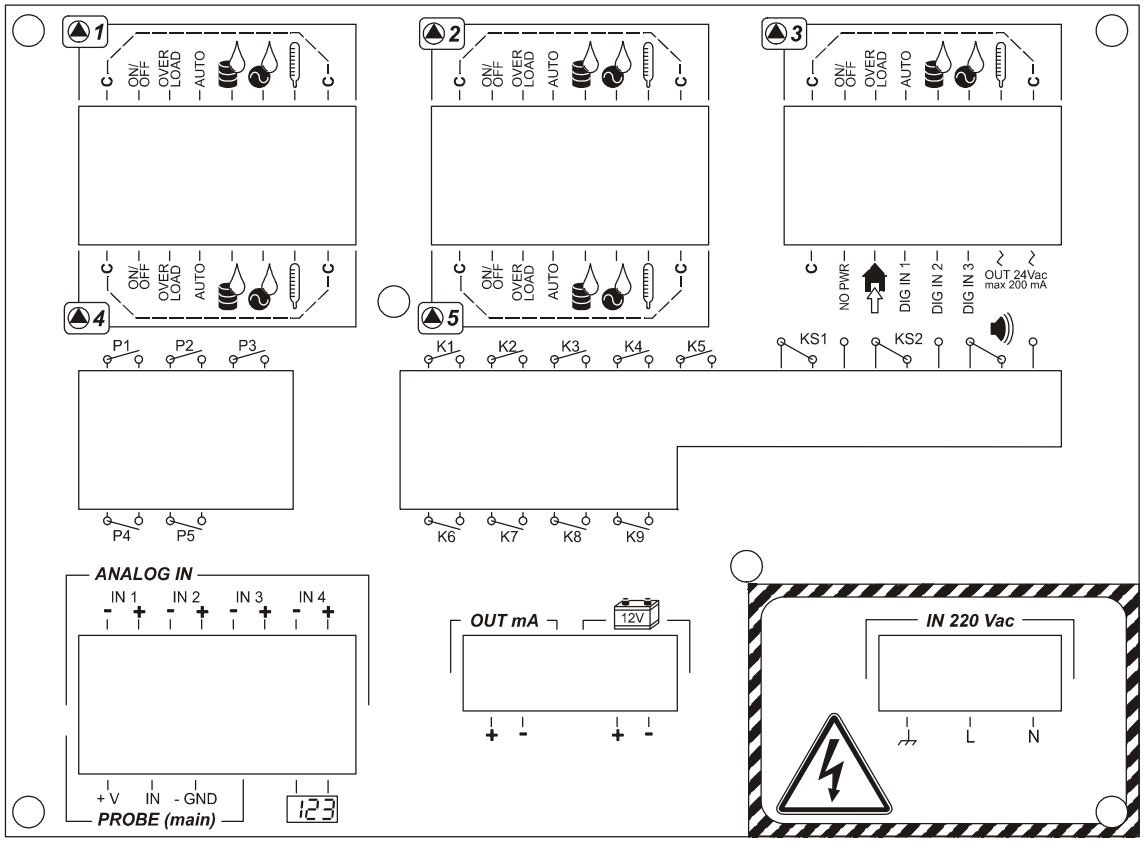
4. REAR AND LATERAL PANEL

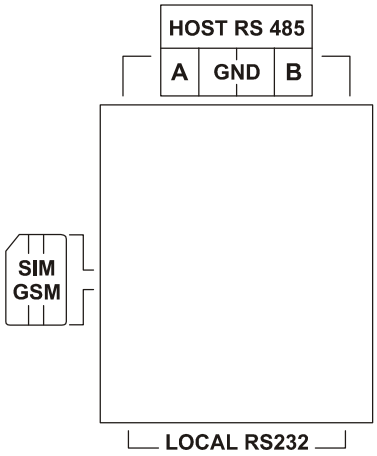
Commander20



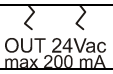
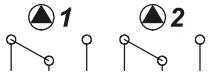
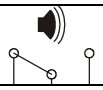
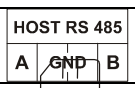


Commander50





5. DESCRIPTION OF THE SYMBOLS USED

SYMBOL	DESCRIPTION
	Pump number; This goes from 1 to 2 for the *Commander20* model and from 1 to 5 for the *Commander50*
C	General
ON/OFF	Photo-coupled digital input (24VAC/dc; max 15mA) indicating pump status (on/off)
OVERLOAD	Photo-coupled digital input (24VAC/dc; max 15mA) indicating electrical panel overload
AUTO	Photo-coupled digital input (24VAC/dc; max 15mA) indicating when the panel selector switch is set to automatic (*COMMANDER50* ONLY)
	Photo-coupled digital input (24VAC/dc; max 15mA) indicating the presence of water in the oil (*COMMANDER50* ONLY)
	Photo-coupled digital input (24VAC/dc; max 15mA) indicating the presence of water in the terminal board (*COMMANDER50* ONLY)
	Photo-coupled digital input (24VAC/dc; max 15mA) indicating high pump pressure (*COMMANDER50* ONLY)
NO PWR	Photo-coupled digital input (24VAC/dc; max 15mA) indicating power supply failure
	Photo-coupled digital input (24VAC/dc; max 15mA) indicating intrusion (e.g. the panel has been opened, if equipped with relative sensor)
DIG IN 1	Photo-coupled digital input (24VAC/dc; max 15mA) indicating the SUPERMAXIMUM level has been reached (if configured)
DIG IN 2	Photo-coupled digital input (24VAC/dc; max 15mA) indicates the SUPERMINIMUM level has been reached (if configured) (*COMMANDER50* ONLY)
DIG IN 3	Photo-coupled digital input (24VAC/dc; max 15mA) indicates timing failure (if configured) (*COMMANDER50* ONLY)
	Separate power output (24VAC; 200mA) for digital input power supply
	N.C./N.O. exchange relay for pump control in *Commander20* (max load: 1A; 230VAC resistive); programmable via SW
P1 ... P5	ON/OFF relay for pump control in *Commander50* (max. load 1A, 230VAC resistive); programmable via SW
K1 ... K9	Auxiliary ON/OFF relays (max. load 1A; 230VAC resistive); programmable via SW and used for analogue inputs (*COMMANDER50* ONLY)
KS1, KS2	Auxiliary N.C./N.O. exchange relays (max. load 1A; 230VAC resistive); programmable via SW (*COMMANDER50* ONLY)
	N.C./N.O. exchange relay (max. load 1A; 230VAC resistive); for the alarm (cumulative) and configurable via SW
ANALOGUE IN IN 1 IN 2 IN 3 IN 4 - + - + - + - +	Auxiliary analogue inputs, 0/4-20mA, galvanically separated (1.5kV); programmable via SW, with programmable activation threshold option (*COMMANDER50* ONLY)
PROBE (main) + V IN - GND	Analogue input for level measurement, 0/4-20mA, galvanically separated (1.5kV), with probe power supply option (out 24VDC; 50mA) for passive sensors
	Photo-coupled digital input (24VAC/dc; max 15mA); Programmable and resettable surge counter, via SW, for any transducer with surge output (e.g. flow rate measurement)
OUT mA	Analogue output, 0/4-20mA (max. load 750O) proportional to primary level measurement with ranges programmable via SW
	Battery input (for 1 rechargeable 12VDC battery; 1.2A for backup and text message transmission in the event of a power cut)
IN 220 VAC L N	ECU power supply (230V; 50/60hz)
	Host serial output RS485
	GSM (Optional) Telìt dual band (900-1800Mhz; RF power peak: 2W (+33dBm) on 50 O); SIM card compatible with GSM Stage 2, 11.14; 3V SIM card (mobile phone type)
LOCAL RS232	RS232 local serial output for connection and local data download

6. SAFETY WARNINGS

6.1. General information

HAZARD: In the event of any kind of emergency in the area where the instrument is installed, turn off the power supply immediately to disconnect the system and unplug the instrument from the power mains.

Any operation in the electrical connection area must be carried out with the instrument disconnected from the power mains.

WARNING: Install the instrument so that it is easily accessible any time maintenance operations are required! Never obstruct the area where the instrument is located!

If you install the instrument in non-EC member countries, you must comply with the local safety regulations.

The system in which the instrument is to be installed must be designed by qualified professionals, taking into account that the connected devices and the substances that the appliance may handle or batch may be hazardous.

The instrument's manufacturer cannot be held responsible for personal injuries or damages to things due to improper installation or incorrect use.

The service and maintenance of the instrument and its accessories must always be performed by qualified personnel

When the instrument is switched on, it signals, for 5 minutes and with visual and sound means, when the connected devices are about to start up so that the operator has time to deactivate them, if desired.

In the event of a power cut, the instrument turns off and, when the power supply is restored, it will resume operation

6.2. Ambient and power supply requirements

- Operating room temperature: 0 ÷ 65 °C
- Power supply: 0 ÷ 230 V, 50/60 Hz

Suitable circuits stabilizers ensure measurement accuracy for variations of up to ±10%. If slow data loggers have been fitted in addition to the analyser, they must be powered and earthed following the instructions given by the manufacturer and punched on the rear of the panel

- Absorbed power: 11 W

6.3. Electric panel

To ensure the measurement reliability remains unaltered over time, we recommend you install the electric panel, containing the ECU, in a place that meets the ambient requirements specified. We also recommend you keep the instrument away from high voltage or power wires, from digital circuits, counters without suitable radiofrequency screens to protect them, and live "switching" electronic circuits.

To obtain an IP65 protection degree also in the programming stage, proceed as follows:

- Use a panel with an IP65 protection degree or above, must be large enough to house the instrument (Commander20: 198x102x85 mm – Commander50: 198x150x85)
- Cut a hole in the panel measuring 186 x 90 mm for the Commander20 and 186x138 mm for the Commander50
- Fit the instrument into the hole so that it is flush with the frame
- Apply the fastening brackets, supplied with the instrument, fitting them into the holes on the container provided and screw in the two tie-rods fully, checking that the front seal is stuck fast to the panel's surface.

In the event that the instrument is installed outdoors, use watertight containers. In addition, we recommend you protect these containers from the rain and sun with roof structures

6.4. Earthing

Even though you have followed all the mechanical installation instructions, **it is still absolutely essential to earth the instruments' metal frame** both to ensure the appliances' correct operation and for accident prevention and safety reasons. To do this, you will need to use the terminal marked with the earth symbol on the rear panel. Connect both the earth wire from the panel and the other earth wires from the various electric motors fitted in the system as well as those from the reaction tanks (if metal), to the said terminal. In exceptional circumstances, despite the fact that the entire system has been earthed, you may still encounter electrical interferences which, detected by the sensor, alter the measurements. In this case, you must also earth the liquid by submerging an earthed metal plate in the tank using a normal plaited cable with rubber insulation.

Do not use the neutral as an earth terminal

WARNING

- **All the control relays are certified for use in appliances where the short circuiting of the connected devices is limited by fuses with lower ratings than the relay's**
- **All the instrument connection and disconnection operations must be carried out when the instrument is switched off**

6.5. Electric pumps

Even if used correctly, the product is subject to the residual risks typical of all systems connected to the power mains: **RISK OF ELECTRIC SHOCK**

6.5.1. Safety regulations for installation and maintenance operations

To perform maintenance operations safely, always follow the procedure below:

- Operations involving the replacement or repair of mechanical parts and/or electrical components must be carried out by skilled personnel
- Stop the electric pump and close the intake and outlet shutters
- Check that the pump is disconnected from the power mains. To disconnect the electric pump from the mains, disconnect first the phase leads and then the yellow-green earth lead
- If the electric pump is submerged, remove it from the tank
- If the electric pump has been in use, wait until its external temperature falls below 50°C
- Replace broken or worn parts with original spares only

If in doubt, consult the manufacturer before performing any repair or replacement operations.
Since the pumps may be used in wells and septic tanks which may contain poisonous GASES, observe the following precautions:

- NEVER work alone when performing maintenance operations
- VENTILATE the well before starting any work
- safety ropes must be attached to anyone lowered down into a well, and suitable means must be provided to allow a swift return to the surface if necessary

Keep out of children's reach! The product is not suitable for unskilled or inexpert people.
Do NOT put your hands or objects near or into the intake port or grating or into the outlet port on the side.

Do NOT install the pumps in WELLS, TANKS or OTHER ENVIRONMENTS where GAS may be present: RISK OF EXPLOSION (explosion-proof versions marked with the symbol -EX are excluded).

Do not allow the loose ends of the power cables to come into contact with any liquid, including the pumped liquid.

6.5.2. Personal Protection Devices (DPI) to be used

When handling the product, especially if already installed, always wear the following items of protective clothing: accident-prevention shoes, safety goggles, accident-prevention gloves and a leather apron or a similar type of protection.

Every time maintenance or repair operations are performed on electric pumps already installed, particularly those which are immersed in dangerous liquids or septic tanks, all parts must be thoroughly cleaned and washed with water or specific products.

6.5.3. Automatic system restart

In the event that the operator forgets to reactivate the "RUN" mode after the "PROGRAMMING" stage, the system uses the following automatic restart procedure in order to avoid standstills. This procedure has been designed in compliance with the safety regulations governing automatic start-ups.

Automatic restart procedure:
If you need to access the “PROGRAMMING” mode, press both the “UP ARROW” and “DOWN ARROW” keys at the same time but, before the system stops (i.e. when it is still in the “RUN” mode), you will read the following prompt:
AUTOMATIC RESTART?
there is no default reply, so you will have to choose between the **“OK”** and **“NO/ESC”** options; you will be then allowed to access the “PROGRAMMING” mode.
If you press OK and no ECU buttons are pressed during the next 5 minutes, the following message will appear on the display:
ATTENTION! START!
This message is displayed for a further 5 minutes, during which an intermittent acoustic signal sounds. When the 5-minute warning time has elapsed, the system restarts, switching to the “RUN” mode fully automatically.
If no reply is given within 5 minutes following the prompt, the display automatically switches to the “RUN” mode. It must be underlined that, in this case, the system has never stopped.

7. MACHINE DESCRIPTION

The Commander20 and ***Commander50*** are microprocessor-controlled devices capable of managing systems including a maximum of 2 or 5 pumps.
For user-friendly operation, a menu guides the user through the setting stages for the various functions.
This system allows the user to manage, in full safety, the machines' operation and optimise maintenance, thanks to the ongoing monitoring of the major system data.
To facilitate the setting data entry and for remote system management purposes, a PC programme called *"Commander Software"* is available.
The features offered by the ***Commander*** can be divided into the following areas:
- system management
- alarm and malfunction management
- **data storage**

The system management **functions are**:
- o Tank filling or draining, depending on the level signal transmitted by a probe and on the start and stop thresholds set by the user
- o Managing a set of pumps which operate alternately (alternating cycle) according to the number of starts or the maximum ongoing operation time
- o Max. number of pumps operating
- o Start-up delay
- o Continuous or discontinuous operating mode (S1/S3/S9)
- o Emergency pump to replace any faulty pump
- o Operating time occasionally extended to a secondary threshold set by the user for tank cleaning purposes
- o Periodic start-up in the event of lengthy stops, to prevent the pump from jamming

The alarm and **malfunction management functions** are:
- o General alarms (power cut, intrusion or signals from auxiliary logging channels)
- o Pump alarms or malfunctions with deactivation of the pump in alarm condition
- o Management of superminimum and supermaximum start thresholds in relation to the max number of pumps permitted
- o Management of high and low level emergency floats

If the device includes the (optional) GSM module, a text message can be sent to the user's mobile telephone to alert him/her about the malfunction detected by the system.

The **data storage** functions are:
- o Total operation time and number of start-ups per pump
- o Recording of data from the auxiliary channels
- o Calculation and recording of the intake and outlet flow rates

In addition to these, the system offers test and manual operation functions.

The tests and the menus on the display can be viewed in any of the languages available (*Commander50*: 3 languages; *Commander20*: 4 languages), which can be selected by the user, as desired.

7.1. Filling and draining the tank

The cycle must be set by the user, selecting one of the following functions:
- **Draining**: (default setting) the ECU activates the pumps as the level rises and deactivates them as it falls. The pumps ensure the tank is drained;
- **Filling**: the cycle is inverted with respect to the previous one. The pumps ensure the tanks are filled.

For each of the 5 pumps that can be controlled, the user must set whether the pump is available and belongs to the alternating group or not.
If the pump does not belong to the alternating group, two thresholds, called "high level" and "low level" must be set. The high threshold must be considerably higher than the low threshold. These thresholds determine the way in which the pump is turned on and off.

More precisely:

Cycle	Threshold	ECU behaviour
Draining	*High (above threshold)*	*Pump switches on*
	Low (below threshold)	*Pump switches off*
Filling	*Low (below threshold)*	*Pump switches on*
	High (above threshold)	*Pump switches off*

If there are several pumps with different thresholds, they will be turned on or off individually, according to the threshold set. In any case, in the event of simultaneous or close starts due to similar thresholds, the start-up delay and the maximum number of pumps allowed to operate at once will be respected.
The thresholds can be set, with a resolution of one centimetre, in a range between 0.00 and 99.99 (99 metres and 99 centimetres).
The thresholds can only be modified when the pump is off, to prevent unexpected activation or deactivation.
In the event that a pump fails to start or stops due to a malfunction before the OFF threshold is exceeded, the ECU deactivates the pump concerned, sets off the alarms and activates the emergency pump, if provided (see further on).

7.2. Set of pumps that operate alternately (alternating cycle)

One or more pumps can be assigned to the alternating group. The pumps assigned to this group start up automatically and cyclically when a pre-set threshold is reached. In this case, this will be a group threshold and not an individual pump's threshold. Each pump will use this threshold, in turns and cyclically. Every time the pump is switched on, the following pump then begins its cycle.
The user must specify the number of pumps in the alternating group (from 1 to 5) and identify them.
The maximum number of threshold pairs that can be set for the alternating group shall be equal to the number of pumps belonging the same group. These pairs of thresholds indicate, in succession, the activation and deactivation levels for the pumps in the group.

7.2.1. Alternation for extended operation time

During the alternating group's standard operation, one or more pumps could remain on for considerably long periods due to an occasional high intake flow rate, which would prevent reaching the deactivation threshold.
Therefore, in this case, even if the system ensures that all the pumps are started following the same time intervals, their operating times would not be homogeneous.
To solve this problem, you can set a maximum, continuous operating time (called "maximum alternating time"), which will be the same for all the pumps in the group. After this time has elapsed, one of the pumps in the group (which must be off and not experiencing malfunctions) is started up, IF AVAILABLE. The pump which has reached the maximum time limit is stopped.
This time can be set to a range from 15 to 240 minutes, in 15-minute steps.

7.2.2. Alarm / malfunction management and consequent actions

If a pump in the alternating group does not start up within the time set, the pump in the group set for the following shift will be started (in the event of a temporary malfunction). In the event of a serious breakdown involving the pump's failure, the emergency pump P5 will be started *(see section 7.6 Emergency pump)*, and the faulty pump will be excluded from the group. At the same time, the alarm management function will be activated *(see section 7.9 Alarm management).*
If the pump stops due to a malfunction before the deactivation threshold is reached, the ECU disables it and manages the alarms accordingly. The level of the fluid must be compared with the last activation threshold. If an additional pump is required, the next pump in the shift cycle will be started.

7.3. Maximum number of pumps in operation

The user can set the maximum number of pumps that can operate simultaneously (regardless of the maximum number of pumps that can operate alternately).
To establish the maximum number of active pumps, there are two different operating pump parameters (which are not related to each other): one for the individual pumps *"MXS"* and one for the pumps in the alternating group *"MXG"*.

7.4. Start-up delay

A delay (of 0-99 seconds and shared by all pumps) can be set between one pump's start and the next.
This delay time is applied whenever several pumps have to be started at the same time or within a very short space of time, including emergency starts.
In the unfortunate case that identical high and low levels have been set, in order to protect the pumps from a continuous overload condition due to the level oscillation around a single threshold (and therefore to prevent an excessively intermittent pump operation), there will be a natural delay due to the level data logging. In addition, the maximum number of start-ups settable for each pump will help prevent the above conditions.

7.5. Continuous or discontinuous operation (S1 / S3 / S9)

The ECU is programmed to manage the pumps in the continuous operating mode "S1". However, the individual pumps can be set to operate in discontinuous mode "S3" by specifying the operation percentage, or to operate in discontinuous mode "S9" by specifying the activation and deactivation times.
These partialising procedures can only be activated in the draining mode and for the individual pumps (not for pumps belonging to the alternating group).
You must set a threshold below which the pumps will operate in partial mode. This threshold must be higher than the deactivation threshold and can be higher than the start-up threshold, in which case you must indicate that the pumps shall operate on a "partial time" basis.
If a pump is configured to operate in discontinuous mode "S3", you must specify the operation percentage selecting from the following rates: 15%, 25%, 40% and 60%. The ECU will operate the pump on a partial time basis, alternating activation time periods with deactivation time periods for a total time of 10 minutes. The activation time period is determined by the percentage set.

Example

A pump programmed to operate in the S3 mode at 25% will run for 2.5 minutes, after which it will remain off (regardless, however, of the fluid levels) for a period of 7.5 minutes (10 min. – 2.5 min. activation). At the end of the 7.5 minutes, it will start up again for 2.5 minutes, and so on until the stop level is reached.

A pump configured in the S9 mode will operate in the same way as in the S3 mode, but in this case the user must specify the duration of the individual activation and deactivation periods.
The operating time and the standstill time must be set to a range between 1 and 99 minutes. The total sum of the two times must not be lower than 10 minutes, to prevent an excessively high rate of starts per hour.
The user must then specify one (and only) partialisation threshold, which must be lower than the pump trigger threshold, below which discontinuous operation is started. The continuous mode "S1" is only resumed once the pump trigger threshold is exceeded (higher than the partialisation threshold).

7.6. Emergency pump (*COMMANDER50* ONLY)

Only pump P5 can be configured to operate as an emergency pump. In this case, the ECU does not request the operating thresholds since, in the event of a pump failure (causing its permanent stoppage), pump P5 replaces it, automatically acquiring its operating thresholds and all its configuration parameters, regardless of whether it operates individually or as part of a group.

7.7. Occasional extended operation

In order to reduce sedimentation on the bottom of the tank, the user can set the last pump (or pumps) so that its/their operating time is extended. This is done by postponing the pre-set deactivation threshold between the filling or draining cycles, at regular intervals. When this function is enabled, the user must set the auxiliary stop threshold, the number of cycles which must run between one operating extension and the next, and which pump or pumps are enabled to perform the said function.

7.8. Periodic start

The ECU can be programmed to start the pumps periodically for a short period, in order to prevent them jamming and/or to dispose of floating waste (regardless of the configuration selected for each pump). The operating time can be set individually for each pump, within a range of 1-15 seconds. The start-up intervals can be set independently for each pump within a range of 1 to 10 weeks. The time interval countdown starts every time the pump is started.
The periodic start function takes into account the maximum number of pumps that can be started simultaneously and the maximum number of pumps that operate simultaneously within the alternating group.
To prevent the tank from being completely drained, or overflowing during the filing stage, a minimum threshold can be set in the first case and a maximum threshold in the second, which is necessary to run the cycle. This option is not a default setting.

7.9. Alarm management functions

The *Commander* ECU, in addition to controlling the system to prevent situations that may damage the machines installed (e.g., dry pumping, overloads, etc.), is also capable of detecting particular anomalous situations and alert the user with various types of alarms.
If the GSM module is installed, a list of numbers is memorised (maximum 3) to which a text message will be sent notifying the receiver of the alarms; each number can be enabled to receive the pump alarms, general alarms or both.
When a malfunction occurs which is not serious enough to result in the pump deactivation, the corresponding red LED on the ECU flashes; the pump is operating normally and can be switched off (red LED flashing) or on (red/green LED flashing). If, however, a malfunction has caused the pump to stop, the red LED is lit up constantly.
All the alarms are acknowledged individually. When an alarm is triggered, it is memorised and appears on the list of alarms;

7.10. Pump alarms

Each pump can feature the following 7 alarm conditions.
For the following alarm conditions, the user can set the system to either send a text message to the numbers stored or not.
All the alarms will be activated if the condition persists for over 5 seconds.

Alarm	**Description**
Maintenance	*This is activated when the pump has reached the maximum number of operating hours or start-ups set between one maintenance service and the next. However, the pump will still be functioning.*
No start confirmation	*This is activated when the start-up confirmation is not received within the time set (ON/OFF). The pump is switched to failure mode and shut down.*
Thermal overload	*This is activated when the thermal overload switch is triggered* *The pump is switched to failure mode and shut down.*
Water in the sump (*COMMANDER50* ONLY)	*This is activated when the humidity probe detects the presence of water in the sump.* *The pump will still be functioning.*
Water in the motor (*COMMANDER50* ONLY)	*This is activated when the probe (or series of probes) detects the presence of water in the motor. The pump is switched to failure mode and shut down.*
Thermal protection (*COMMANDER50* ONLY)	*This is activated when the motor's thermal protection is triggered.* *This alarm can be set to switch the pump to failure mode and shut it down (default) or to use the pump as soon as normal conditions are restored. Every time this feature is activated, an alarm message must always be sent out.*
Flow rate	*If the flow rate calculation is enabled, a minimum pump flow rate limit can be set within a range of 1 to 9999 l/s, below which the minimum flow rate alarm is triggered. This alarm will cause the pump to stop permanently.*

The overload switch alarm can be set to control the pump stop. If it has been programmed to stop the pump (MANUAL ALARM RESET), the ECU will stop the pump permanently. Its operation can only be resumed if the ECU is reset by an operator. If, instead, it has been programmed not to stop the pump (AUTOMATIC ALARM RESET), the pump will be stopped temporarily and will be restarted once the alarm condition is corrected (automatic reset following thermocouple cooling time).

The emergency pump P5, if provided, would only start operating in the event of a “manual alarm reset”, since (only in this case) the pump would be permanently stopped.
The “water in sump” and “maintenance” alarms do **not** stop the pump's operation.
In addition to the pump alarms and the level alarms (float and thresholds) the ECU also manages the following general alarm conditions.
For each alarm, you can set the general alarm relay activation, along with the activation of an auxiliary output relay (among those available).

Alarm	Description
Probe signal	*This is activated in the event of a level probe failure, regardless of whether the emergency float is activated or not.* *The ECU continues operating if there are emergency floats installed.*
Battery	*This is activated in the event of a low battery charge level.* *The ECU will still operate normally.*
Intrusion	*This is activated in the event that the relative digital input is activated.* *The ECU will still operate normally.*
Analogue threshold exceeded	*This is activated in the event that the threshold set for each auxiliary analogue channel is exceeded (see further on).*
Mains power cut	*This is activated in the event that the relative digital input is activated.* *In this case the ECU sends out the text alarm messages, then switches off.*
Timing failure	*The digital input 3 (DIG IN 3) can be set as a timing failure alarm. In the event of activation of this alarm, the ECU stops the pump operation and sends out the text alarm messages.*
Insufficient credit for text messages	*This is activated in the event that the credit left on the telephone card is not sufficient to send a text message.* *The ECU will still operate normally.*

7.11. Superminimum and supermaximum thresholds

An alarm threshold can be set (using emergency floats) to indicate the superminimum (during the filling cycle) and the supermaximum (in the draining cycle) levels. When either of these thresholds is reached, the system activates the maximum number of pumps that can be started at the same time, selecting those with the highest activation thresholds.
When this threshold is reached, a specific alarm (“level alarm”) is activated.

7.12. Emergency floats

The ECU ***Commander50*** is equipped with two digital inputs (1 and 2) which can be enabled for using high and low level (superminimum and supermaximum) emergency floats, in the event of probe malfunctioning.
To stop the pumps, the user can set the level for the stop float activation.
If this parameter is set in the normal draining and filling cycle ranges, when it goes above or below the set threshold level, the ECU can check the correct operation of the float. In the event that the float malfunctions, the related alarm is activated.
The start float can be configured so that it has priority over the probe signal or so that it starts operating in the event of probe signal failure only (the start float may not be higher than the last threshold, therefore it must be ignored if the probe is operating efficiently).
In the event that the system detects the activation of the emergency float, all the pumps will be activated (subject to the maximum number of pumps that can operate at same time and to the start-up delays). The pumps are stopped when the stop float is activated or after the time limit set by the user has elapsed. The time countdown begins as soon as the start float returns to the resting position (at the top during filling, at the bottom during draining). The time can be set within a range of 0 to 999 seconds, the cycle restarts every time the emergency float intervenes.
The intervention of the emergency float activates a specific alarm included in the general alarms group.
In the ***Commander20*** model, one digital input only can be set: DIG IN 1.

7.13. Pump data recording

The following data are stored for each pump:

- Total operation time
- Operating time since last maintenance service
- Total number of starts (activation)
- Number of starts since last maintenance service
- Last 10 malfunctions with malfunction date and time

The last 10 malfunctions can be located in the following groups:

- Superminimum and supermaximum thresholds exceeded
- Emergency float activation
- Analogue channel threshold exceeded
- Power cut (power supply availability checked through an external panel)
- Timing failure (220 V, DIG IN 3 preset)
- Intrusion
- No GSM network coverage

7.14. Auxiliary analogue and digital channels

For each of the four auxiliary analogue channels the user can set two thresholds, even matching ones, to activate and deactivate one of the auxiliary relays. Furthermore, these thresholds can be linked to the activation and deactivation of an alarm.
For each channel, the user can set the system to record the data for logging purposes, at regular intervals and with different procedures. In addition, the system can be set to record the data transmitted by the internal NTC Thermistor (temperature). The time intervals between one recording and the next can be set individually for each channel within a range of 1 to 99 minutes. The level, flow rate, temperature and analogue input averages are recorded. As far as the level is concerned, the maximum and minimum peaks are also stored. In addition, the pump operation status is recorded.
In the ***Commander20*** model there are no auxiliary analogue channels.

7.15. Flow rate calculation and recording

If the shape and size of the tank are set, the ECU can provide an estimated flow rate based on the level variations over time.
To enable this function, the user must set the following parameters:

- Number of tank sections (from 1 to 8)
- Level and area values (in m^2) for each section
- Flow rate calculation time (from 1 to 255 s)

7.16. System Start/Automatic Restart

In the event that the operator forgets to reactivate the "RUN" mode after the programming stage, the system uses the automatic restart procedure in order to avoid standstills. This procedure has been designed in compliance with the safety regulations governing automatic start-ups. *(see section 6 "SAFETY WARNINGS")*

7.17. Default reset

If you need to reconfigure all the ECU settings, you can perform a general reset. This will help you reprogramme the *Commander*, as you will be sure that none of the system parameters will remain set to the previous values.
The only settings not affected by the general reset are the "COMMUNICATIONS" settings. In fact, the "Type", "Baud rate" and "Address" settings remain the same as they were prior to the reset procedure. This means that the user can keep an eye on the system's information output all the time.

8. COMMUNICATIONS

You can choose from 3 possible types of interface for the communications:
- interface RS 485
- local serial port RS 232
- GSM modem

The local serial port RS 232 is fixed onto the instrument and to access it you need to press both the "DOWN ARROW" and the "ESC" keys at the same time.
The other interfaces, RS 485 and GSM, are interchangeable.

9. "RUN" OPERATING MODE

The "RUN" mode refers to the ECU's **standard operation** mode, in which the system is operating and all the controls and communications are active.
To access the "RUN" operating mode, press "OK" when the ECU switches on (following the 'AUTOMATIC RESTART?' prompt). In this mode, the ECU is active and manages the system's pumps according to the parameters set.

The user can view the major system data by scrolling through various screen pages with the "RIGHT ARROW" and "LEFT ARROW".

10. "PROGRAMMING" OPERATING MODE

The "PROGRAMMING" mode refers to the ECU **programming** mode.
To access the PROGRAMMING operating mode, you need to press the "UP ARROW" and "DOWN ARROW" keys at the same time and confirm by pressing the "OK" or "NO/ESC" key.
In this condition, all the controls and communications are deactivated, the ECU is not active and, therefore, all the pumps are off.

The unit status, as regards its most significant data, is shown by means of a certain number of screen pages which can be scrolled through using the "UP ARROW" and "DOWN ARROW" keys.

11. PROBES

In order to monitor the level of the fluid in the tank, the user can connect various probes to the ECU, depending on the user's needs or the fluid specifications.
The main compatible probe types are the following:

- ultrasound probes: These are located outside the section where the fluid is stored. The sound wave in the air is generally the preferred method because it prevents contact with the fluid and, therefore, does not affect the fluid's density and viscosity. There is, however, the problem of false echoes when the distance between the sensor and the fluid surface is less than 25 cm (dead zone). Surface waves, scum and condensation can also alter the signal. Measurement accuracy increases as the cone's angular aperture decreases.
You must be especially careful about the ambient pressure these sensors are exposed to, as it can alter the reading accuracy considerably.

- Piezoresistive probes: These are located inside the section where the fluid is stored (generally 20 cm from the tank bottom, to prevent them being covered by sediment). They are based on the variations in electric resistivity, a feature typical of certain materials, following a mechanical stress (produced by the pressure of the fluid). They are suitable for fluids with constant density and viscosity levels.

- piezocapacitive probes: These are located inside the section where the fluid is stored (generally 20 cm from the tank bottom, to prevent them being covered by sediment). They are based on the variations in electric capacity (the transducer dielectric constant varies). They are suitable for polluted fluids in environments that are particular exposed to electrical interferences and/or with high temperatures and pressure levels.

12. INSTRUMENTS SUPPORTED

In general, any sensors and/or transducers that monitor the measurable parameters of the fluids (water or suchlike) can be used, for example:

- Level meters
- Flow rate meters
- pH meter
- Oxygen meter
- Density meters

13. DESCRIPTION OF THE "RUN" OPERATING MODE

The "RUN" operating mode refers to the ECU's **standard operating** mode, in which the system is operating and all the controls and communications are active.
To access the "RUN" operating mode, press "OK" when the ECU switches on (following the 'AUTOMATIC RESTART?' prompt). In this mode, the ECU is active and manages the system's pumps according to the parameters set.
The user can view the major system data by scrolling through various screen pages with the "RIGHT ARROW" and "LEFT ARROW".
In the example below the user is scrolling through the menu using the "RIGHT ARROW" key.
NOTE: The display shown is that of the ***Commander50*** model. The display on the ***Commander20*** model shows 2 lines at a time and the data for 2 pumps only.

13.1. SCREEN PAGE 1

Every time you access the RUN mode, i.e. when you wish to start the system, the display looks like this:

```
DD/MM/YY HH:MM:SS
LEVEL(m)=  3.28
xxxxxxxxxx
RS232-DB9
```

the data displayed
on the 1st line are the date and time
on the 2nd line: the current tank level (given in metres).
on the 3rd line: a string set by the user, containing a maximum of 10 characters, (e.g. the system name)
on the 4th line: the type of interface for the communications.

In this latter case, the following options are possible:
1) RS485: when interface RS485 is in use
2) RS232: when the local serial port is in use (9-pole female connector, no further modules are required)
3) GSM: when the GSM modem is in use (the relative module must be installed). In this case you will see, also on the 4th line of the display, the other specifications shown below.
After a reset (unit switched on or RUN mode restarted) the modem is initialised and, if the sequence is completed successfully, the signal level bars appear. When an text message is sent, a blank rectangle appears (which remains displayed for a couple of seconds).
If the initialisation sequence fails, one of the following messages may appear:

- GSM ERR: when a general error occurs (e.g. there is no GSM module)
- GSM SIM: when there is no SIM card
- GSM PUK: when you are using a SIM card with an enabled PIN and access has been attempted and denied three times (in this case, you must remove the SIM card and unlock it with the PUK code)
- GSM PIN: when you are using a SIM card with an enabled PIN and one of the following situations occurs:
  i) The PIN has not been set
  ii) The PIN is set but incorrect
  iii) The PIN is locked

In cases i) and ii), you must set the correct PIN code;
In case iii) you must unlock the PIN. Note that this lock is not caused by the SIM card (in which case you could unlock it with the PUK as mentioned earlier) but by the ECU itself.

13.2. SCREEN PAGE 2

The following screen page contains some of the major data monitored

```
FLOW RATE (l/s)= 0
COUNTER= 0
TEMP(°C)= 24.3
```

On the 1st line: the flow rate in litres/second (l/s)
on the 2nd line: the value reached on the counter
on the 3rd line: the temperature (°C)

13.3. SCREEN PAGE 3

This is the **ALARMS page**

```
ALARM  1/10*
DD/MM/YY HH:MM:SS
xxxxxxxxxxxxxxxx
```

It allows the user to view the last 10 alarms activated, alarm 1 being the most recent; you can scroll through the alarms with the “UP ARROW” and “DOWN ARROW” keys.
If the alarm viewed has not yet been muted, there is an asterisk beside the alarm number. If you press the “OK” button, the alarm is muted (and the asterisk disappears) but the alarm will remain active until the operator intervenes.
The asterisk (*) indicates that this alarm has not been acknowledged yet (in the RUN mode the alarm relay is active). By pressing “OK” when this alarm is displayed, you acknowledge the alarm (operator's intervention) and the alarm relay is de-energised (the asterisk is removed). If the alarm relay remains active, this means there is at least one other alarm to acknowledge. The user is reminded of the non-acknowledged alarm condition if the ECU is turned off then on again (or if you access the PROGRAMMING mode, then restart the RUN mode): If there is even only one alarm active, the alarm relay is activated again. The alarms can be acknowledged also in the PROGRAMMING mode (following the same procedure), with the difference being that all the digital outputs, including the alarm relay, are OFF.

13.4. SCREEN PAGE 4

This is the **PUMP RELAYS** screen page

```
PUMP RELAYS
P1G 0 P4G 1
P2G +0 P5E 0
P3S ^0 MXS=1 MXG=2
```

It shows the status of the pump control relays (0=OFF, 1=ON) and the relative operation modes (G: Group, S: Single pump, E: Emergency).
In the example, pump 3 (configured as a single pump) is faulty(this is indicated by the presence of the "^" symbol and by the corresponding LED lit in red), pump 4 (configured as part of a group) is operating, pump 2 (part of a group) is logically ON but physically OFF (indicated by the presence of the "+") as it is set to run in discontinuous mode (S3 or S9) and is in the OFF stage of the time period.
The “MXS” signal, in the bottom right-hand section, specifies the maximum number of single pumps that can operate simultaneously.
The “MXG” signal, on the other hand, indicates the maximum number of pumps in a group that can operate simultaneously.

13.5. SCREEN PAGE 5

This is screen page concerning the **TOTAL OPERATING TIME** and it refers to all the pumps managed by the ECU

```
OPERATING TIME
P1= 0:00 P4= 2:00
P2= 23:36 P5= 0:00
P3= 0:00
```

This indicates the operation time of each pump, in the “hours:minutes” format, following the last counter reset.

13.6. SCREEN PAGE 6

This is the **OPERATING TIME UNTIL PUMP MAINTENANCE** page and it is accessed from the previous screen page using the “DOWN ARROW” key

```
MAINTENANCE TIME
P1= 0:00 P4= 2:00
P2= 23:36 P5= 0:00
P3= 0:00
```

It shows the length of time remaining for each pump (hours:minutes) since the last time the respective counter was reset and until the next scheduled maintenance procedure.

13.7. SCREEN PAGE 7

This is the **NUMBER OF STARTS** page for each pump

```
STARTS
P1=  0      P4= 6
P2= 86      P5= 0
P3=  0
```

This indicates the number of times each pump has been started since the last time the respective counter was reset.

13.8. SCREEN PAGE 8

This indicates the **NUMBER OF STARTS UNTIL THE NEXT MAINTENANCE SERVICE** for each pump and it can be accessed from the previous screen with the “DOWN ARROW” key

```
MAINTENANCE STARTS
P1=  0      P4= 6
P2= 86      P5= 0
P3=  0
```

This indicates the number of time the pump has been started since the last time the respective counter was reset, until the set maintenance value.

13.9. SCREEN PAGE 9

This is the **AUXILIARY ANALOGUE CHANNELS** screen page

```
CH1 3.80 m      K6=0
CH2 120 mch
CH3
CH4
```

The value, unit of measurement and status of the relay selected for that channel are indicated.
The presence of the value and the unit of measurement indicate that the channel is enabled.
In the example, channel 1 is enabled and manages relay K6 (1=ON, 0=OFF), channel 2 is enabled (no relay is managed); channels 3 and 4 are disabled.

14. DESCRIPTION OF THE "PROGRAMMING" OPERATING MODE

The "PROGRAMMING" mode refers to the ECU programming mode.
To access the "PROGRAMMING" operating mode you need to press both the "UP ARROW" and "DOWN ARROW" keys at the same time and confirm by pressing the "OK" or "NO/ESC" keys (see further on: AUTOMATIC RESTART).
In this status, all the controls and communications are deactivated, the ECU is not active and, therefore, all the pumps remain off.
The unit status, as regards the most significant data, is shown by means of screen pages which the user can scroll through with the cursors.

14.1. AUTOMATIC RESTART

If the "UP ARROW" and "DOWN ARROW" keys are pressed at the same time, the following screen appears

```
AUTOMATIC RESTART?
```

In this condition the system keeps on operating according to the stored settings. The user can answer the prompt in two ways:
"NO/ESC" – the system stops and switches to the PROGRAMMING mode. The system remains still until the operator accesses the RUN mode voluntarily.
"OK" – the system stops and switches to the PROGRAMMING mode. If no keys are pressed in the five minutes that follow, the ECU displays a message, accompanied by a sound signal alerting the user for a further five minutes, after which the system restarts automatically.

```
WARNING
START 5:00
```

The same message is launched when you intend to switch from the PROGRAMMING mode to the RUN mode.

14.2. SCREEN PAGE 1

This is the screen page that appears every time the user accesses the PROGRAMMING mode, i.e. when you wish to access the

```
MENU programming mode
> 1 RUN
  2 SETUP
  3 TEST
  4 ALARMS
  5 CLOCK
  6 COUNTER RESET
  7 PUMP MAINTENANCE
```

The 1st line shows the name of the programming level in question;
The 2nd line contains the symbol ">", which means you are in a menu and that the strings displayed are the options available. To make the selection, position the desired options next to the ">" marker (using the "UP ARROW" and "DOWN ARROW" keys) and press the "RIGHT ARROW" key. To return to the previous menu level, press the "NO/ESC" key.
The first option in the main menu is RUN. This allows you to restart the standard operating mode.

As the number of possible settings is high, a menu hierarchy has been used: the selection of an option can open up a submenu.
The following general rule applies: the ">" symbol on the left of the 2nd line indicates you are within a menu and, in general, the option selected in the menu level above is used as a name for the submenu.
The “2” on the left of the name means it is a 2nd level submenu. In fact, the submenu levels are indicated by a number in the top left-hand corner.

14.3. Setting the parameters

In the majority of cases, a block of (usually linked) parameters is set.
The data can be entered or modified in two ways:

- Selecting from a preset list of options: in this case the values available can be scrolled through with the "UP ARROW"/"DOWN ARROW” keys
- Writing the individual characters: in this case, there is a cursor on the screen and, using the “UP ARROW”/”DOWN ARROW” keys, you can select the character you wish to enter in the position marked by the cursor.

To move on to the next parameter, press “OK”. In the event that you enter a non-admissible character or one that is incompatible with the other parameter values, the “OK” key has no effect (therefore you cannot move on to the next parameter).
To cancel the values entered at any moment, press the “NO/ESC” key (the initial parameter values will be restored).
At the end of the sequence the user is promted for confirmation: if you press “NO/ESC”, you quit the session and the old settings are maintained. if you press “OK”, the new parameter values will be saved.
The value initially displayed for each parameter is always the current one.

14.4. SETUP screen page

By selecting MENU>SETUP, you activate the following menu

```
2 SETUP
> 1 General
   2 Pumps
   3 Level
   4 mA output
   5 Floats
   6 Digital input 3
   7 Analogue channels
   8 Flow rate
   9 COMMUNICATIONS
  10 ALARMS
  11 Set defaults
```

14.4.1. General

By selecting MENU>SETUP>GENERAL, you activate the following options:

```
2.1 GENERAL
> 1 Controller name
2 Operation
3 Recording step
4 Language
5 Password
```

CONTROLLER NAME is a string, containing a maximum of 10 characters, where you define the unit name;
OPERATION is used to set the operating mode: draining or filling;
RECORDING STEP is used to define the recording step: 0, 1, 2, 5, 10, 15, 20 minutes (value 0 disables the recordings);
LANGUAGE is used to select the language (maximum 5 supported languages);
PASSWORD is used to set the password required to access the programming / manual test /counter reset functions. The password is a string containing a maximum of 6 characters. If the string is blank, it is assumed that the password has not been set and all areas can be accessed freely.

14.4.2. Pump settings

By selecting MENU>SETUP>PUMPS you activate the menu with the following options:

```
2.2 PUMPS
> 1 General
  2 P2
  3 P2
  4 P4
  5 P4
  6 P6
  7 Single pumps
  8 Group
```

In the GENERAL menu, you can set the following parameters (shared by all the pumps):

- Start-up delay (from 0 to 99 s): specify the minimum time that must lapse between one pump starting and the next
- Periodic start threshold (from 0 to 99.99 m)
- Threshold for discontinuous operation mode S3/S9 (from 0 to 99.99 m)
- Reset the thermal protection device (manual or automatic)
- Cycles for extended operation (from 0 to 30): this indicates how often (how many cycles) the operating tyme must be extended (value 0 disables this function)
- Auxiliary threshold for the time extension (from 0 to 99.99 m). This threshold is not requested if the number of cycles specified is null (extended operation disabled)

In P1, you can set the operating parameters for pump 1:

- Type of operation: disabled, single, group, emergency (pump 5 only in the *Commander50* model)
- Maximum operating time (from 0 to 999 hours)
- Maximum number of starts (from 0 to 9999)
- Minimum flow rate (from 0 to 9999 l/s)
- Duration of periodic starts (from 0 to 15 s)
- Periodic start-up delay (step) (from 1 to 10 weeks): this indicates time period over which the pump has been inactive since the last start-up
- Start-up confirmation (from 0 to 60 s)
- Operating mode (S1/S3/S9)
- ON stage for S3 mode (15%, 25%, 40%, 60% of the set period of 10 minutes)
- Operating time in S9 mode (from 10 to 100 minutes)
- ON stage for S9 mode (from 1 to (N-1) minutes, where N is the S9 period in minutes)
- Extended operation enabling (YES/NO)
- High threshold (single pump only)
- Low threshold (single pumps only)

In P2, P3, P4, P5 you can set the operating parameters for pumps 2, 3, 4, 5, respectively in the same way as for P1.

NOTES:

- Pump P5 can be configured as the emergency pump
- Operation modes S3/S9 are only available for the single pumps
- The low threshold cannot be set with a value that is greater than the high threshold
- The thresholds (high and low) and the extended operation enable are only requested for the single pumps
- The time extension is performed if a number of cycles (not null) has been set (global extension enable)

In **SINGLE PUMPS** you can set the maximum number of pumps that can operate simultaneously, selecting from a 0 - N range, where N is the maximum number of pumps that can be set as single pumps; the number N appears on the 1st line.

NOTES: if the type of operation of one or more pumps is changed, the max no. of pumps operating at once is reset and, therefore, must be entered again.

In **GROUP** you can set the maximum number of pumps that can operate simultaneously, selecting from a 0 - N range, where N is the maximum number of pumps set for the alternating group; the number N appears on the 1st line. The following additional parameters are requested:

- Maximum operation time (from 15 to 240 minutes, a step of 15 minutes) for the alternation;
- Extended operation enabling;
- Low and high thresholds.

NOTES: if the type of operation of one or more pumps is changed, the max no. of pumps operating at once is reset and, therefore, must be entered again. If M is the max. no. of pumps operating simultaneously, M pairs of thresholds will be required; for each pair of thresholds the low threshold value will not be accepted if it is higher than the high threshold value; the low threshold value will not be accepted if it is lower than the previous low threshold value either; the same applies to the high thresholds.

14.4.3. Transducer level settings

By selecting MENU>SETUP>LEVEL you activate the setting function for the level measurement parameters, i.e. you can enter the values required for the management of the probe connected to the ECU.
The following parameters can be set:

- Current signal type (0-20 or 4-20 mA)
- Level value at 0 or 4 mA (depending on the previous setting, from 0 to 99.99 m)
- Level value at 20 mA (from 0 to 99.99 m). This is the MAX value that the probe can read

14.4.4. mA output

By selecting MENU>SETUP>mA OUTPUT you activate the setting function for the current output parameters.
The following parameters can be set:

- Current output type (0-20 or 4-20 mA)
- Level value for 0 or 4 mA (depending on previous setting, from 0 to 99.99 m)
- Level value for 20 mA (from 0 to 99.99 m)

14.4.5. Floats

By selecting MENU>SETUP>FLOATS, you activate the setting function for the parameters relating to the use of the emergency floats (for the Superminimum and Supermaximum checks).
The following parameters can be set:

- Upper float enable (digital input 1)
- Lower float enable (digital input 2)
- Activation time (from 0 to 900 s per step of 10 s)

For the first two parameters, 3 options are available: DISABLED, ON = 1, ON = 0; the last two items show the logical value corresponding to the active status (1: Normally CLOSED or 0 normally OPEN).
The activation time indicates how long the pumps are forced to remain in the ON mode, even after the float has changed status (in the filling mode the role is inverted: the activation of the pumps is determined by the lower float).

14.4.6. Digital input 3

By selecting MENU>SETUP>DIGITAL INPUT 3 you activate the setting function for the parameters relating to the use of digital input 3. inputs 1 and 2 are solely for the emergency floats, input 3 is for general use.
The user is required to set the following two parameters:

- Channel enable
- Action type when active

For the channel enable, you can select from DISABLED, ON = 1, ON = 0; in the last two cases, the input is enabled and active when the logical value is 1 or 0. The second parameter indicates the type of action to be performed when the channel is active: NONE, PUMPS OFF (all the pumps are switched off).

14.4.7. Analogue inputs

By selecting MENU>SETUP>ANALOGUE you activate the setting function for the parameter relating to the use of the four analogue inputs.
For each of the four channels, you will be prompted to set:

- Enable
- Unit of measurement (max 4 characters)
- Input type (0-20 o 4-20 mA)
- Value at 0 or 4 mA
- Value at 20 mA
- Relay to manage (none, K1, K2, ..., K7)
- SET POINT ON value
- SET POINT OFF value

The SET POINT ON (VSPON) and SET POINT OFF (VSPOFF) values must be different; these values determine the SET POINT ON operating logic: if VSPON > VSPOFF the relay (if enabled) is energised when the value is above VSPON, if VSPON < VSPOFF the relay is energised when the value drops below VSPON. In any case, VSPOFF represents the relay de-energisation threshold.
An alarm can be enabled for each channel ; this is done from SETUP>ALARMS>GENERAL. The alarm is generated in relation to the VSPON threshold: if VSPON > VSPOFF the alarm is generated when VSPON is exceeded, if VSPON < VSPOFF the alarm is generated when the value drops below VSPON.

14.4.8. Flow rate calculation

By selecting MENU>SETUP>FLOW RATE, you activate the setting function for the flow rate measurement parameters. The reading is based on the variations in the level over time.
You will be prompted to set the following parameters:

- Number of tank sections (from 1 to 8)
- Level value (in m) for each section
- Area value (in m^2) for each section
- Flow rate calculation time (from 1 to 255 s)

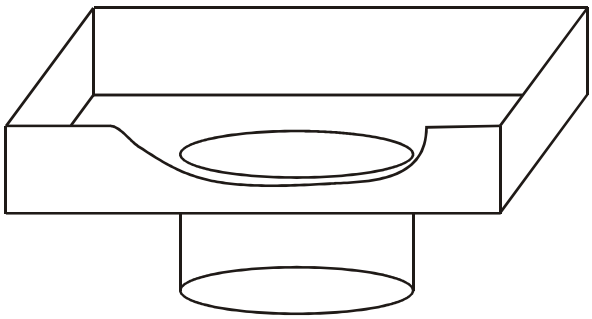
A null value for the number of sections disables the flow rate measurement while a non-null value (N=1,...0.8) enables it. This number indicates the number of sections following the basic section, therefore the actual number of sections to be set (for N>0) is N+1. The section numbering starts from 0 (for example if you set the number of sections as 3, you will be requested the parameters (level and area) for 4 sections: sect0, sect1, sect2 and sect3). Note that the level is also requested for sect0.
The section areas are given in m^2 and if the level value is below the level value set for the previous section, it will not be accepted.
The level of the lowest section (section 0) and that of the highest section represent, respectively, the lower and upper limits for the flow rate calculation: if the initial and final levels do not fall within these limits, the measurement is cancelled and the flow rate value is not refreshed (the last measurement remains valid).
As the area is requested for each section, there is no need to set the shape of the plan of the tank.

Listed below are the most common and actual cases which maximise calculation accuracy:

i) Solids with constant sections. This includes prisms and cylinders
(in actual fact, the section can be any shape, including, for example, U or L shapes)
ii) Frustum of pyramid and frustum of cone

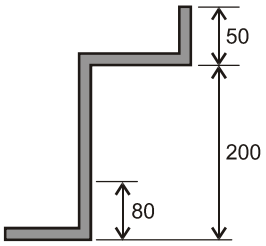
Note that the user can manage the discontinuity of the horizontal section.

Example
A tank whose shape is a cylinder with a base area of 10 m^2 and height of 2 m, on top of which there is a parallelepiped with a base area of 20 m^2 and a height of 1 m.



The discontinuity is managed with the following settings (the levels for section 0 and section 3 have been chosen at random).

	Level(m)	*area (m^2)*
Sect0	*0.80*	*10.00*
Sect1	*2.00*	*10.00*
Sect2	*2.00*	*20.00*
Sect3	*2.50*	*20.00*



The discontinuity is at a level of 2 m. Basically, sect1 and sect2 are the bases of a solid with a null height and which, therefore, has a null volume.

The flow rate calculation time (from 1 to 255 s) is the time during which the flow rate is measured, therefore it is also the period during which the result displayed constantly is steady.
Due to the natural delay involved with data logging, in order to reduce the calculation error, we recommend you set the flow rate calculation time at over 30 seconds.
The calculation of the intake/outlet flow rate (draining/filling) must be performed with the pumps disabled and during the RUN stage.
When all the pumps are still, the intake flow rate is calculated, at regular time intervals, according to the level variation over the time set, and it is given by the voloume variation in relation to the calculation time.
The moment a pump is switched on, the intake flow rate is assumed to be constant until the following stop of all the pumps.
When only one pump is operating, the outlet flow rate - determined by the pump based on the variation in the volume over the calculation time - is calculated by adding the intake flow rate frozen the moment the pump started. This value (not displayed) is then compared with the minimum flow rate set for the pump in question, and determines whether or not the minimum flow rate alarm will be triggered.
The flow rate is given as l/s and the following convention is adopted: the value is positive for the incoming flow (level increased in the calculation time interval), and negative for the outgoing flow.

14.4.9. COMMUNICATIONS

By selecting MENU>SETUP>COMMUNICATIONS you activate the setting function for the communication parameters.
The following screen page appears:

```
2.9 COMMUNICATIONS
> 1 Type
2 Baud rate
3 Address
4 SIM PIN status
```

TYPE is used to select the type of interface desired from GSM, RS232, RS485 and RS232-DB9. The first three options require the additional module, the fourth (RS232-DB9) refers to the 9-pole female connector (DB9), which is always present. If GSM is selected, the following further parameters will be requested:

- PIN: 4-digit (decimal figures) string to enter the SIM card PIN code. This string is only considered valid if 4 figures are entered, otherwise it is assumed that the PIN code has not be set and, in the event that the SIM card requests the PIN, it will not be transmitted to it (the message "GSM PIN" appears on the normal screen, see “RUN” OPERATING MODE SCREEN PAGE 1). You do not need to set this parameter if a SIM card which does not require a PIN code is used.
- TEL NUMBER 1, First telephone number to call for sending the text alarm message. Please remember not to leave any gaps at the beginning; to disable this function, leave the field blank
- TEL NUMBER 2, Second telephone number (as above)
- TEL NUMBER 3, Third telephone number (as above)

In BAUD RATE, you can select the communication speed from 9600, 19200 and 38400 bps (this setting is not relevant if GSM has been selected, in which case the automatic setting is 9600 bps).
In ADDRESS, you can set the address of the peripheral unit to which the ECU is connected (from 1 to 63).
SIM PIN STATUS is used to manage the PIN lock and is important when the GSM modem is in use. Normally, the following message is shown:

PIN UNLOCKED

which means the ECU will send the PIN code if requested by the SIM card.
The message:

PIN LOCKED
“OK”=UNLOCK

however, means there has been a previous (unsuccessful) attempt to access the SIM card. If this situation occurs, the ECU will no longer attempt to send the PIN code (even if it is switched off then back on again).
To re-enable the SIM card access, press “OK”. Note that the locking procedure is managed by the ECU (after just one unsuccessful access attempt), not by the SIM card.

14.4.10. ALARMS

By selecting MENU>SETUP>ALARMS you activate a menu with the following options:

```
2.10 SET ALARMS
> 1 General
  2 Level
  3 PUMPS
```

Through this menu you can set which events (in RUN mode) will generate an alarm. The following options are available:

NO	(no alarm must be generated)
YES	(this will generate an alarm)
YES TEXT MESSAGE	(this will generate an alarm and send out a text message)

In the third case, the generation of an alarm is accompanied by a text message (if the GSM module is installed and selected).

14.4.11. Set defaults

If you select MENU>SETUP>SET DEFAULTS, the following screen page appears:

```
SET DEFAULTS
 ‘<’ +”OK”=SET
```

By pressing the “LEFT ARROW” and “OK” keys at the same time you reset the ECU. This way, all the settings are deleted (the default settings are restored) except those concerning the COMMUNICATIONS.

14.5. TEST

By selecting MENU>TEST, you access the test relay and one of the following types of screen page is activated:

```
3 TEST
>  1 Inputs
   2 Relays
   3 LEDs
   4 Battery
   5 mA output
```

Scroll through the list with the “UP ARROW”/”DOWN ARROW” keys.
In **INPUTS**, the status of the alarm relays for each individual pump is displayed, along with the digital and analogue input statuses (use the “RIGHT ARROW”/”LEFT ARROW” keys to scroll through all the screen pages)
In **RELAYS**, if you press the “OK” key, you switch the status of the relay marked with the asterisk. Note that if one of the P1, P2, P3, P4, P5 relays (for pumps 1 - 5, respectively) is energised, the asterisk disappears for 3 seconds: a pump cannot then be started until those 3 seconds have elapsed(asterisk displayed again).
In **LEDs**, if you press the “OK” button, you switch the status of the LED marked with the asterisk.
In **BATTERY**, the battery voltage is displayed (its charge level is shown).
In **mA OUTPUT**, you can set a signal from 0 to 20 mA) to check that the analogue output is operating correctly

14.6. ALARMS

By selecting MENU>ALARMS, you access the same screen page as the alarms available in the RUN mode (see “SCREEN PAGE 3 - “RUN” OPERATING MODE).

14.7. Clock

By selecting MENU>CLOCK you access the date and time configuration screen page.

14.8. COUNTER RESET

By selecting MENU>RESET COUNTERS, you access the following screen page:

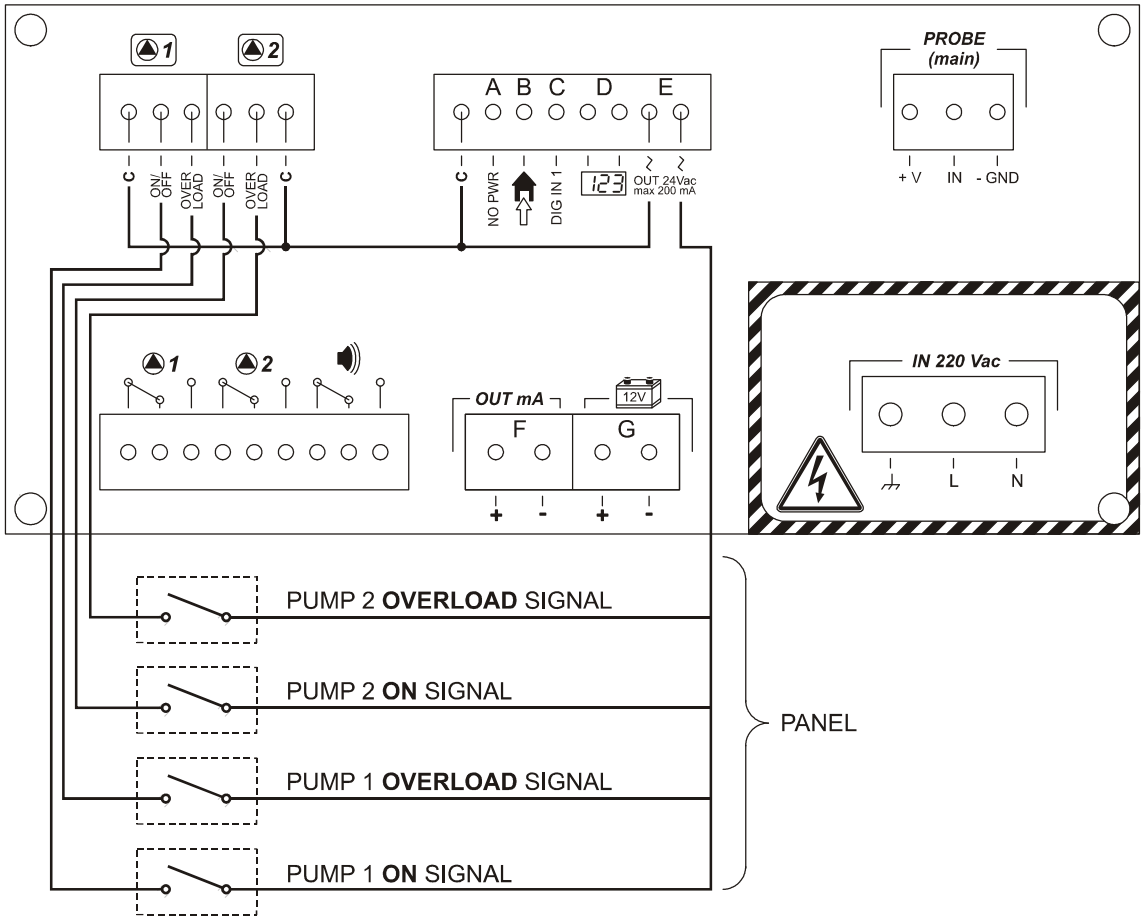
```
6 RESET COUNTERS
>  1 COUNTER
   2 P2
   3 P2
   4 P4
   5 P4
   6 P6
```

from here, you can reset the surge counter and the counter for each pump (start-up's counter and operating time counter).
To carry out this operation, press the “LEFT ARROW” and the “OK” keys at the same time.

14.9. Pump maintenance

By selecting MENU>PUMPS MAINTENANCE, you access the screen page in which you can reset the start-ups' counter and operating time counter for each pump, by proceeding in the same way as outlined earlier.

15. EXTERNAL CONNECTION DIAGRAM



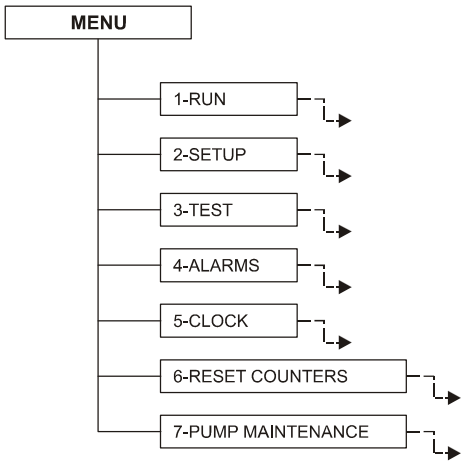
NOTE:
The programmable surge counter (flow rate measurement counter) must be DC-powered (from an external power supply).
This meets the standard applicable to flow rate meters.

16. PROBE TECHNICAL SPECIFICATIONS

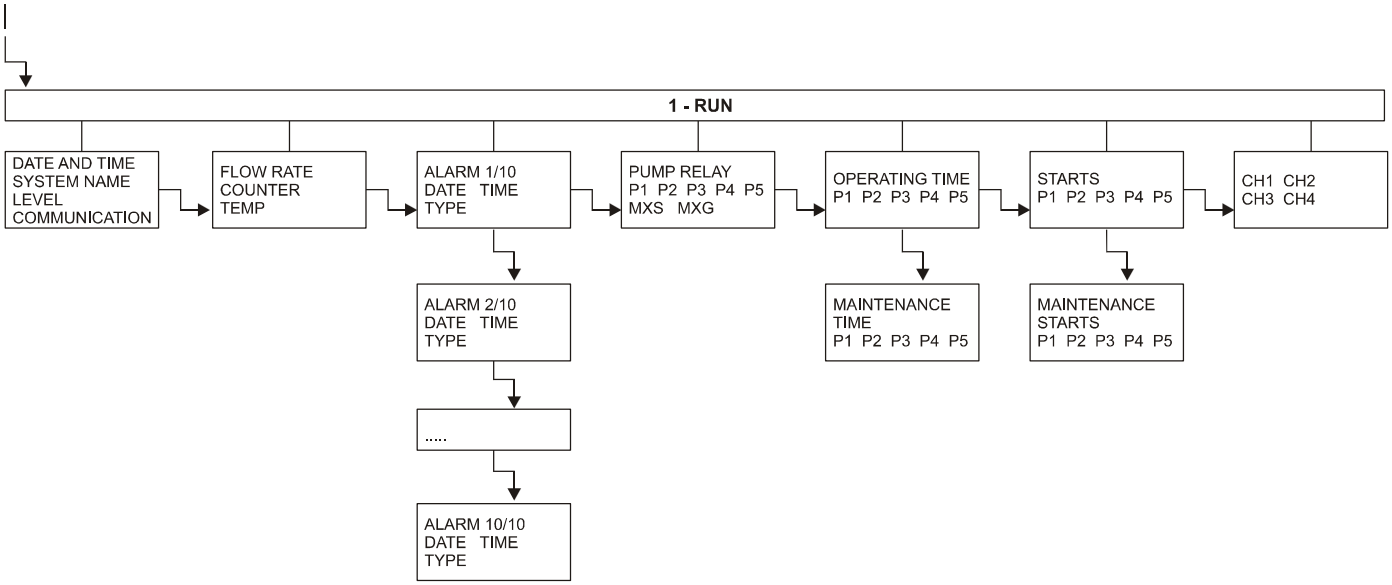
Brand and model	**GE-DRUCK PTX 1730**	***ENDRESS+HAUSER* WATERPILOT FMX 167**	**MICROSONIC MIC 601**	**LUNDAHL DCU 1104**
Type	Piezoresistive	Piezocapacitive	Ultrasound	
Measuring range	0÷600 mH_2O	0÷200 mH_2O	0.8÷8 m	0.6÷15.2 m
Analogue output [mA]	4÷20	4÷20	4÷20	4÷20
Power supply [Vdc]	9÷30	10÷30	12÷30	12÷30
Current	20 mA at f.s.	3.5÷22.5 mA	70 mA	200 mA at 24 V
Protection degree:	IP68 up to 700 mH_2O	IP66 / IP67	IP65 NEMA 4X	IP65 / IP67 NEMA 4X
Approval	CE	CE, ATEX, FM, CSA	CE	CE
Response time [ms]	0.5	80	225	Programmable with PC
Resolution	<1 mm	1 µA a f.s.	1 mm	2.54 mm
Precision (accuracy)	±0.25% f.s.	±0.2% f.s.	±4 mm	±0.25% f.s.
Temperature range	-20÷+60 °C	-10÷+70 °C	-20÷+70 °C	-30÷+60 °C
Temperature effects	±0.5÷1% f.s. in: -2÷+30 °C	±0.5% f.s. in: 0÷+30 °C; ±1.5% f.s. in:-10÷+70 °C	Internal compensation, **NO** external	Internal compensat. , **NO** external
Measurement interval	---	---	Programmable MAX	Programmable MAX
Opening angle	---	---	±1°÷±6°	±9°
Dimensions	Ø=17.5 mm L=177 mm	Ø=22 mm L=230 mm	M30x140 mm	Ø~3.5'' L~12.5''
Material	316 stainless steel; EPDM	AISI 316, ceramic, viton	*Case:* threaded nickel-plated brass; *Transd.:* porous	*Case:* PVC; *Transd.:* ceramic + (PVC or Teflon)
Cable	Polyurethane sheath L=1÷600 m	PE sheath; L=10 m	L=2 m	10 conductors; PVC sheath; L=2 m
Field of use	Water or **non**-aggressive fluids	For treatment of fresh water and waste water, including aggressive waters.	Indoors or outdoors, **not** for heavy-duty use; Wide tanks; **NO** aggressive vapours	Indoors or outdoors, heavy-duty use; Wide tanks; indoors/outdoors

17. FUNCTION SUMMARY TREE

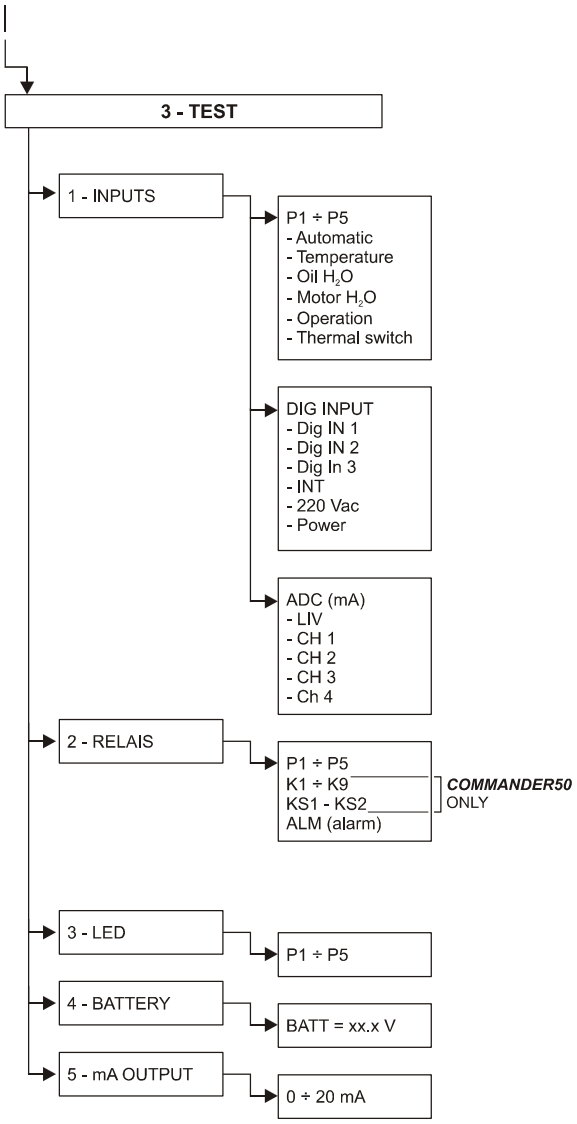
MENU tree



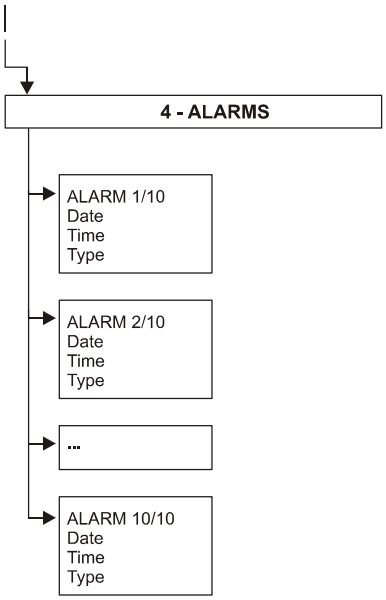
RUN tree



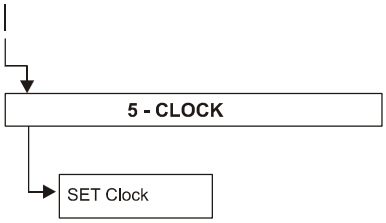
TEST tree



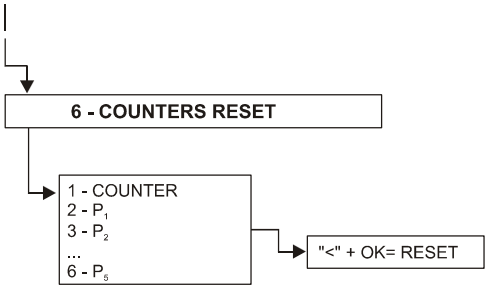
ALARMS tree



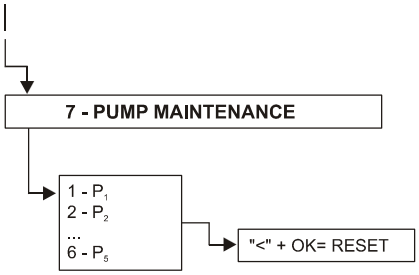
CLOCK tree



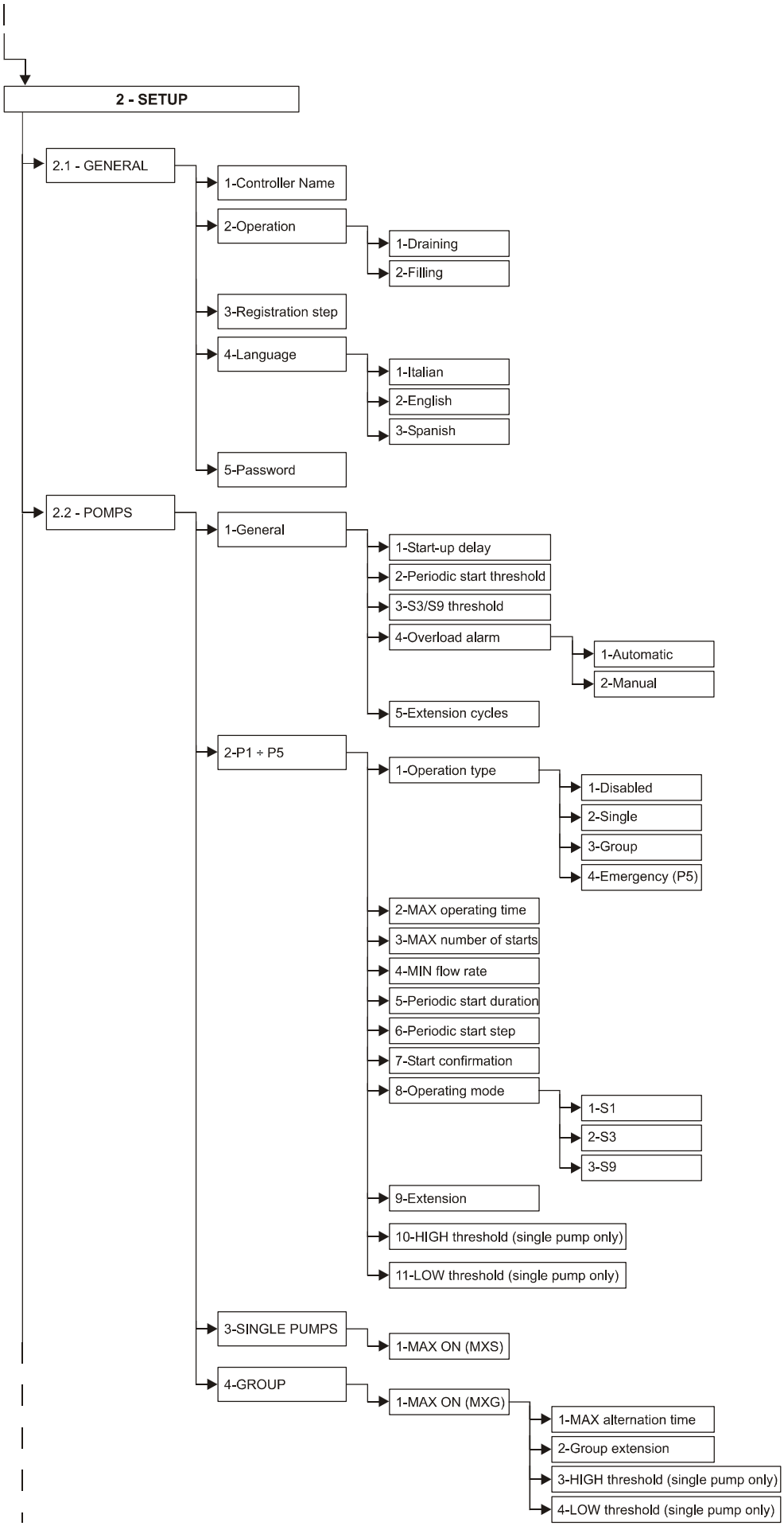
RESET COUNTERS tree



PUMP MAINTENANCE tree

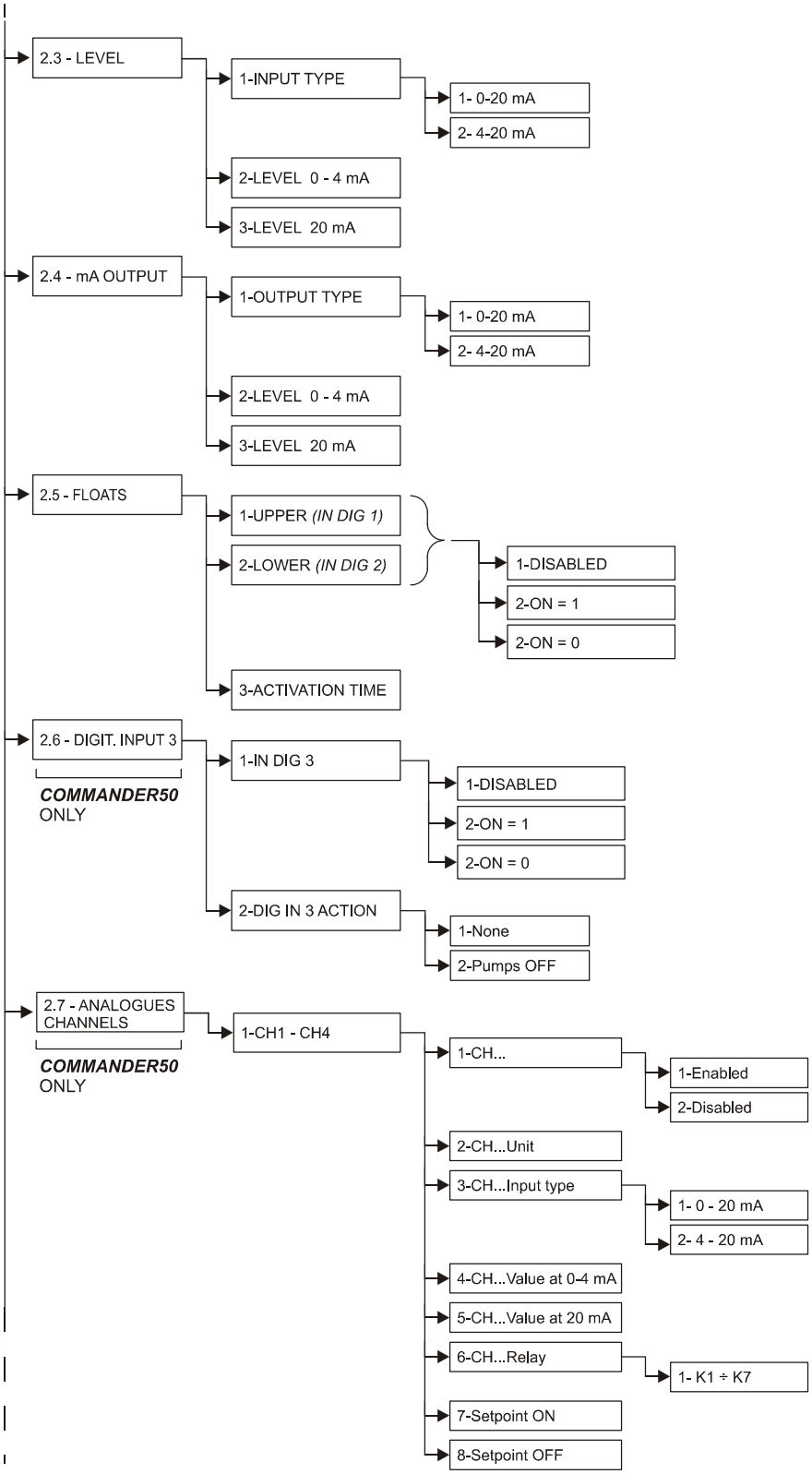


SETUP tree



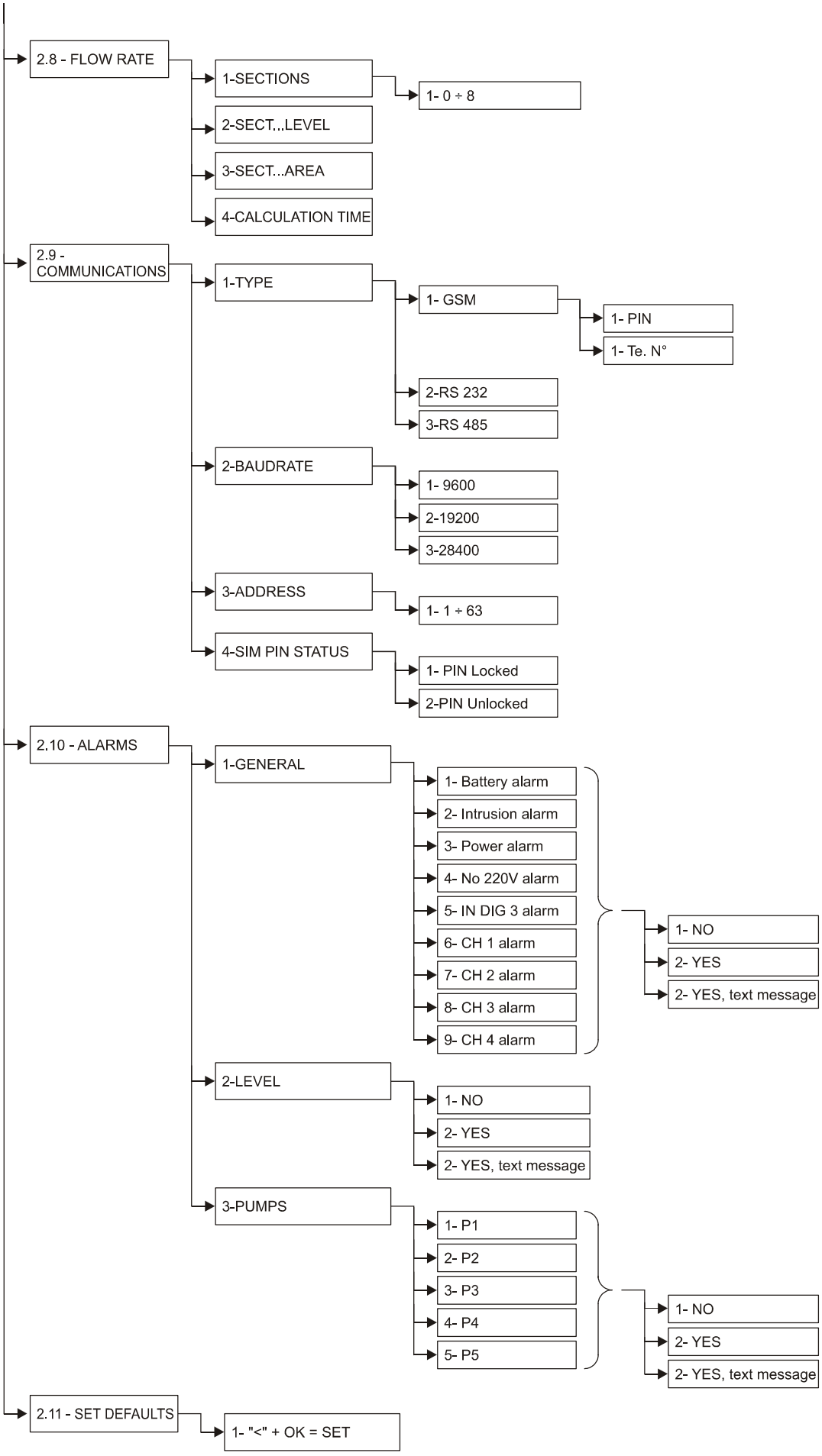
To be continued...

...P.T.O



To be continued...

...P.T.O


2.8 - FLOW RATE
1-SECTIONS
1- 0 ÷ 8
2-SECT...LEVEL
3-SECT...AREA
4-CALCULATION TIME
2.9 - COMMUNICATIONS
1-TYPE
1- GSM
1- PIN
1- Te. N°
2-RS 232
3-RS 485
2-BAUDRATE
1- 9600
2-19200
3-28400
3-ADDRESS
1- 1 ÷ 63
4-SIM PIN STATUS
1- PIN Locked
2-PIN Unlocked
2.10 - ALARMS
1-GENERAL
1- Battery alarm
2- Intrusion alarm
3- Power alarm
4- No 220V alarm
5- IN DIG 3 alarm
6- CH 1 alarm
7- CH 2 alarm
8- CH 3 alarm
9- CH 4 alarm
1- NO
2- YES
2- YES, text message
2-LEVEL
1- NO
2- YES
2- YES, text message
3-PUMPS
1- P1
2- P2
3- P3
4- P4
5- P5
1- NO
2- YES
2- YES, text message
2.11 - SET DEFAULTS
1- "<" + OK = SET

NOTES

NOTES