

Series No.....Customer.....Date of delivery.....

Operating Instructions GRANUDOS 10 TOP

Safety Devices

1. Chlorine and acid may not be mixed together or with other chemicals

Pay attention to the safety devices on chemical Containers

2. Close hopper immediately after filling
3. If an adapter to a chemical container is used the hopper must be screwed even and firmly to the container
4. Ensure machine is kept clean. If chemical is spilled, clean up immediately.
5. Only instructed personnel may work with the GRANUDOS
6. Ensure booster pump does not run dry, always isolate pump when backwashing.

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1. The Functions of GRANUDOS 10 TOP:

The features:

- Measuring free chlorine , pH-value, redox tension, temperature
- 4-lines-display, operated by 1 selection key
- Control and monitoring of all operational functions
- Control Dosing of dry chlorine by measuring free chlorine **or** redox
- Acid dosing by a peristaltic pump included
- Dosing of flocculant by a peristaltic pump
- Filter backwash disinfection
- Shock chlorination programmable
- Night program with reduced set points for free chlorine and flocculant
- Filling a buffer tank with chlorine solution to disinfect other small pools by additional dosing pumps (optional)
- Interface RS485 to link a computer, printer or mimic .
- fault remote control (non volt)
- Mimic (optional)

1.1 Data, Measures, Performance

Dosing performance:

chlorine: 0.5 kg/h, optional 2,5 kg/h
 motor 12rpm, optional 50 rpm

acid: 1,0 l/h, optional 2,0 l/h
 dosing hose 3,2x1,6, opt. 4,8x1,6

flocculant 105 ml/h with dosing hose 0,8x1,6

Measures:

base: 71 x 52 cm
 height: 130 cm
 weight: 40 kg

Material:

PE, polyethylene
 control housing ABS IP54

Booster Pump

centrifugal pump: SS - 0.3 kW, 230 volt 1ph
 supply pressure: **minimum 0,2** – 1,2 bar
 counter pressure: 0 – 1,2 bar
 (depending on supply pressure)
 water flow: app. 1000 l/h

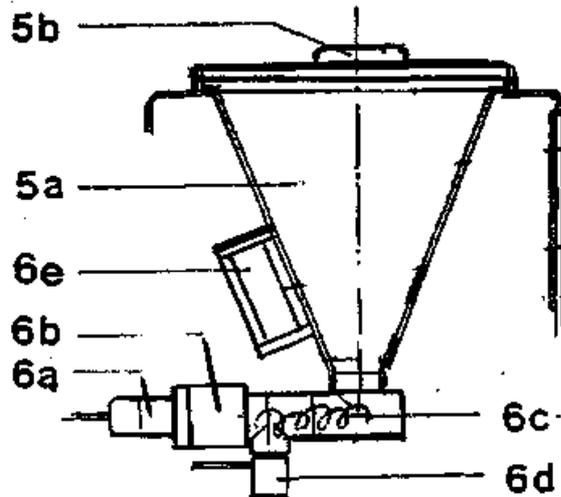
Fault remote indication by relay



1.2 Dosing Assembly dry chlorine

The dosing assembly, placed into the main housing consists of the dosing hopper (5a) and the dosing unit with dosing motor (6a), the dosing screw (6c) fitted together and pushed into and screwed to the motor holder (6b). The dosing nozzle (6d) is heated to eliminate condensation of the warm pool water vapour. The dosing unit is screwed into the dosing hopper.

The required dosing rate is adjusted at the control board by means of a dosing cycle and dosing time. The solenoid knocker acting at each dosing prevents bridging of the chemical in the hopper



5a dosing hopper

5b hopper lid

6a dosing motor

6b motor holder

6c dosing screw

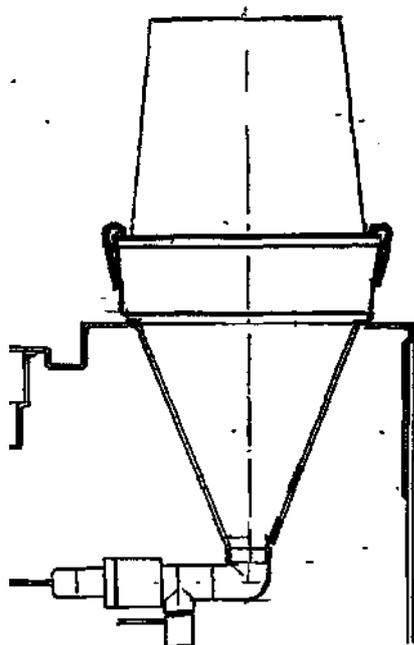
6d heated dosing nozzle

6e knocker

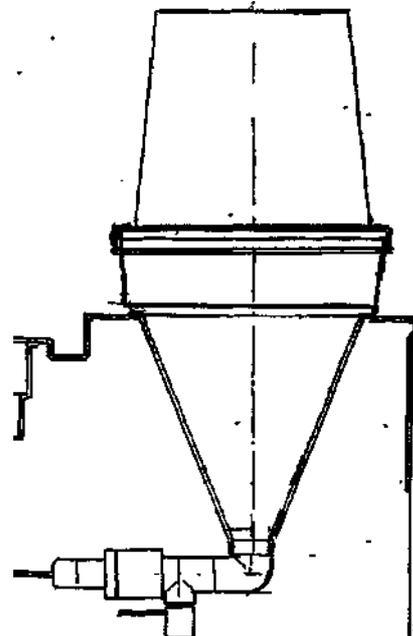
The knocker (6e) gives a stroke to the dosing hopper wall and thus prevents clogging of the chemical.

The complete dosing assembly can be taken out of the frame for service. Fitting systems as shown below allow chemical containers of 10 kg to be fitted directly to the hopper reducing the handling required ie. the chemical does not need to be transferred from the container to the hopper by hand using a scoop.

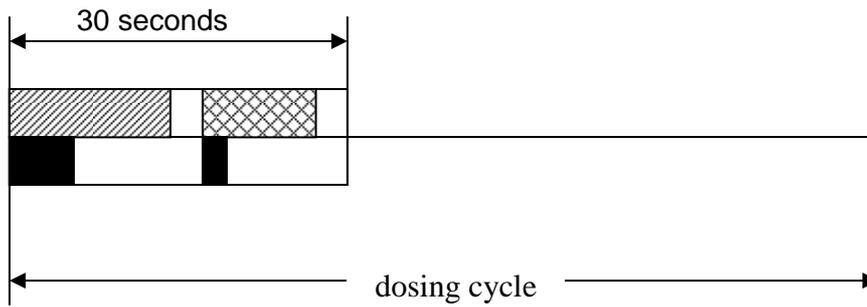
**Fitting system to join a
10 kg container with round edge**



**Fitting system to join a
10 kg HTH container**



The dosing is principally as to the following scheme:



Adjustable from 30 seconds to 10 minutes

 max. dosing time chlorine time
  max dosing time acid
  actual dosing time

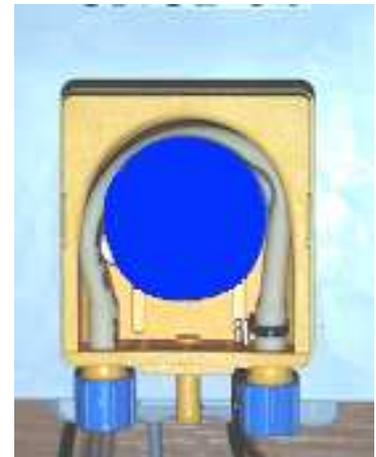
Dosing is always in the first 30 seconds of the set dosing cycle adjustable from 30 seconds to 10 minutes. Between chlorine and acid dosing there is always a pause of at least 3.5 seconds ensuring dosing of both chemicals never occurs.

The actual dosing time for the chlorine and acid dosing motor is calculated by the processor as to the proportional gap between the actual and set values.

1.3 Acid Dosing

The acid required either for pH-control and for cleaning of the flushing, mixing and dosing system is metered by the peristaltic pump to the flushing water via the dosing injector (11). As the cleaning procedure is vital for the correct function of the complete dosing assembly, chlorine dosing is stopped if the level switch on the supply carboy lance indicates container empty.

Please do not use concentrated hydrochloric acid for this duty as that penetrates the peristaltic hose and will destroy the pump head. Maximum dosing performance is app. 1 l/h and is set similarly to the chlorine. The dosing cycle set for chlorine is valid for acid too.

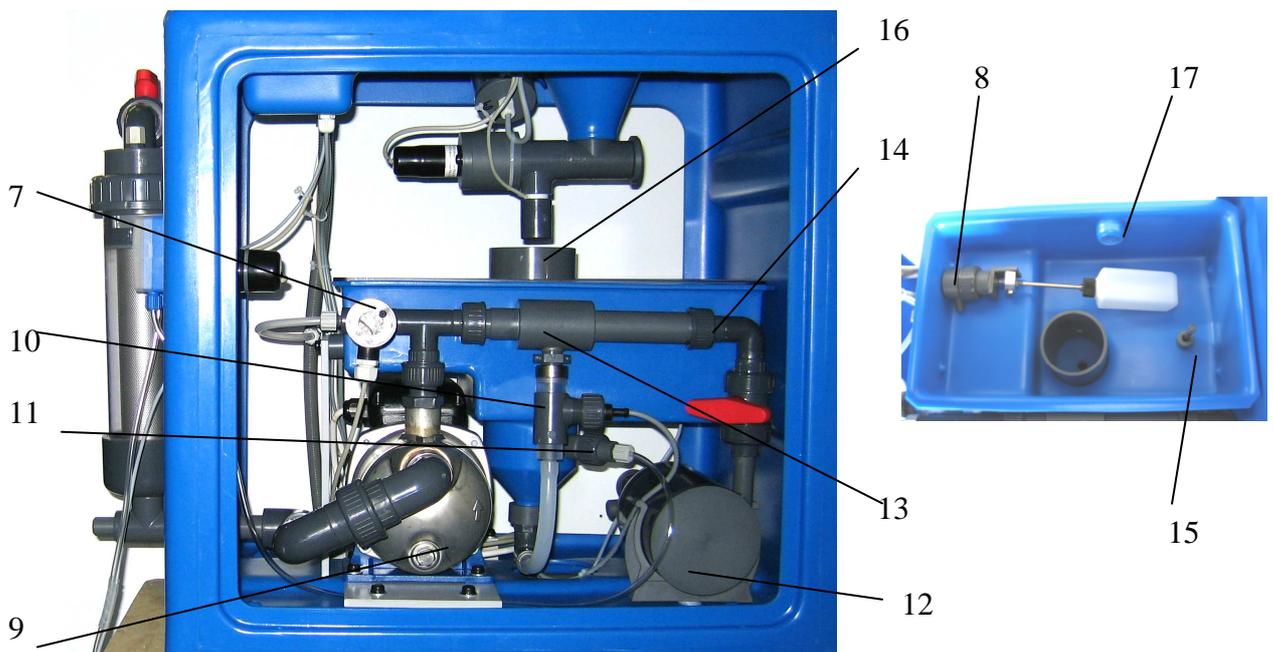


1.4 Flocculant dosing

For the dosing of the flocculant the same type of peristaltic pump is used as for acid but is rpm-controlled ensuring a continuous chemical flow is achieved, which is important for best performance of the flocculant.

The dosing performance is set in the menu by setting the circulation rate of the filter system in m^3/h and the specific dosing rate of the chemical in ml/m^3 of circulation. The dosing of flocculant works independent of the function of measuring/dosing of chlorine/acid.

1.5 Dissolving System



- | | | | |
|----|--|----|---|
| 7 | pressure switch | 13 | venturi nozzle |
| 8 | floating valve | 14 | orifice washer |
| 9 | booster pump Lo 2HMS3 | 15 | level switch low/high |
| 10 | flow switch holder with flow switch | 16 | lid on flushing tank
with chlorine dust protection |
| 11 | acid dosing valve | 17 | overflow to drain |
| 12 | mixing and dissolving
chamber with PVC ball valve | | |

The supply water coming from the pool circulation from behind filter (minimum pressure 0,2 bar) is divided at the discharge of the booster pump (9), one way leading to the flushing tank via the floating valve (8), the other branch directed to the venturi nozzle (13), where the flushing water is sucked together with the dosed chemicals out of the flushing tank. (A third way possibly goes as measuring water directly to the measuring cell). A flow switch (10), being installed in the suction tube of the venturi monitors the suction power of the venturi. To adjust the suction to different pressure conditions an orifice washer (13c) with different bores can be used. To mix the chemicals and to ensure the complete dissolving of the chlorine granules a cyclone mixing chamber (12) is fitted after the venturi.

To ensure that calcium hypochlorite and acid do not come into contact with each other in the open part of the dissolving assembly a sophisticated control system is installed:

- metering of the two chemicals is regulated with pauses between the metering intervals
- dosing motors of chlorine and acid are controlled by connected relays – joint dosing is impossible
- flow switch (10) indicates if water flow to venturi falls below 150 – 200 l/h
- level switch (14) indicates water maximum or water minimum level in the flushing tank thus supervising water supply conditions.

If any non-compliance with the given limits occurs, the chemical dosing will be stopped, the fault is shown on the display.

2. The measuring system

The measuring water flow system consists of

- tubing connection with ball valve (1)
- filter (3)
- water flow control (5)
- measuring electrodes cell (11)

2.1 measuring water flow control

The measuring of free chlorine is dependent of the measuring water flow through the cell and must be controlled therefore within a range of +/- 10-20% of the set value. The switch bobbin (10a) of the flow monitoring switch must be at top and the blue cleaning glass beads in the chlorine measuring cell must rotate effectively.



2.2 Measuring cell

The measuring cell is fabricated of transparent PMMA and consists of three parts:

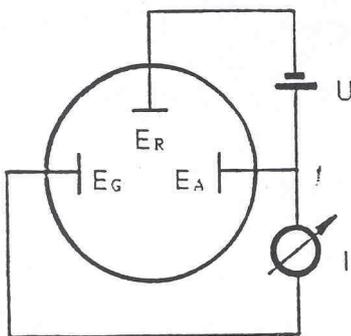
- flow control cell with temperature sensor
- Measuring cell for free chlorine
- Measuring cell for pH-value and redox tension

The measuring water flow is monitored by a reed switch. The flow bobbin (10a) is pushed upwards in the flow control cell to the temperature sensor fitted into the top of the flow control cell. The reed sensor is fitted simple pushed behind the temperature sensor in the flow cell. At low flow – the switch bobbin goes down in the bore, “meas. water low ” is indicated at the display and dosing is stopped.

When the Granudos is stopped to avoid uncontrolled water flow through the open measuring cell a spring loaded stop valve is fitted into the inlet union of the measuring cell holding app. 0,7 bar supply pressure.

2.2.1 Measuring Free Chlorine

The measuring method for free chlorine functions to the potentiostatic principle: The active gold electrode is loaded via a reference electrode by a certain potential at which the chlorine chemical reaction on the gold surface is optimised, the influence of the reaction of other chemicals on the gold is minimised. So a stable and reliable proportional measuring current is achieved at a very stable situation at the zero chlorine point



E_R Reference electrode
 E_A working gold electrode
 E_G counter electrode
 I measuring current
 U Potential on reference electrode



The active gold electrode consists of a gold round piece and is fitted within a stainless steel body which is working as the counter electrode, the measuring current flows between these two electrodes. This assembly is screwed from the bottom into the measuring cell. Blue glass beads moved by the measuring water are cleaning the surface of the gold electrode. The Ag/AgCl reference electrode is screwed from top.

By using 3 separate electrodes for the system a high measuring stability is achieved and separation makes cost effective replacements in the future.

2.2.2 pH-Value

The pH-electrode is screwed from top of the combination cell for pH-value and redox.

2.2.3 Redox Tension

The redox tension is the relevant value to judge the hygienic state of the pool water. It is indicating the relation between the **red**-uctiv forces (organic chemicals) and the **ox**-idising forces (free chlorine) in the water. The relevant potential is built up on the surface of the platinum electrode and is measured against the reference electrode of the pH-electrode as a tension (mV). The higher the redox tension is, the quicker any micro organisms are killed. The platinum surface of the electrode is cleaned by glass beads as the gold electrode

As the redox tension is very dependent on the free chlorine and the pH-value it can be used very well to monitor these measurements.

2.2.4 Temperature

For temperature measuring a digital sensor is used and it also acts as a distance holder for the flow sensor as well.

2.3 Test water take off

At the outlet of the pH/redox cell the measuring water is flowing free out via a short hose to a tube connected to the flushing tank of the GRANUDOS. The measuring water goes back to the circulation. At this hose the test water to control the water quality by test reagents can be taken.

2.4 Test cylinder for redox tension

For testing the redox system a test cylinder is fixed at the front right besides the measuring cell. The redox electrode is screwed in, test buffer is filled to the cylinder, the pH-electrode is put in from top and you can read the resulting redox tension at the display. See programme "**Redox test**".



2.5 Test and cleaning chemicals

The test and cleaning chemicals for the electrodes are found on the left side of the GRANUDOS housing

- buffer solution pH 4,0 50 ml
- buffer solution pH 7,0 50 ml
- buffer solution Ag/AgCl - Pt 475 mV 50 ml
- cleaning liquid (diluted hydrochloric acid) 50 ml
- glass beads to clean the platinum and gold electrode

3. The auto control system TOP Control

Operation of the Top Control is by means of a selector turn key and a 4 line display:

By turning the key you move through the menu / programme from one to the next point marked by a „>“. By a „click“ you come to the next point or programme level to change a value or to operate a programme e.g. “calibration”. At dark underlined „>“ the indicated value can be changed immediately.

To change a parameter or a programme a user code no. must be given. This code no. is 15.

The windows are always changing with all 4 lines together.

3.1 The normal operating window

At switch on or “reset” after 10 seconds where the program no. is indicated the standard window comes.

mg / l	PH	mV	° C	> Measurements	
0 , 5 4	7 , 1 4	7 2 0	2 3	> Actual values	
2 0 %	2 5 %	HH : MM		> Dose output / clock time	
o f f	D o s	> a u t o		> Dosing status	programme

mg / l	pH	mV	° C	> Measurements	
0 , 5 4	7 , 1 4	7 2 0	2 4	> Actual values	
> e m p t y	a c i d			> Fault indication	Red lamp burns
o f f	o f f	> s t a r t		> Dosing status	programme

1. Line: Measurements
2. Line: actual measuring value free chlorine, pH-value, redox, temperature
3. Line: Information line: Dosing output in % of set dosing performance and clock time.
A fault or alarm value is indicated here. Additional faults and alarms are indicated in a separate window by a “click” onto the > before the fault indicated. At start or reset a “**start delay**” time is indicated with no dosing, set in the menu to get steady measuring situation. With a “click” you come directly to “**start**” if a value is not in the p-range or to the set programme, normally “**auto**”.
4. Line: Functions indication of dosing motors for chlorine and acid by **Dos** – dosing, or **off** (not dosing). The function of the flocculant pump is visible without indication as it works continuously.
On right side the set **programme status** is indicated, which may be set by the operator, by a external switch or by internal software

Programme status:

- auto:** = Automatic operation. Dosing of chlorine and acid proportional with added basis dosing as to the set parameters, all fault and alarm indication.
Flocculant dosing as set.
- start:** = Start programme: At switch on or at „reset“ and measuring value is out of proportional range dosing is working after the set „**start delay**“ time with full power till the proportional range is reached, then normal operation. The set alarm values are not seen in this start period.
- filter:** = Filter disinfection. By an external switch dosing is working on „**high dosing**“ performance as set. After the machine is switched off a “**reset**” is performed

- automatically, the alarm values are not monitored until the proportional range is reached.
- Shock dis** The programme “**Shock disinfection**” is active. Dosing is working on „**high dosing**“ performance as set. After the end of the set programme the alarm values are not monitored until the proportional ranges are reached again.
- off-CCT:** = Switch off of machine by a CCT (central control technics) by a switch, the measuring system works on
- buffer:** = Filling a buffer tank by the „empty switch“ of that. Dosing with “**high dosing performance**“ as set, a solenoid valve opens to the buffer tank. Filling time is 10 minutes. Than automatic „reset“ and back to normal operation
- off-dos:** = Switch off dosing within the menu to check functions where the dosing is not wanted.
- hand:** = Continuous dosing of chlorine and acid. Measuring system works, maybe faulty.

Note!: When choosing „hand“ dosing the dosing performance must be adjusted to a lower level.

In normal operation the cursor is standing/blinking on the “**status**” position.

3.2 Main menu

In the main menu all parameters are to be set which are necessary for operation. In addition all relevant information can be found in the relevant programmes. Start with a click on „>“ of „**Program status**“ (4. line right), then in the following selector window on 2nd line the user code no. has to be set. **The user code no. is 15.** With a “click” the operator is than in the main menu and is guided through the programmes line by line. The 1st line of each program is always “back”. So to come back to operation you turn back the selector and “click” on “back” till to the start window.

```

W D D D . M M . J J   H H : M M
> O p e r a t o r   c o d e   > X X X X
> S e r v i c e   c o d e   > X X X X
> r e s e t

```

- > day/ date / watch time
- > The user code no is 15
- >
- > Systems new start

```

> b a c k   t o   p r o g r a m m e
> c a l i b r a t i o n
> p r o g r . s t a t u s . > a u t o .
r e d o x   s t a t u s   > i n d

```

- >
- > To sub program "calibration"
- > Program status "auto." - "hand" .- "off"
- > Redox status "indic“ or ."control"

```

> t e s t   i n p u t s .
> t e s t   o u t p u t
> s e t t i n g s   c h l o r i n e
> s e t t i n g s   p H

```

- > To test program "inputs"
- > To test program "outputs"
- > To settings "Chlorine"
- > To settings "pH"

```

> s e t t i n g s   C R P a l a r n
> s e t t i n g s   C R P c o n t r .
> s e t t i n g s   f l o c
> s h o c k   c h l o r i n a t i o n

```

- > To settings "Redox-alarms"
- > To settings "Redox-control "
- > To settings "Flocculant"
- > To program "shock chlorination"

```

> n i g h t   p r o g r a r
> s t a r t   d e l a y   > x x M i n
> d a t e   > M o . 0 7 . 1 0 . 0 3
> w a t c h   t m e   > 1 5 : 3 2 : 4 5

```

- > To night program – lower dos
- > Step1 0-15 (0 =dosing without delay)
- > Day name, day, month, year
- > hour, minutes, seconds

```

> n e t w o r k
> s y s t e m   r e s e t
> i n f o   s e r v i c e   d a t a

```

- > To sub program (Code etc.)
- > To sub program (factory values etc.)
- > To sub program info etc

1.Line: Back to programme if you have changed your mind

Calibration: Calibration program for free chlorine, ph, redox

> b a c k	> Back to main menu
> C l 2 D P D 1	> To sub menu
> C l 2 c a l i b r a t i o n	> To sub menu
> C l 2 z e r o p o i n t	> To sub menu
> p H 7	> To sub menu
> p H c a l i b r a t i o n	> To sub menu
> p H e l e c t r o d e c h e c k	>
> R e d o x c h e c k	> To sub menu

free chlorine: - quick calibration of chlorine gain by „Cl DPD 1“ (standard calibration)
- Exact calibration of chlorine slope
- zero-point of chlorine measuring

pH-value: - quick calibration by phenol red (pH 7.00)
- Exact calibration by both buffers pH 7.00 and 4.00 (standard calibration)
- check of pH-electrode

Redox check check by buffer solution 475 mV

status program: **direct select of programme**

„auto“ = automatic dosing as to the measuring data and set parameters with all monitoring and alarms

„hand“ = continuous dosing with set parameters – Please change dosing output to the required performance.

„off“ = dosing off, e.g. for maintenance

status redox: “ind“ = only indication of redox, with supervision of free chlorine by redox alarm if redox is becoming too high or too low

„contr“ = control of chlorine dosing by measured redox if maybe chlorine measuring system is faulty

test inputs: The status of the switch inputs are indicated for simple function check. E.g. if you take out the acid lance from the container, the indication in the window shall change from open (0) to closed (1) if container is not empty. The connectors of the switches are indicated.

test outputs: By a click the function of all outputs, e.g. dosing motors, knocker, alarm ect. can be activated and so checked whether they are functioning correctly.

Settings: Attached you find a listing of all settings to be done for control and dosing parameters. Every group of parameters is worked through. To move to the next settings turn the selector anti clockwise back and select the next group to work through. It is recommended to write down the selected values to the attached list.

settings chlorine All chlorine data are to be set here. The data are limited within ranges to avoid wrong settings.

performance test: finding the effective dosing performance

set point: required concentration for free chlorine

Selection range: 0,2-2 mg/l

p-range range of free chlorine within the dosing performance is calculated as to the distance to the set value

Selection range: 0.1-0,3 mg/l

chlorine high: high alarm value with **alarm, dosing off**

Selection range: set point + 0,1+ max 0,5 mg/l

chlorine low: low alarm value with **alarm, dosing off:**

There could be a fault at measuring system or at dosing technics

Selection range: set point – p-range – 0,1 – 0,3 mg/l or no alarm

dosing cycle:	As chlorine and acid may not be dosed together a dosing cycle is defined within that for the chemicals a certain time window is reserved for dosing. These time windows are used to calculate the proportional dosing rate. Short dosing cycle (30-60 sec.) is used for high dosing rate and fast reaction, long cycle (120-600 sec.) for low dosing rate or slow reaction. Selection range: 30 – 600 seconds
dosing performance	for the individual pool required dosing performance. It is limited by the set dosing cycle, e.g. with double dosing cycle time you can get only half of the maximum possible dosing performance Selection range: maximum is indicated at display
basic dosing:	basic dosing performance estimated as dosing needed without bathers load and added to the calculated proportional dosing rate. At reaching the set point basic dosing is divided to half. Selection range: 0 – 25 % of set dosing performance
high dosing:	high dosing performance used for the programmes: „shock chlorination“ – „filter disinfection“ – „buffer tank filling“.
start up time: (not active 8/03)	The actual measured value must be nearer as 20% to the set points. Set for chlorine and pH separately! If not reached: alarm, dosing off . Maybe problem with dosing technics or dosing setting performance is too low. Selection range: 0 / 30-300 minutes
dos monitore (not active 8/03)	Dynamic monitoring of dosing: If set dosing performance is sufficient, the actual value free chlorine or pH must be always near the set values. So if the actual value falls down to less 50% of the proportional range there must be assumed a fault with the measuring or dosing system. Alarm, dosing off . Selection range: 0 / 15-120 minutes
settings pH	Identically work out as to the settings of chlorine. The dosing cycle is here pre-defined by the chlorine cycle All monitoring timers are to be set individually.
Settings redox ind.	alarm values for redox high and low to monitor the chlorine dosing, chlorine dosing stops
Settings redox control	If chlorine dosing is controlled by the redox tension here the required values are set. The data about dosing performance are taken from “settings chlorine”.
settings flocculant	determination of the dosing performance of the dosing pump. The required dosing performance is internally calculated by setting the specific dosing rate (ml/m³) for the flocculant and the circulation rate (m³/h) . the resulting dosing rate is indicated in ml/h.
settings shock chlorination	shock chlorination can be executed at every day at for up to 30 minutes. As dosing performance the values for “ high dosing ” set at „ settings chlorine and pH ” are used. After the shock chlorination the alarm values are not recognised till the values are again in the p-range.
settings night program (not active 8/03)	for a certain set time at night the set point for free chlorine can be reduced and the dosing rate for flocculant, but only if the redox is higher than a set value e.g.750 mV as an indication for a good water quality
start delay	At a „reset“ in this time dosing is not executed to stabilise the measuring system. The resting time is indicated in the third line on the display. With a “click” you come directly to the set dosing program or to “start”, if a measuring value is not in the p-range. Selection range: 0-15 minutes
date	to adjust
time	to adjust

4. Installation

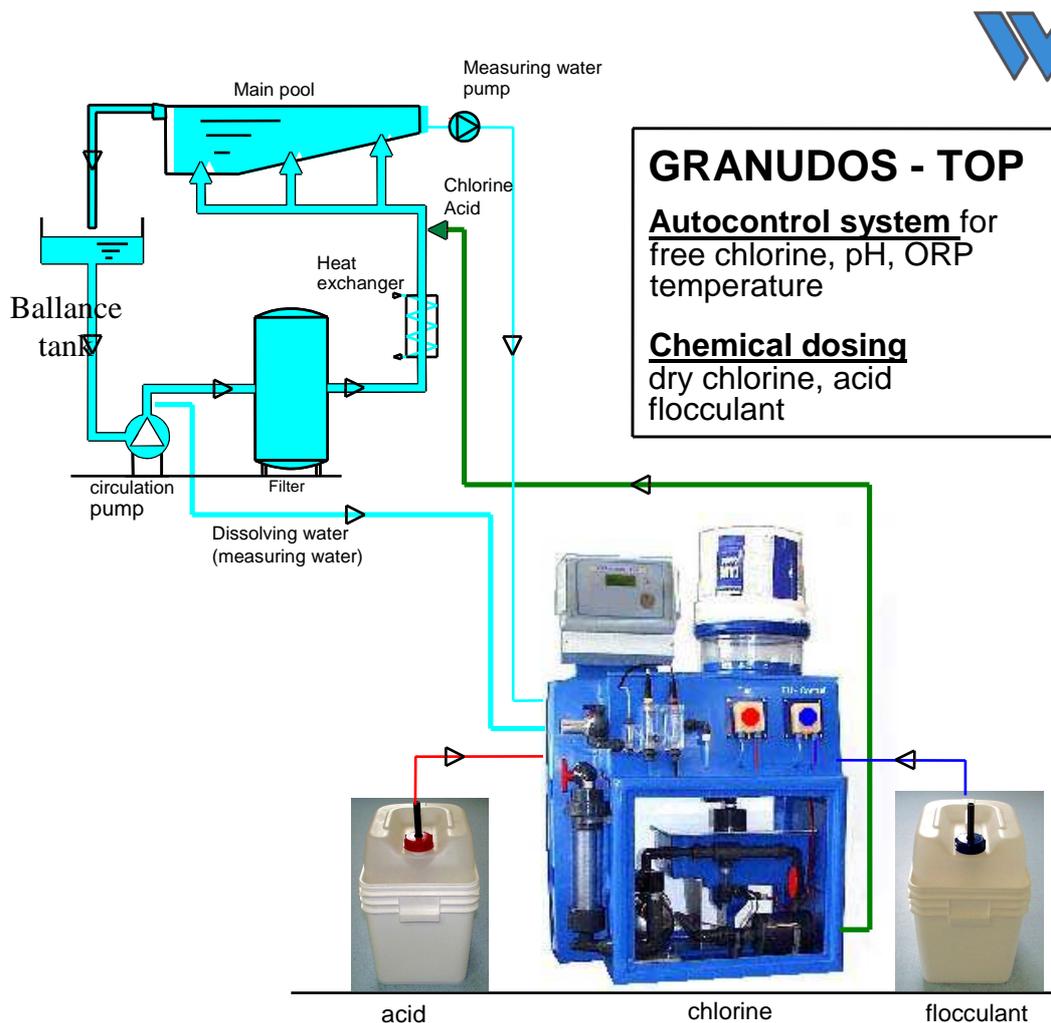
4.1 Tubing – please see installation diagram

For satisfactory water flow through the dissolving system the supply pressure must be at least 0,2 bars. At low service pressure the counter pressure must be low, too. Counter pressure and pressure loss in the dosing line should be as low as possible. At works the GRANUDOS has been tested at following pressure conditions:

Service pressure	1,2 bars	Counter pressure	1,2 bars
	0,6 bars		0,8 bars
	0,3 bars		0,5 bars

Within these ranges the GRANUDOS should function well. In addition please pay attention to the following:

1. Tapping point for supply water to be before filter. Minimum pressure 2 mwg.. Measuring water supply directly from the booster pump or by an extra tapping point. In this case block the measuring water tapping above the booster pump by the attached PVC stopper 3/8"
2. dosing point after heat exchanger
3. Ensure that the tapping/dosing points are free flowing and not blocked by scale or corrosion.
4. Pipe runs to be kept as short as possible. PVC-tubing 25 mm or hose 1". For longer distances or poor pressure conditions use bigger tubing. If hoses are used do not kink them !!
5. Piping should not go up and down as there could be formed "air bags" in the tubing preventing free water flow with consequently damage of the pump – especially at taking into operation.
6. Use high quality PVC ball valves 3/4".
7. If mounted above pool level please install non return valves into the supply and dosing tube, the latter spring loaded (0,3-0,5 bar) to prevent self emptying of the flushing system



4.2 Electrical connection

The electrical supply of the GRANUDOS has to be controlled by the electrical supply of the circulation pumps that dosing can only take place with water circulation and accordingly water supply to GRANUDOS. The GRANUDOS has to be stopped at back washing, too! See wiring diagram
To connect external systems to the GRANUDOS please use only flexible cable type as attached

Electrical works are only to be executed by authorised people.

4.3 Flocculant

If the GRANUDOS Top is supplied with the flocculant pump fit the injector ½” to the tapping point as far as possible before the filter directly before or behind the circulation pump. Do not kink the tubing. If it happens, use a new one!

5. Start

After piping is finished, open the ball valves at the tapping points and at GRANUDOS. Press floater of floating valve inside the tank down to let water flow into the flushing tank. When the flushing tank is half full switch on the GRANUDOS mains, the booster pump of GRANUDOS should not run dry.

5.1 Setting the operation and dosing parameters

Take the attached list of settings and work through all settings as indicated. We recommend to write down all settings in this list for further discussions if needed.

To ensure correct dosing of the chemicals water flow through the flushing tank and measuring cell must run in the correct way as described below, otherwise you get faults indication and no function..

Please note, that this start procedure must be executed at every new start after a longer stop of operation to prevent interruptions and pump failures

5.2 Deaeration of the water supply tubing

When switching on the GRANUDOS take care to deaerate the supply water tubing completely. For this please observe the water level inside the pre-filter. If it get's empty switch off the pump/machine and wait till the filter is full again, then switch on again. On operation the filter must be and stay full of water; a little air at top staying steadily does not matter. The deaeration procedure can take some minutes depending on the length of the supply tubing.

5.3 Adjusting measuring water flow

the flow is adjusted so that the switch bobbin in the flow monitoring is pushed up and the glass beads are rotating effectively in the chlorine as in the pH/redox cell. If measuring water is too low and the switch bobbin falls down, “**meas. water low**” is indicated at the display and dosing is switched off.

5.4 Water level in the flushing tank

Water level in the tank should be maintained at half full. To obtain a higher level unscrew float rod, for a lower level screw in the float rod. One turn gives about 1 cm in height.

5.5 Pressure switch suction side pump

The installed pressure switch has a fixed switch point at 30 cm wg to protect the pump only against cavitation.

5.6 Water flow/Suction performance of the venturi

At stable water level the switch bobbin of the flow switch inside the suction tube (10) should definitely have risen up to the top, the control lamp of the switch may **not** burn.

To adjust the water flow to the pressure conditions of the filter system a nozzle is inserted in the union (13c) behind the venturi. If water level in the tank tends to run low or if switch bobbin is at top without pump running (too high suction at the venturi – high pressure difference between tapping points) fit the nozzle with the 5,5 mm diameter hole you find in the spare parts kit. If the water level tends to run high and/or

suction is too low – switch bobbin does not rise (too high counter pressure?) put in the 7 mm nozzle or use without nozzle.

5.7 Filling of chlorine into the hopper

5.7.1 Filling standard hopper 5 kg without adapter

Before carrying out any task involving chemicals the operator should put an personal protective equipment to provide adequate protection to eyes, respiratory orifices, hands and clothing.

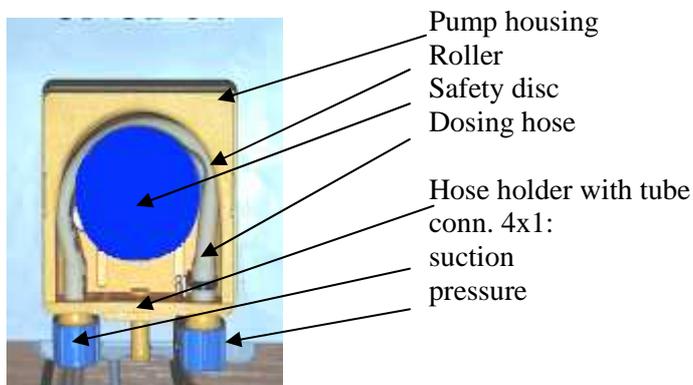
- Lid of control box is closed. Open the chlorine hopper lid.
- Fill the chlorine into the hopper carefully to the hopper wall with help of a scoop from the drum minimising any dusting up of the chemical.
- Add only the consumption of chlorine for app. 2 weeks.
- After filling the hopper carefully cover the lid of the chemical drum again.
- Close the hopper lid.

5.7.2 Filling with adapter HTH 10 kg drum

Put new drum in front and screw off the lid. Lift out the empty hopper from the GRANUDOS housing and put it with the drum to floor. Fix the drum with your legs and turn the hopper off the drum. If chemical rests in the “empty” drum pour it carefully to the “full” drum. Now screw carefully the hopper onto the new drum that the curl fits well together. Take the full drum with the hopper, turn it and put it into the GRANUDOS housing that the cable is behind in the hole on backside and the bolt of the hopper in front in the hole.

5.8 Acid and flocculant dosing pumps

The acid dosing pump (red mark, red dosing tube) and the flocculant dosing pump (blue mark, blue dosing tube) mounted front panel of the housing is delivered with loose dosing hose to prevent deformation on stock time. Push the hose holder into the shaped form of the housing and the hose back into the yellow housing. Turn the roller (half round to outside) clockwise some times so that the hose is situated evenly back in the housing. Then push the safety disc on the shaft and the pump cover – both in the small bag attached above the pump. Position the chemical containers within their safety tubs beside the GRANUDOS, open and put the suction lances marked red and blue into them.



attention

the hose must not be twisted

As acid use one on base of sulphuric acid (37 – 50 %). Do not use concentrated hydrochloric acid as this will damage the peristaltic pump.

6. Calibration of the measuring systems

In the main menu the calibrations are worked through as indicated at the display. Here some general remarks.

Even the measuring systems are working very stable, the characteristics of sensors are changing with time. By daily checks the measuring quality is monitored.

Please note, that the chemical check kits monitoring measures are not exact, that there are systems faults of about +/- 0.2 at pH-Value and +/- 0,5-0.1 mg/l at free chlorine possible. So calibration should only be done after repeated and higher deviation.

6.1 Calibration of pH-value

There are 3 calibration programmes offered by the *Top-Control* system:

- Quick calibration only by using the phenol red indication – calib only within +/- 0.2 pH
- Full calibration programme by the 2 buffer solutions pH 7,0 and 4,0 – **normally used**
- Electrode check

Worked through by the operators guide at the display. Please note, that the phenol red check has a systems fault of +/- 0,2. Only the full calibration will indicate the true pH-value – provided that the buffer solutions are ok.

6.2 Calibration of free chlorine

There are 3 calibration programmes offered by the *Top-Control* system:

- Quick calibration by using the DPD 1 indication – **normally used**
- Full calibration programme – with all advises to the operator
- Electrode check – adjusting zero point of electrode - used if there are severe doubts in measuring.

The experience shows, that the free chlorine measuring should not be calibrated too often. Please note following guide lines. Calibration only if the DPD-check daily before the begin of pools opening:

:

- At several days there is a deviation in the same direction
- More than 0,1 - 0,15 mg/l shows with several checks
- Not too low values shown, at least 0,3 mg/l

Calibration only in the morning before opening the pool when all circulation water has the same quality. With high bathers load and maybe poor hydraulics in the pool the values can change rapidly and calibration can lead to bad results. If calibration seems necessary please calibrate only a half of the deviation and check again next morning.

Please note that the measuring fault with DPD is 0,05-0,1 mg/l . At a low free chlorine value of e.g. 0,2 mg/l the relative fault would be 25-50 % ! After coming up again with the free chlorine to 1 mg/l, the real free chlorine value could be then from 0,5 – 2 mg/l

6.3 Check of redox tension

At normal pool operation the indicated values of free chlorine, pH and redox are in an equilibrium, they show always the same relation. With free chlorine 0,3-0,6 and a pH of 7,0-7,4 the redox indicated should be about 720-780 mV. This actual values depend on fresh water quality and efficiency of the pool water treatment, but they stay constant. As the indicated values of free chlorine and pH are controlled, they stay very constant. If redox indication changes this is an indication for changes in real values of free chlorine or pH or there is a change in the water treatment, e.g. flocculation, bad backwashing, etc. So first check the free chlorine and pH and if they are ok than check the redox as shown in the programme. If this is ok too check your water treatment.

If there are inconsistencies mostly the fault is at the pH-electrode even it can be calibrated normally. The platinum electrode normally is very stable

7. Faults and alarm identification and problems solving

All faults caught by a switch or sensor input as all value alarms are identified and shown at the display in the 3rd line. Here is only the 1st fault shown. Following faults are shown in a listing after “click” on the cursor before the fault indication. As all switches at the GRANUDOS 10 are normally open a fault is clearly indicated by the (1) at the end of the line indicating “closed”. In the line is also indicated on what connector the switch is connected.

The faults or alarms must stay for at least 6 seconds to be recognised. If a fault/alarm vanishes itself, the Granudos starts again automatically. If a switch obviously is faulty and stops function, you can start the machine by disconnecting the faulty switch, but see for a new one as this function is now not monitored.

7.1 Faults indicated by monitoring switches

Flow meas-w 6.2-1 (1) (6. is push connector S6 – contacts 2-1)

Flow switch for measuring water indicates too low flow. Flow switch bobbin is not on top.

Increase flow, clean pre-filter and screens in the chlorine and pH-cell

Empty Cl 2 5.7-9

In the GRANUDOS 10 the chlorine hopper empty switch is **not** installed. Switch input bridged.

Empty pH 4.1-2 1

Acid container indicates empty. Change container to a full one.

Empty flocc 4.4-3 1

Flocculant container empty. Replace container with a full one.

Pressure GR 4.9-8 1

Pressure of supply water to GRANUDOS is too low. Granudos stops.

When taking in to operation the supply pressure is really too low. From works the switch pressure is fixed to 0.5 bar. After opening the switch cover, you can readjust the switch pressure to 0,2 bars. This should be the minimum.

See for pre-filter, maybe a supply valve has been shut?

Suction low 5.3-1 1

There is more water coming into the tank than is sucked away by the venturi.

Suction power of venturi is not enough: switch bobbin of flow switch in suction tube is at bottom of tube.

By pressing the connecting hose from tank to the suction tube the bobbin does not move, switch LED burns.

- At installation: service pressure too low – counter pressure too high. tubing faulty or too small: take out orifice washer (13c) from union behind venturi.
- Booster pump performance too low – see pressure limits at para “**Installation – piping**”.
Fit the supplied pressure gauge to inlet and outlet to check pressure situation.
- Particles inside venturi or at outlet nozzle of flushing tank (high possibility after installation)
- Suction tube and/or mixing cyclone are turbid by calcium: acid dosing too low:
If there is still a little suction this can be easily cleaned by pouring hydrochloric acid into the suction cone of the tank.

Level high 4.7-5 1

Water level in the flushing tank high.

If suction power of venturi is O.K. switch bobbin of flow switch in suction tube is at top of tube. By pressing the supply hose to the suction tube the bobbin goes down and switch LED burns. If loosened again, bobbin goes up quickly and switch LED goes out.

In this case there should be a fault in the floating valve: check whether by moving the floater slowly up and down the incoming water flow decreases or increases steadily. If so adjust water level by turning the floater rod one turn right. If floating valve does not work steadily, fit a new valve diaphragm.

If suction is not sufficient, see above at “**Suction low**”

level low 4.6-5 1

water level in the flushing tank is low.

- Suction power too high: fit an orifice washer (13c) of 5,5 mm inside union behind venturi.
- Supply water tubing is blocked
 - Floating valve to tank is blocked

Cl 2 missing 5.6-4 1

chlorine missing switch is indicating at the program “buffer tank filling” no dosing chlorine. GRANUDOS switches off as obviously there is a problem at the chlorine dosing technics.

7.2 Input switches to start special programmes (shown as programme status – not as fault)

shock-disin	6.6-5	0	shock disinfection/high chlorination - not active version 8/03
off CCT	6.8-7	0	Granudos switched off by the central control technics
buffer	6.4-3	0	buffer tank empty switch to start filling of buffer tank.

7.3 Software alarms

There are only allowed ranges for the setting of alarm levels depending on the set points. Some alarms can be deactivated by setting a “0” instead of a value in the settings windows.

At software alarms principally check the water figures free and combined chlorine and pH. If the shown values are not correct, first calibrate / check the electrodes .

Redox high

Indication for high free chlorine or good water quality.

If free chlorine indication at the display is high too, reduce dosing performance of chlorine and/or set higher redox alarm level.. See for better sampling water take off point. If chlorine indication is normal at set point, check free chlorine by DPD method and adjust the measuring system.

Check pH – may be too low – see para. 6.3

Redox low

Indication for low free chlorine or poor water quality

If free chlorine indication at the display is low too:

- fault on chlorine dosing technics
- check output voltage, test dosing by activating output for chlorine dosing motor

Chlorine high

- check pH – may be too high – see para. 6.3

- Chlorine dosing motor output faulty, dosing whereas set point is surpassed – use new electronic plate

- poor hydraulics in the pool can lead to uneven distribution of chlorine to the sampling water. Reduce dosing performance at increased basic dosing

Chlorine low

- fault on chlorine dosing technics

- check output voltage, test dosing by activating output for chlorine dosing motor dosing screw blocked or loose, heated dosing nozzle blocked.

- poor hydraulics in the pool, clouds without chlorine coming to measuring water take out - increase dosing performance at increased basic dosing

pH high

acid dosing motor output or dosing pump/hose faulty.

:

check dosing function of acid pump by selecting test program for acid pump. If pump runs, see whether an air bubble is sucked to pump, if not examine the pump roller and pump hose. If all is OK, choose lower set point for pH

pH low

- acid dosing motor output faulty, dosing whereas set point is surpassed – use new electronic plate

7.4 Faults not indicated by monitoring switches

Overflow from tank too much at switch off of GRANUDOS

- switch bobbin of flow switch blocked on top situation
- sealing of switch bobbin faulty
- membrane of floating valve faulty
- supply pressure of an external booster pump too high
- set in spring-loaded check valve in ell of floating valve. Please make sure that because of pressure drop you will need a pressure of at least 0,4 bar.

8. Maintenance

It is strongly recommended that a regular maintenance programme is undertaken. Consult your installer/supplier and take up a service/maintenance agreement. This way the machine will be maintained in good operating condition. The machine should be serviced at least once a year.

8.1 GRANUDOS functions

Minimum checks include the following items:

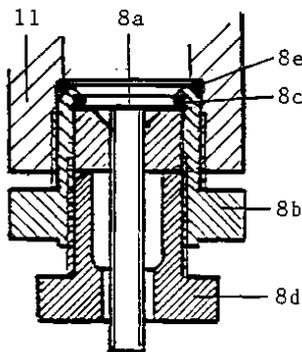
- **maintain the environment of the machine clean**
- clean strainer if necessary – a polluted filter causes cavitation and consequently damage of the booster pump.

For cleaning take out the complete filter and clean the filter insert outside.

- pay attention to any noise of the pump: cavitation, bearings – if so, contact your supplier
- check monthly for the acid pump whether the springs are o.k. If corrosion can be seen, change the dosing hose. In any case change it once per year.
- monthly or with each new drum/filling up check function of all sensors i.e. water flow, level and empty switches
- every 2 months clean the chlorine dosing screw: dismantle the hopper and take out dosing motor with the screw, clean with a brush – do not use water
- change membrane of floating valve once per year
- change seal of flow switch bobbin every ½ year
- check once per year acid dosing valve – change seals

8.2 Measuring technics

8.2.1 Chlorine electrodes - Changing and cleaning



The chlorine sensor itself is the gold electrode (8a) with the contact tube. It is fitted into the stainless steel electrode holder 3/4" (8b) with a flat joint (8c). for cleaning or change if worn :

- Pull out the push connector down and place it to the side to prevent water entering connectors.
- Screw out the electrode holder (8b) from the cell.
- Screw out the pressure screw 1/2" (8d)
- Now take the isolated contact tube and pull it out
- clean the electrode with alcohol and electrode cleaner

**Attention! The electrode cleaning liquid is a light acid
Before fitting the gold electrode clean and dry it well
Fit a new flat gasket and fill than the cavity with cleaning glass beads.**

To change the reference electrode undo screw connector and place it to side that it does not get wet. A cleaning of the electrode is technically not necessary. In any situation do not wipe over the diaphragm to avoid scaling

8.2.2 pH-electrode

- At any circumstance avoid moisture getting into the connection of the electrode. The electrode will not function.
- Pay attention, that there is no air in the bottom part of the inner electrode. Remove air by shaking it like a medical thermometer.

Attention! New electrodes are to be calibrated before taken into service

8.2.3 Redox- electrode

The redox-electrode is fabricated the same as the chlorine electrode

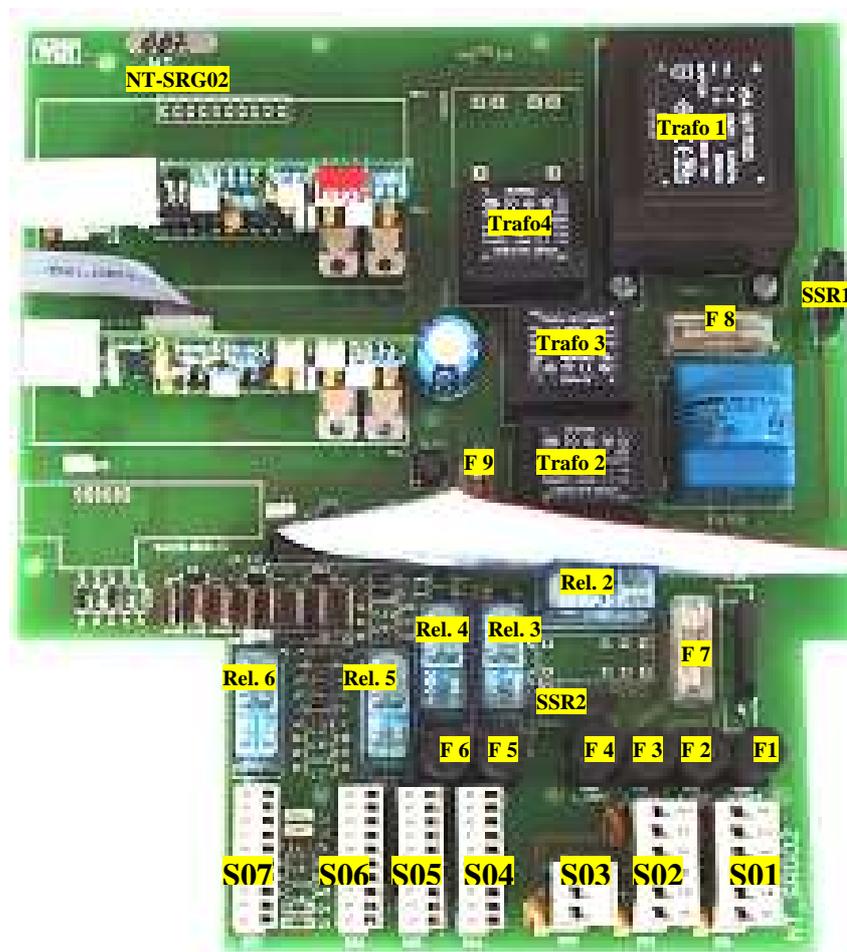
8.3 Taking out of service

- disconnect acid dosing hose (or use a new one at starting again)
- empty the dosing hopper, take out chlorine dosing screw, clean it thoroughly and store it at a dry place
- clean all parts of GRANUDOS thoroughly, empty all water containing parts as measuring cell, pump, filter, mixing cyclon
- leave the GRANUDOS switched **on** – use **program status “off”**
- clean the environment of the machine thoroughly.

If there is no risk of frost keep the electrodes within the cell.

9. Base plate

9.1 Fuses, relays, transformers, amplifiers



Fuses

F1	solenoid knocker	315	mAT
F2	mains	4,0	AT
F3	booster pump, (supply solenoid valve - option)	3,15	AT
F4	solenoid valve buffer tank (option)	1,25	AT
F5	power output 24 VDC total	800	mAT
F6	chlorine dosing motor	315	mAT
F7	supply NT-SRG02 internal 240 volt	1,25	AT
F8	transformers 3+4 for amplifiers	100	mAT
F9	control plate transformer 9 VAC	315	mAT

Relays

SSR. 1	solenoid knocker 240 v (solid state relay)
SSR 2	Solenoid valve buffer tank filling
Rel 1	reserve
Rel. 2	booster pump 240 v
Rel. 3	locking relay control chlorine
Rel. 4	locking relay control acid
Rel. 5	fault remote control non volt (normally open)
Rel. 6	turn change chlorine dosing motor

Transformers

Trafo 1	power transformer 24VDC, 16 VA
Trafo 2	control plate transformer 9VAC
Trafo 3	amplifier pH, Redox
Trafo 4	amplifier chlorine, temperature

9.2 Connecting table (The connectors nos. are printed on the plate below the connector)

Connectors 240 VAC 6 x 5 mm

Connector S01

1	Ph	Supply 240 v
2	N	Supply 240 v
3	SL	
4	SL	
5	-	205 VDC knocker
6	+	205 VDC knocker

Connector S02

1	Ph	booster pump
2	N	booster pump
3	SL	
4	SL	
5	N	solenoid valve parallel to booster
6	Ph	solenoid valve parallel to booster

Connector S03 solenoid valve buffer tank filling

1	SL
2	N
3	Phase

Connector S04

Switches from dissolving system, empty switches

1 - 2	empty acid
3 - 4	empty flocculant
5 - 6	water level low
5 - 7	water level high
8 - 9	pressure switch supply

Connector S05

1	-	flow switch suction GR
2	+	flow switch suction GR
3		switch lead flow switch suction GR
4	-	chlorine missing switch
5	+	chlorine missing switch
6		switch lead chlorine missing switch
7		bridge to conn. 9
8		
9		bridge to conn. 7

Connector S06

1 - 2	flow switch measuring water
3 - 4	buffer tank empty - filling
5 - 6	Filter disinfection /shock chlorination
7 - 8	Granudos off-CCT
9 - 10	fault remote (NO) (for low tension only!!)

Connector S07 - 24 VDC-dosing motors

1	-	flocculant pump
2	+	flocculant pump
3		
4		
5	-	dosing pump acid
6	+	dosing pump acid
7	-	heating nozzle
8	+	heating nozzle
9	-	dosing motor chlorine
10	+	dosing motor chlorine

Detailed current diagram see last page!

10. Spare Parts GRANUDOS 10 Top

	<u>Designation</u>	<u>Item No.</u>
Chlorine dosing	dosing hopper 5 kg	12798
	cover for dosing hopper GR 10	12353
	dosing motor PLG 30-12 rpm	13811
	motor holder PLG- d25	11541
	dosing screw d6/D19 GR10	12320
	dosing nozzle heated GR	11556
	knocker GR 10 complete	12868
Acid dosing	acid pump Sa complete	11628
	pump housing Sa	12702
	roller Sa	12609
	dosing hose 3.2x1,6 Sa	12782
	supply carbuoy lance	12523
	acid injection valve GR	11633
	repair set for acid valve	11636
Flocculant pump	dosing hose 0,8x1,6Ph-Sa	13482
	other pump parts identically to acid pump	
Filter	filter housing d75 GR	12746
	filter top with PVC ball valve d25	12304
	O-ring filter GR	11258
	cover control box GR10	10796
Floating valve	floating valve d25 GR10 complete	12916
	membrane for floating valve	11619
	floater	11621
	level switch GR/PAK	10496
Booster pump	booster pump Lo 2HMS3-A	10657
	slide ring seal complete -A	12800
Flow switch assembly	flow switch holder GR ½'' – S14 US	12729
	flow switch GR/PAK ind. 18x1	11603
	flow switch bobbin ind. ½''US	12730
	seal ring Vi 14/9 flow switch bobbin	11090
	connecting tube Si 10/2,5/180	11565
	venturi ½'' GR/PAK complete	11792
	orifice washer for venturi	11594
Venturi	venturi-nozzle ½''	12306
	venturi-body with connector ½''	12305
	mixing cyclon GR 10 Top	13778
Cyclon Control system	measuring / basic plate SRE-02	13781
	controller plate SRE-02	13780
	cover lid to Top Control	13779
Electrodes	pH-electrode	10933
	chlorine-electrode ¾'' Top SS-gold complete.	13782
	redox-electrode ½'' complete.	11984

11. Settings List - Protocol for taking into operation

We recommend to write down all parameters set at taking into operation

	parameters set by factory	Parameters set at taking into service	Optimum parameters in service
User code	0 0 0 0		
Status Programm	auto		
Status Redox	Indic. (only redox alarms)		
Para. Chlorine			
- performance test	factory - 1000 g/h		
- set value	0,5 mg/l		
- p-range	0,2 mg/l		
- alarm high	0,7 mg/l		
- alarm low	0,2 mg/l		
- dosing cycle	60 seconds		
- dosing output	200 g/h		
- base dosing	5%		
- high dosing	500 g/h		
- start up time	0 minutes (not active)		
- dos. monitoring	0 minutes (not active)		
Para. pH			
- performance test	factory 1000 ml/h		
- set value	7,1 pH		
- p-range	0,2		
- alarm high	7,5 pH		
- alarm low	6,8 pH		
- dosing cycle	60 (see chlorine)		
- dosing output	100 ml/h		
- base dosing	5%		
- high dosing	200 ml/h		
- start up time	0 minutes (not active)		
- dos. monitoring	0 minutes (not active)		
Para. Redox Alarms			
- redox alarm high	900 mV		
- redox alarm low	600 mV		
Para. Redox control			
- set value	750 mV		
- p- range	100 mV		
- alarm high	800 mV		
- alarm low	650 mV		
Para. Flocculation			
- Status floc	on		
- performance	factory 105ml/h		
- standard dos. rate	0,5 ml/m ³		
- circulation	50 m ³ /h		

	Factory parameters	Parameters taking into service	Optimum parameter in service
Para. Shock chlorination			
- day, time	Fr – 22 hour		
- duration time	0 minutes		
- high chlorination output	output		
Night dosing	not active 08/03		
- status	off		
- chlorine set value	0,3 mg/l		
- floc. dos. reduction	20 %		
- aktive at redox over	750 mV		
- start time	20 hour		
- end time	06 hour		
Start delay	5 minutes		
network	not active		
language	not active		
printer	not active		

Remarks:

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Date

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place

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Fitter

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operator