AQUA CUBIC

USER'S AND MAINTENANCE MANUAL

VALVES
CONTROLLERS
ACCESSORIES

EC DECLARATION OF CONFORMITY

Manufacturer **S.I.A.T.A. S.r.l.**
Address Via Virginio 370/372
50025 Montespertoli-Florence (ITALY)

Herewith declares that:

PN
AC5-02/05

Description
AQUA CUBIC DUPLEX CONTROLLER

is in *conformity* with the provision of the following EEC directives:

- **Elettromagnetic Compatibilty 89/336/EEC, 93/68/EEC**
- **Low Voltage 73/23/EEC,93/68/EEC**

and that the following harmonized standards have been applied:

EN 50081-1 Generic Emission Standard-Part 1:residential,commercial and light industrial premises.
EN 50082-1 Generic Immunity Standard-Part 1:residential,commercial and light industrial premises.
EN 60742 Directions concerning isolation and security trasformers.

S.I.A.T.A. S.r.l. has a quality system in accordance with the requirements of **ISO 9001/ UNI EN ISO 9001-ed.1994** (Certificate n° 95.022 SGS ICS)

Date
18.09.1998

Managing Director
LUIGI FERRALI

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1 – GENERAL CHARACTERISTICS

Aqua Cubic controls the SIATA multi-way valves for water treatment devices.

The regeneration cycle is completely programmable. It can be enabled using on of the following ways:

- As soon as the treatable volume becomes exhausted;
- Manually, by means of **Manual Regen** key.

Aqua Cubic is provided with an **EEPROM** that stores programming data, and a **buffer battery** that allows working parameters to be maintained in memory when power is off.

Aqua Cubic, as well as all the SIATA *controllers*, complies with the EC Directives. It is assembled in the SIATA factory in Montespertoli, Florence, Italy, operating with its certified Quality System according to

ISO 9001 / UNI EN ISO 9001.

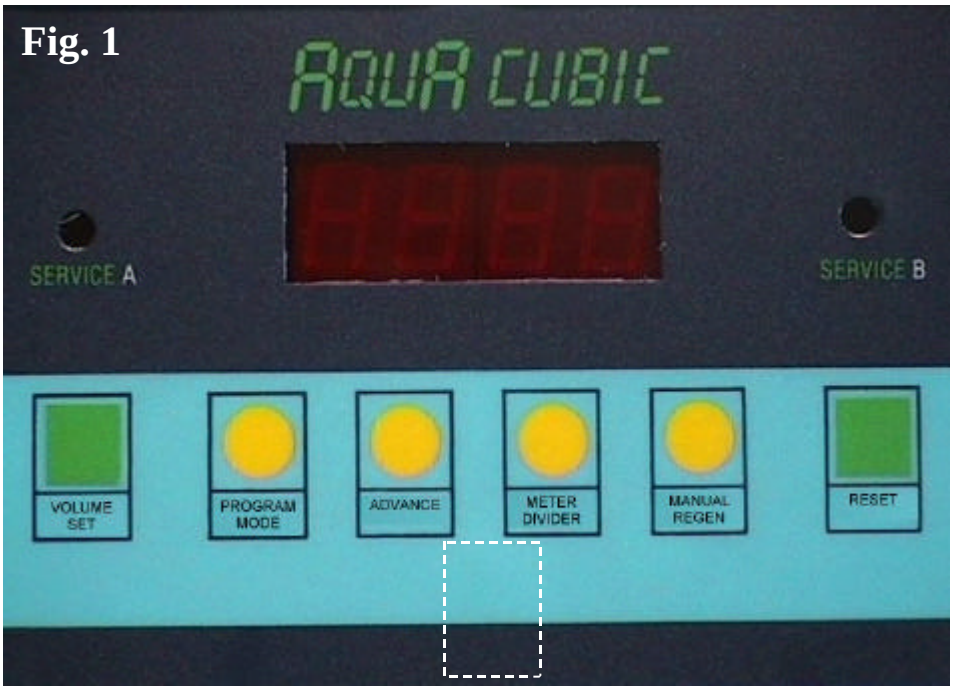
2 – TECHNICAL DATA

Supply Voltage	230 Vac ± 10% (*)
Mains Frequency	50 Hz ± 3% (*)
Adsorbed Power	4.6 VA
Working Temperature	4° C – 40° C
Case Size	165 mm x 127 mm x 70 mm
Total weight	0.8 to 1.5 Kg

(*) Special versions are available upon request.

3 – MEANING OF LEDs AND KEYS

Fig. 1



Meaning of LEDs (Tab. 1)

SERVICE A	ON when column A is working
SERVICE B	ON when column B is working

Meaning of keys (Tab. 2)

VOLUME SET	Allows to change the available volume. At the end of programming, allows to set regeneration cycle phases.
PROGRAM MODE	Allows to program regeneration cycle phases.
ADVANCE	If pressed while in programming or time setting, it increases the digit currently blinking on the display. If pressed on normal operations, it leads to diagnostic functions (from ver. 9/98)
METER DIVIDER	Allows to set the divider of the liter counter.
MANUAL REGEN	Allows to manually activate the regeneration. If pressed while in stop, it sets the residual time to zero and allows to enter the next phase (step-by-step) from version 9/98.
RESET	Pressed while in programming mode, it allows to quit without saving the parameter currently edited. Pressed during regeneration, it terminates it.
HIDDEN KEY	It is located below the six keys, centered between Advance and Volume/Clock. It starts a test regeneration (1 min. for each phase). If pressed during some programming operations, it sets the digit currently blinking to zero.

4 –CODE MEANING

Fig. 2

On the case rear panel a label as in Fig. 2 indicates:

AC5-02/05	the controller code
12804	the progressive number (which is the same as the lot number)
SN 228/98	the serial number with reference to the code

In particular, the controller code is composed as follows:

AC 5 – 02 / 05

- Controller version, assigned by the Technical Office for customizations (05 = standard).
- Typology of the electric connections (02 = DIN sockets).
- Number of installed drivers (5 = 5 drivers).
- Family to which the controller belongs (AC = Aqua Cubic).

5 - GENERAL INFORMATION

Please find herewith below some instructions to be followed during the controller usage and maintenance in order to ensure its long operating life.

5.1 – Packing and storage

The package consists in a box with a product identification label.
The device must be stored in environments compliant with the following characteristics:

- temperature from +4°C to +40°C;
- relative humidity from 30 % to 95 %.

5.2 – Installation

The *controller* installation must be performed by qualified technical staff; the installation procedures must be performed when the device is disconnected from power.
The device consists in an ABS case closed on the front side by a cover blocked with 4 screws, fixed with four screws and protected by a transparent cover.
The controller is supplied by a 230/12 Vac transformer. Different transformer types (e.g. 115/12 VAC 60 Hz) are available upon request.
The case of **Aqua Cubic** has a hole on the right side, near the DIN 180º connector (see Fig. 7).

Fig. 3

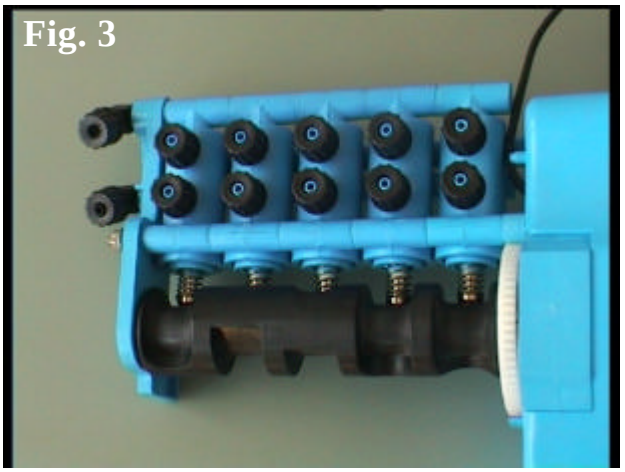
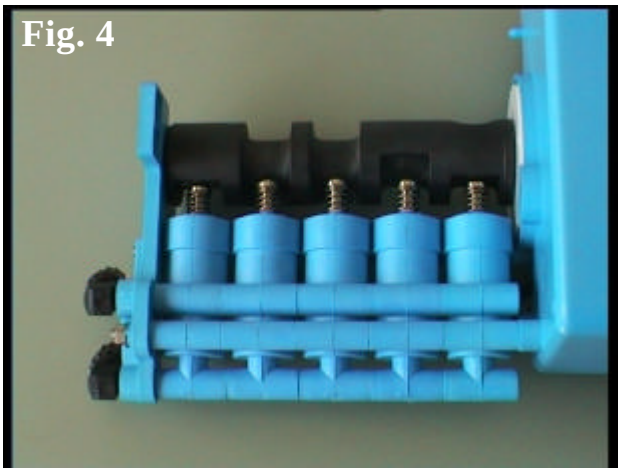


Fig. 4



Should you prefer to feed the *controller* external drivers (see Fig. 3 and 4) with compressed air, please verify that:

- The driving air pressure ranges from 1 to 6 bars. In no case the air pressure can be higher than the input water pressure;
- An air humidification system (using water or an adequate silicone lubricant) is mounted on the pneumatic line. This is required to prevent internal driver seals from getting dry.

SIATA recommends to always supply drivers with water. In this case it is necessary to use an input filter to avoid impurities.

Please be particularly careful when installing the controller in environments that are not compliant with the EN 50082-1 standard (Electromagnetic Compatibility).

5.3 – Maintenance

Please mind to check the battery efficiency about every 12 months as follows:

- Write down the volume shown on the display. Verify that the value is not equal to the treatable volume (you can access it by pressing Volume Set).
- Turn the timer off for about 15 minutes.
- Turn the timer on. Read the value shown on the display: if the display shows the total treatable volume instead of the value previously written, then replace the battery using the spare part code 867.

The following servicing operations **must always be performed when the controller is off power**.
When replacing the sole electronic board, and each time you must operate with the case opened, avoid as much as possible touching components and welded parts with your hands, especially near the CPU, since electrostatic discharges could eventually cause serious damages to the *controller*.
Moreover, it is better not to place the electronic board on a metal surface, unless this has been properly insulated (a few paper sheets are enough).
To store electronic boards, always use the anti-static envelopes that come with the replacement kits.
Avoid the electronic board to come in contact with liquids. Should this happen, dry the board with an air jet.

5.4 – Safety devices

The *controller* is equipped with the following safety devices:

- Safety and insulation transformer.
- Safety electronic circuit against voltage peaks and disturbances.
- Autoreset (from version 9/98)

6 – INSTRUCTIONS FOR USE

6.1 – Powering on

Aqua Cubic is not provided with power switches. Powering on is obtained by plugging the power transformer into the outlet.

6.2 – Working

After powering on, the display located on the front panel shows the available volume.
When powering on for the first time, it is advisable not to switch off the controller for at least 24 hours on end, in order to avoid an anomalous battery charge.

The activation of the regeneration process is triggered after the available volume becomes exhausted. If a liter counter sensor is not connected to the controller, then the regeneration can only start by pressing the **Manual Regen** key.

Event	What happens	Displayed code
Powering on	The display shows the available volume	**2 0 0 0**
Start of operation	When a regeneration process terminates, or when the Reset key is pressed, the working parameters are restored with previously programmed values. The display shows the whole treatable volume.	**2 0 0 0**
Volume is exhausting	While on-duty, impulses generated by the counter decrease the treatable volume.	**1 9 9 9**
	When the volume reaches 0, regeneration starts.	**1 C 2 5**
An inhibition signal is present on the DIN 180º plug (see fig. 11).	This event is not indicated in any way on the display. The *controller* cannot start any regeneration while this signal is active. Anyway the operator can force a regeneration start by pressing the **Manual Regen** key.	
Manual Regen key pressed while on duty.	A regeneration cycle starts, even if the controller is inhibited (see previous event).	**1 C 2 5**

6.3 – Programming mode

Pressing the **Program Mode** key accesses programming of regeneration cycle times. Pressing the **Advance** key changes values. Proceed as follows:

Programming table (Tab. 3)

Step	☞	Display	Meaning
1	PROG. MODE	2 0 0 0	Remaining volume. Display does not change.
2	VOLUME SET	1 d 2 5	Rotation time for the first phase. **Do not modify.**
3	PROG. MODE	1 C 1 0	Stopping time for the first regeneration phase.
4	PROG. MODE	2 d 2 5	Rotation time for the second phase. **Do not modify.**
5	PROG. MODE	2 C 3 0	Stopping time for the second regeneration phase.
6	PROG. MODE	3 d 2 5	Rotation time for the third phase. **Do not modify.**
7	PROG. MODE	3 C 2 0	Stopping time for the third regeneration phase.
8	PROG. MODE	4 d 2 5	Rotation time for the fourth phase. **Do not modify.**
9	PROG. MODE	4 C 2 0	Stopping time for the fourth regeneration phase.
10	PROG. MODE	5 d 0 0	Rotation time for the fifth phase. **Do not modify.**
11	PROG. MODE	5 C 0 0	Stopping time for fifth regeneration phase.
12	PROG. MODE	6 d 0 0	Rotation time for the sixth phase. **Do not modify.**
13	PROG. MODE	6 C 0 0	Stopping time for the sixth regeneration phase.
14	PROG. MODE	7 d 0 0	Rotation time for the seventh phase. **Do not modify.**
15	PROG. MODE	7 C 0 0	Stopping time for the seventh regeneration phase.
16	PROG. MODE	8 d 0 0	Rotation time for the eighth phase. **Do not modify.**
17	PROG. MODE	8 C 0 0	Stopping time for the eighth regeneration phase.
18	PROG. MODE	8 C 0 0	New values are stored into the EEPROM.

Programmed as shown, **Aqua Cubic** is a double-working device, where the two columns work alternatively and are regenerated one at a time. It is possible to request the single version, where both columns composing the device work at the same time and are regenerated in sequence.

To set the volume, press the **Volume set** key and proceed as follows:

Volume setting (Tab. 4)

Step	☞	Display	Meaning
1	VOLUME SET	0 2 0 0	Volume. The digits on the right-hand side blink.
2	ADVANCE	0 2 0 1	Setting.
3	VOLUME SET	0 2 0 1	Volume. The digits on the left-hand side blink.
4	ADVANCE	0 3 0 1	Setting.
5	VOLUME SET	0 2 0 0	Volume storage. The display shows the value as before the changes.

The volume set following the procedure of **tab. 4** does not become active at the end of the programming. It becomes active only by pressing the **Reset** key or after a regeneration process.
Thus, after setting the volume (**step 5 of Tab. 4**), the display shows the residual volume and not the volume just set.

To set the divider of the counter, press the **Meter divider** key and proceed as follows:

Divider setting (Tab. 5)

Step	☞	Display	Meaning
1	METER DIV.	A A 0 1	Divider. The value blinks.
2	ADVANCE	A A 0 2	Setting operation.
3	VOLUME SET	0 2 0 0	Divider storage. The display shows the new value.

Any time you press **Reset** while executing the procedures of tables 3, 4 and 5, you will exit the programming procedures without saving the changes.

The **Hidden key** allows to set the edited value to zero.

NOTE:
The values shown in the column **Display** of tables 3, 4 and 5 are only examples.
The controller can display values completely different from those indicated here.

6.4 – Special systems

The full version of **Aqua Cubic** (with 3 DIN plugs, see fig. 9) allows you to control systems with SIATA valves and diaphragm valves, or systems with diaphragm valves on specific request.

6.5 – Normal operations

Aqua Cubic, as well as the other SIATA *controllers*, is considered "on duty" when it is able to accomplish a regeneration. This is possible ONLY when the *controller* "senses" that the cam is correctly positioned at the limit stop.
To perform some tests before installation, **Aqua Cubic** must be connected to its case, so that the limit switch be correctly closed.
Aqua Cubic does not allow any operation until the limit switch input is closed.
As already indicated in 6.3, after programming **Aqua Cubic** press the **Reset** key or perform a regeneration process in order to transfer the new parameters into the memory.

6.6 – Managing the volume

Steps of **tab. 4** show how to program the treatable volume.
If you use the Hall effect-based, SIATA liter counter, then set the divider (**AA01**, **tab. 5**) to 14, that is, every 14 impulses the available volume is decreased by an average, non settable amount of one liter. Thus the maximum programmable volume is **10.000** liters. If you need to use a larger volume, then use a simple arithmetical operation by multiplying the divider by two, three, four and so on. At the same time, divide the treatable volume by two, three, four and so on.
For example:

15.000 liters of water must be treated.

Volume / 2	15.000 / 2	**7500** in **steps 1** and **3** of **tab. 4**
Divider x 2	AA14 x 2	**AA28** in **step 2** of **tab. 5**

When the device begins working, the treatable volume will be **7500 liters**.

50.000 liters of water must be treated.

Volume / 5	50.000 / 5	**0000** in **steps 1** and **3** of **tab. 4**
Divider x 5	AA14 x 5	**AA70** in **step 2** of **tab. 5**

When the device begins working, the treatable volume will be **10000 liters** (displayed as **0000**).

Please note that Setting the volume to **0000** means setting it to **10.000**. Setting the divider to **AA00**, means setting it to **100**.

The maximum treatable volume when using the Hall effect-based, SIATA liter counter is **70.000** liters, obtained by setting the treatable volume to **10.000** liters and the divider to **AA98**.

If you use a counter issuing one impulse each liter (or cubic meter), the maximum treatable volume is **1.000.000** of liters (or cubic meters). To do so set the treatable volume to **10.000** liters and the divider to **AA00** (this corresponds to 100 impulses each liter or cubic meter). Please note that, given the nature of the Reed counters, the usage of counters type 1 impulse/1 m^3 or similar is discouraged.

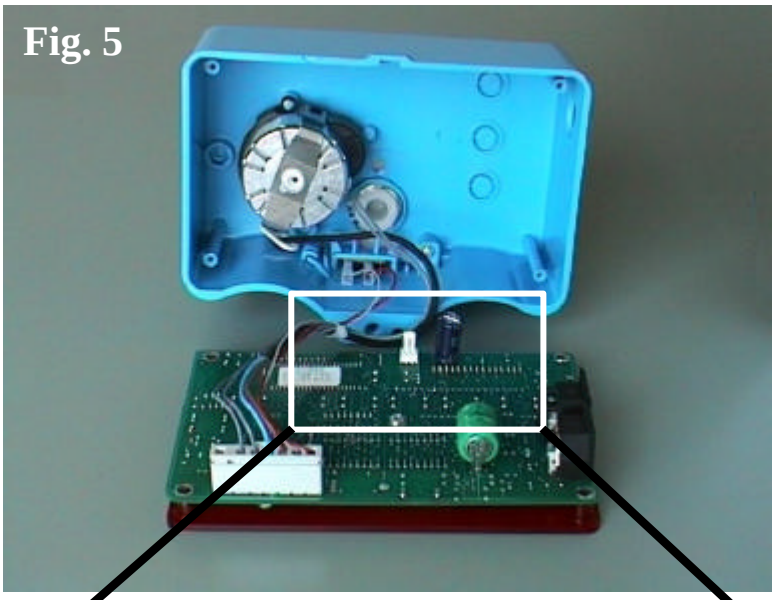
6.7 – Reset

Several events may influence the *controller*: battery exhausted, very high electromagnetic disturbance (beyond the limits established by the EN 50082-1 standard), handling the electronic board, a short circuit between connections or DIN sockets.
Such events may cause one of the following problems: the "out of program" and the "latch up".
In the first case, the RAM on the CPU becomes "dirty" due to the disturbing event. The results are unpredictable: for example, complete failure of the *controller*, abnormal behavior, or the alteration of working parameters.
The second case happens when the CPU autonomously turns its state to "latch-up", a special condition that allows it to be protected against potential damages.
The difference consists in the fact that the first condition is mostly autonomously solved by the controller thanks to an autoreset circuit that becomes active when it is not receiving any signal from the micro-controller for at least 5 seconds of anomalous microcontroller signals. The second condition always requires a manual intervention.

Figures 5 and **6** show where it is necessary to intervene in order to solve the above mentioned conditions.

The first operation to be performed when the controller is apparently off, or when its behavior is anomalous, is the so called "software reset". It consists in short-circuiting for a while points **A1** and **A2** shown in fig. 6, when the controller supply transformer is connected to the supply voltage.
If this operation gives no results, proceed with the second reset type: the "hardware reset".
It consists in short-circuiting for 5 seconds points **B1** and **B2** shown in fig. 6, when the controller supply transformer is **disconnected** from the supply voltage. Once this operation is completed, connect the supply transformer to the supply voltage and check that the controller powers on immediately or after the 5 seconds necessary for the autoreset. If the controller does not power on, repeat the "software reset " on points **A1** and **A2** shown in fig. 6.
If the controller still remains off, please refer to **Chap. 7**.

Figures 5 and 6 show the points involved in the reset procedure.



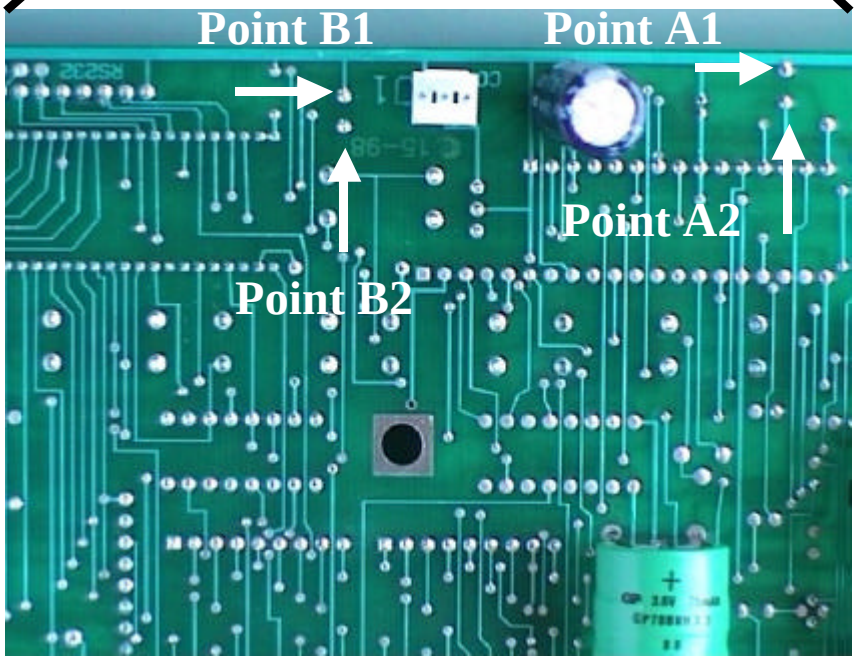


Fig. 6

6.8 – Connections

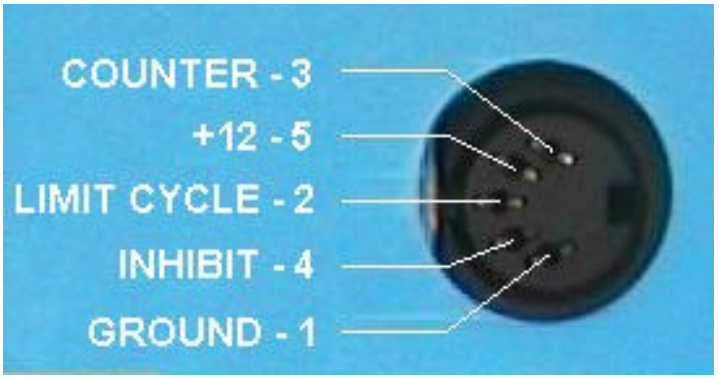


Fig. 7

Through the 180º DIN socket, shown in fig. 7, **Aqua Cubic** can be connected to some external devices as follows:

Contacts	Function
1 – 3	Volume, reed counter or counters with make, not supplied.
1 – 5 – 3	Volume, magnetic, Hall effect counter, +12 VDC supply.
1 – 4	Inhibit signal input (when closed).
2 – 5	Cycle End Impulse output, Open Collector.

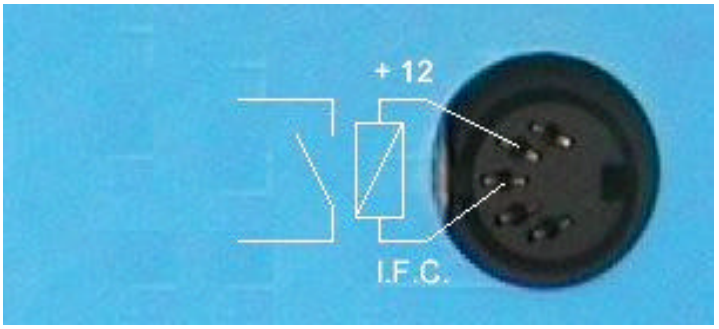


Fig. 8

Fig. 8 shows the correct usage of Cycle End Impulse, available as Open Collector. The relays should not exceed a maximum coil activation current of **20mA**.
Below are the codes of some relays that can be used for this purpose. They all have a coil voltage of 12 VDC:

Manufacturer	**Model**
OMRON	G5V-1 12Vdc
TAKAMISAWA	MZ-12HS-U
MATSUSHITA	JQ1-12V or JQ1a-12V or HD1-M-DC12V

6.8.1 – Connecting the model to 3 DIN sockets

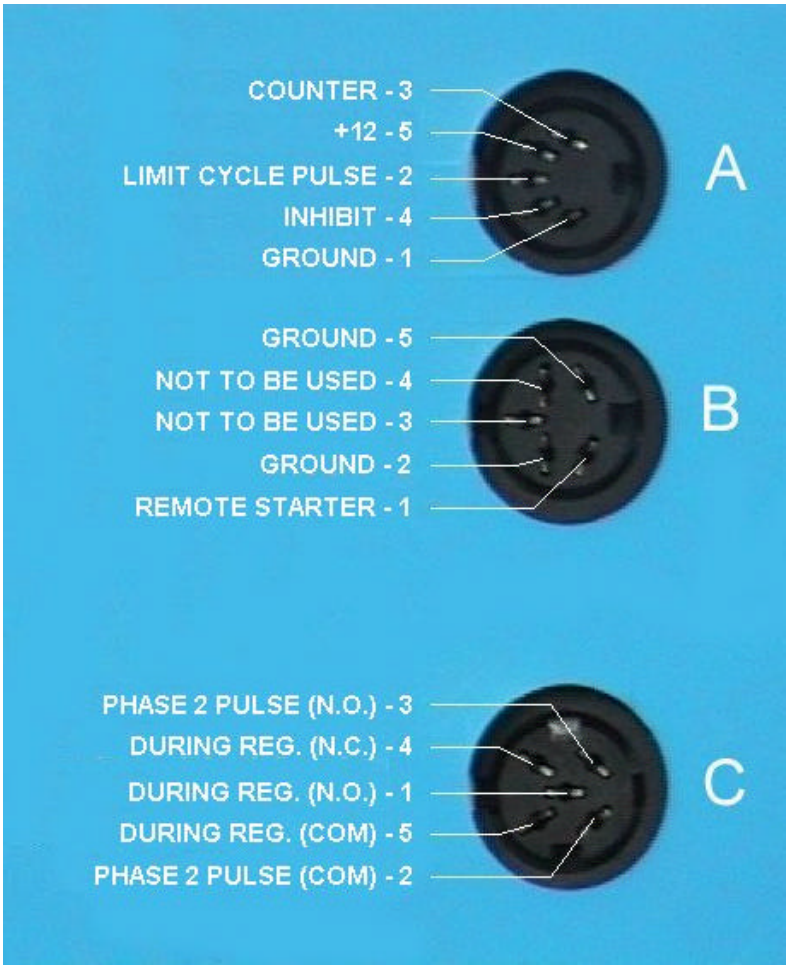


Fig. 9

Fig. 9 shows the connections available with the model provided with 3 DIN sockets. They can be used as follows:

Contacts	Function
DIN A, 1 – 3	Volume, reed counter or counter with make, not supplied.
DIN A, 1 – 3 – 5	Volume, magnetic, Hall effect counter, +12 VDC supply.
DIN A, 1 – 4	Inhibit signal input (when closed).
DIN A, 2 – 5	Cycle End Impulse output, Open Collector.
DIN B, 1 – 2	Remote Start input (when closed).
DIN C, 2 – 3	2nd regeneration phase impulse (normally open output).
DIN C, 5 – 1	Regeneration active impulse (normally open output).
DIN C, 5 – 4	Regeneration active impulse (normally closed output).

6.9 – Diagnostics

Aqua Cubic has a diagnostic system, that the maintenance personnel can use to learn the status of the controller.
To access this function, press and hold the **Advance** key for at least 5-6 seconds. The following parameters will be displayed:

Display	Description
F – 0 0	Days elapsed since the last regeneration.
0.0.0.0.	Number of regeneration processes performed.
0 0 0 0	Volume consumed since the last regeneration process.

The counter counting the performed regeneration processes cannot be reset by the user.

6.10 – Testing the regeneration automatic start

To test the regeneration autostart function, proceed as follows:

- With reference to **tab. 4**, set **0002** as treatable volume.
- Using the magnetic sensor cable and a SIATA turbine, reduce the volume to 0.
- After the volume has reached 0, the regeneration should start.

NOTE:
To perform these tests, the limit micro-switch of the controller must be correctly connected and working. Thus, it is recommended to use the controller when installed in its case.

7 – TROUBLESHOOTING

Here are some basic troubleshooting operations to solve those small problems that can arise while using **Aqua Cubic**.
As a general rule it is suggested, whenever possible, to check the problem by replacing the sole electronic board with another one, new or certainly working. It is important to understand whether the problem comes from electronics, mechanics, or wiring harness. Replacing the electronic board may be a precious help to identify the real cause of the defect. If our suggestions are not sufficient to solve your problems, please contact the SIATA assistance department.

DEFECT	POSSIBLE CAUSE	REMEDY
The *Controller* does not power on.	Outlet out of order. Transformer plug out of order. Transformer out of order.	Check the problem by connecting any other device to the same outlet, and by connecting the controller to another outlet.
	Wiring harness problems.	Open the case. Check that the wires are correctly mounted in the 7-pole connectors.
	The controller is blocked.	If you use the DIN lateral socket, verify that inside the connector there are no short-circuited terminals. Follow the instructions in 6.9
The motor does not stop after reaching the limit stop position.	The plastic parts are damaged.	Open the case. Verify the integrity of the plastic parts that hold the microswitch (see Fig. 10).
	The microswitch is damaged.	Open the box and check (Fig. 10): integrity of microswitch; correct placement of microswitch; correct placement of terminals; integrity of wires; integrity of the lever that activates the microswitch.
	The cam is out of place.	Open the case (Fig. 10). Verify that the Seeger ring that locks the cam is integer and correctly placed in its housing. Moving the cam with your hands, verify that it activates the microswitch lever.
The *controller* does not perform regeneration	The controller is not correctly programmed.	Verify that the programming has been performed correctly. Verify that the regeneration start mode corresponds to that really needed.
	The controller is inhibited.	If you use the DIN socket (Fig. 11), verify that inside the connector there are no short-circuited terminals.
The display shows wrong parameters.	Controller is in “out of program”.	Reset the controller, following the instructions in 6.8

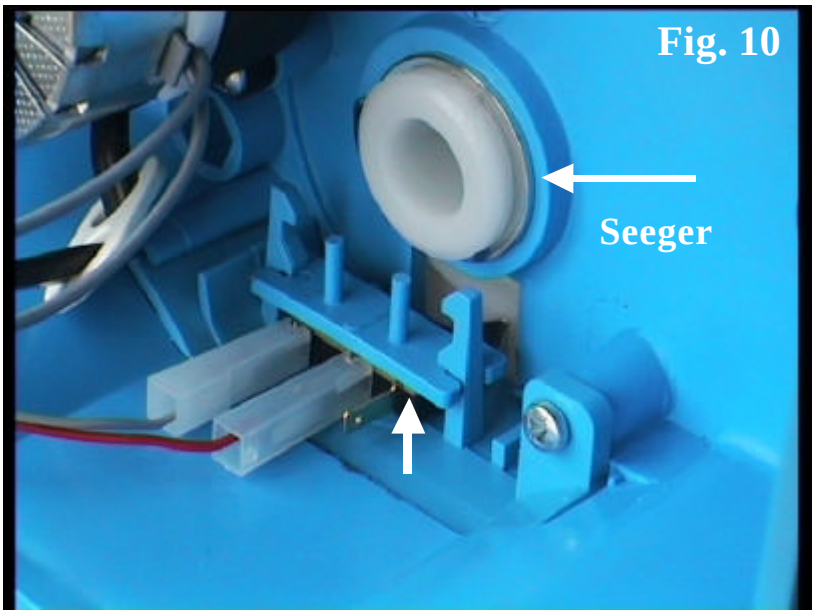


Fig. 10 clearly shows the microswitch, the mechanical parts for mounting and command, and the terminals connecting to the *controller*.

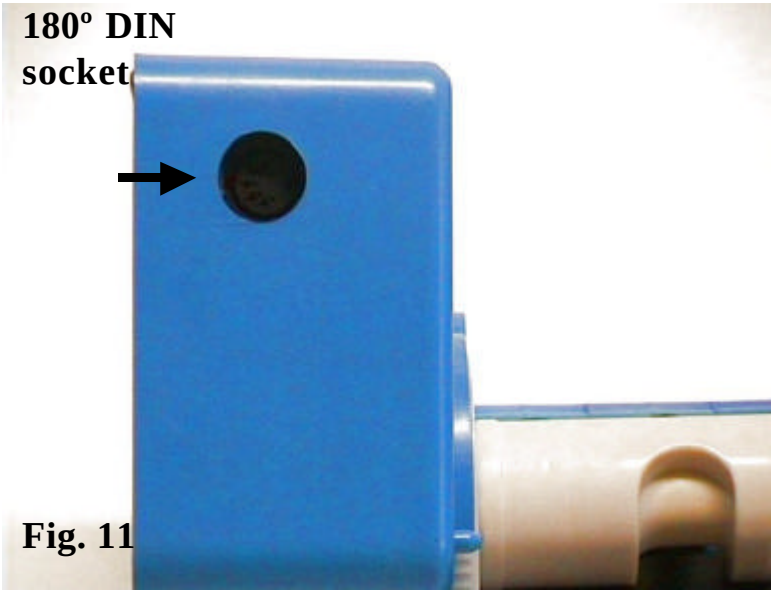


Fig. 11 shows the DIN 180º socket, where a liter counter sensor can be connected.

8 – SPARE PARTS

Attachments DA0189 and DA0191 show the assembling tables for spare parts of a timer with external drivers (the table shows 2 drivers, but there can be up to 9) and of a timer with no external driver (this model is normally named **132**).
The numbered items in the tables refer to **table 6**, **Table of items**. They are further distinguished into explicit variants and implicit variants.

Among implicit variant we have:

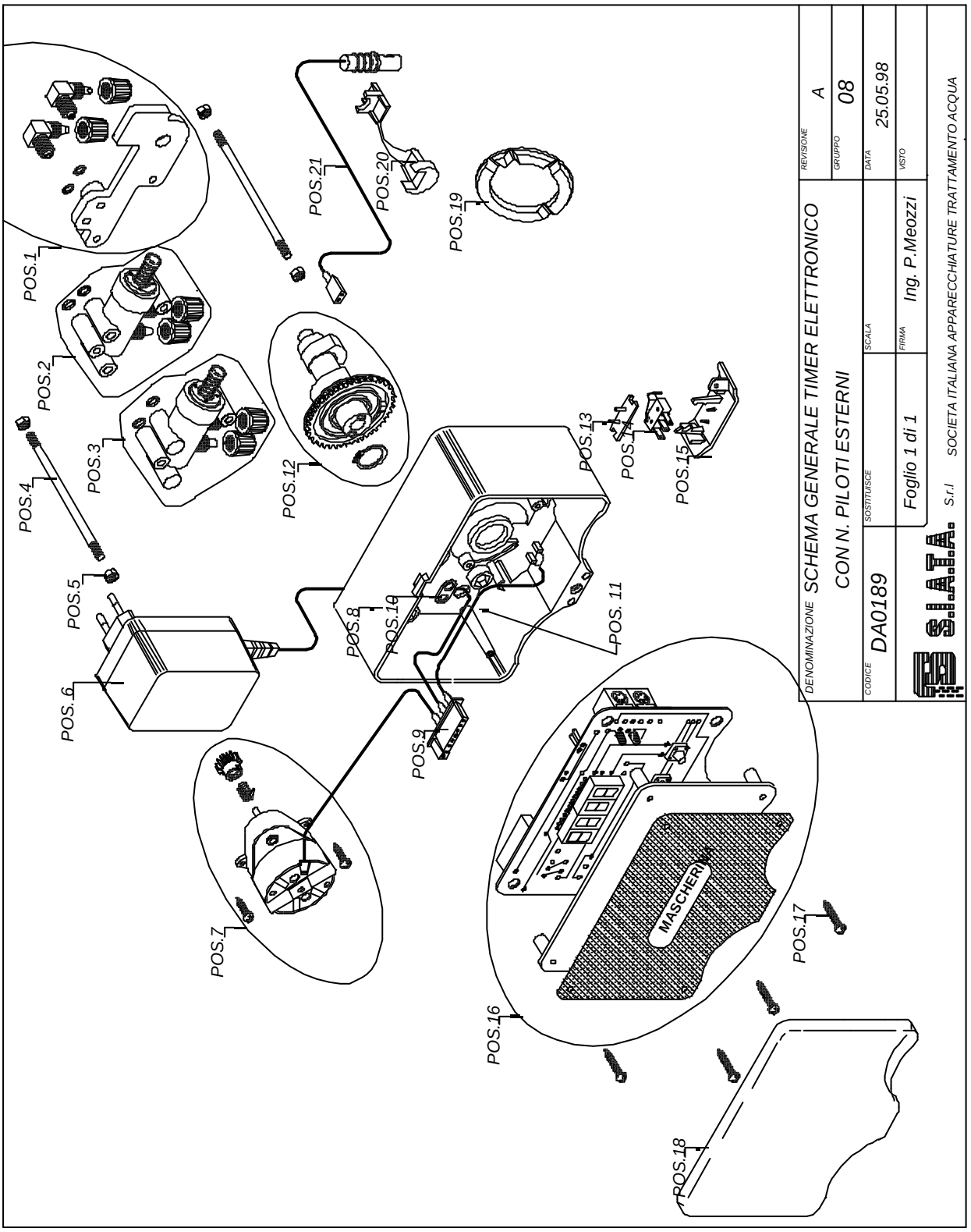
1. **The cam group**. Items from 1 to 5, and item 12 (external driver group) indicated in attachment DA0189 are replaced by the sole item 22 (cam group 132) in attachment DA0191.
2. **The turbine sensor cable**. Items 20 and 21 are shown in both attachments. They are present only on **volumetric** timer, no matter if external drivers are installed or not.
3. **Second microswitch**. Item 19 in both attachments indicates the ring that controls the second microswitch while the cam rotates. Please contact the SIATA sales department for further information on the performance obtainable with this modification.
4. The plug-shaped transformer (item 6) is available in two models: ***chlorine timer*** transformer code 95-STC1; ***non-chlorine timer*** transformer code 95-STD.

The explicit variants concern only the timers with external drivers (attachment DA0189), which in the table are marked with an asterisk (*):

1. **Number of pass-through drivers** (item 2). Their quantity changes according to the number of drivers installed on the timer. For example, a timer with 4 external drivers has 3 pass-through drivers (item 2) and only one closed driver (item 3).
2. **Coupling bars** (item 4). Their lengths change according to the number of drivers installed on the timer. The coupling bar code can be obtained by combining the base code (468-) with the number of drivers. Therfore, for a two-drivers timer the code is 468-2, while for a five-drivers timer is 468-5 and so on.
3. **Programming Cam** (item 12) for external drivers. It changes depending on the device type.

Tab. 6 – Table of items shown on attachments DA0189 and DA0191

Item	Description	Code
1	Complete driver shoulder	433-KIT
2	Complete driver (closed)	2253-A
3	Complete pass-through driver	2253-B*
4	Coupling bar for external drivers	468-*
5	M5 nut for threaded bar	468-D
6	230V – 12 V plug-shaped transformer	95-STD
	230V – 6 V plug-shaped transformer (CHLORINE)	95-STC1
7	Ratiomotor	94-R7
8	Timer case kit	81-KIT
9	7-pole connector	93-7
10	Timer supply cable lock	90
11	Microswitch wire	97
12	External cam kit	2221-2*
13	Micro-switch locking plate	88-A
14	Microswitch	92-F
15	Microswitch holder	88
16	Aqua Cubic electronic board kit	871-K
17	Cover fastening screw	120
18	Transparent cover for timer case	82
19	Stop ring on power takeoff	84-AS
20	Black cable lock	90-XP
21	Turbine sensor cable, 50 cm length	2223-50
22	New driver timer programming cam kit	2229


POS.1
POS.2
POS.3
POS.4
POS.5
POS.6
POS.7
POS.8
POS.9
POS.10
POS. 11
POS.12
POS.13
POS.14
POS.15
POS.16
POS.17
POS.18
POS.19
POS.20
POS.21
MASCHERINA
DENOMINAZIONE SCHEMA GENERALE TIMER ELETTRONICO
CON N. PILOTI ESTERNI
REVISIONE A
GRUPPO 08
CODICE DA0189
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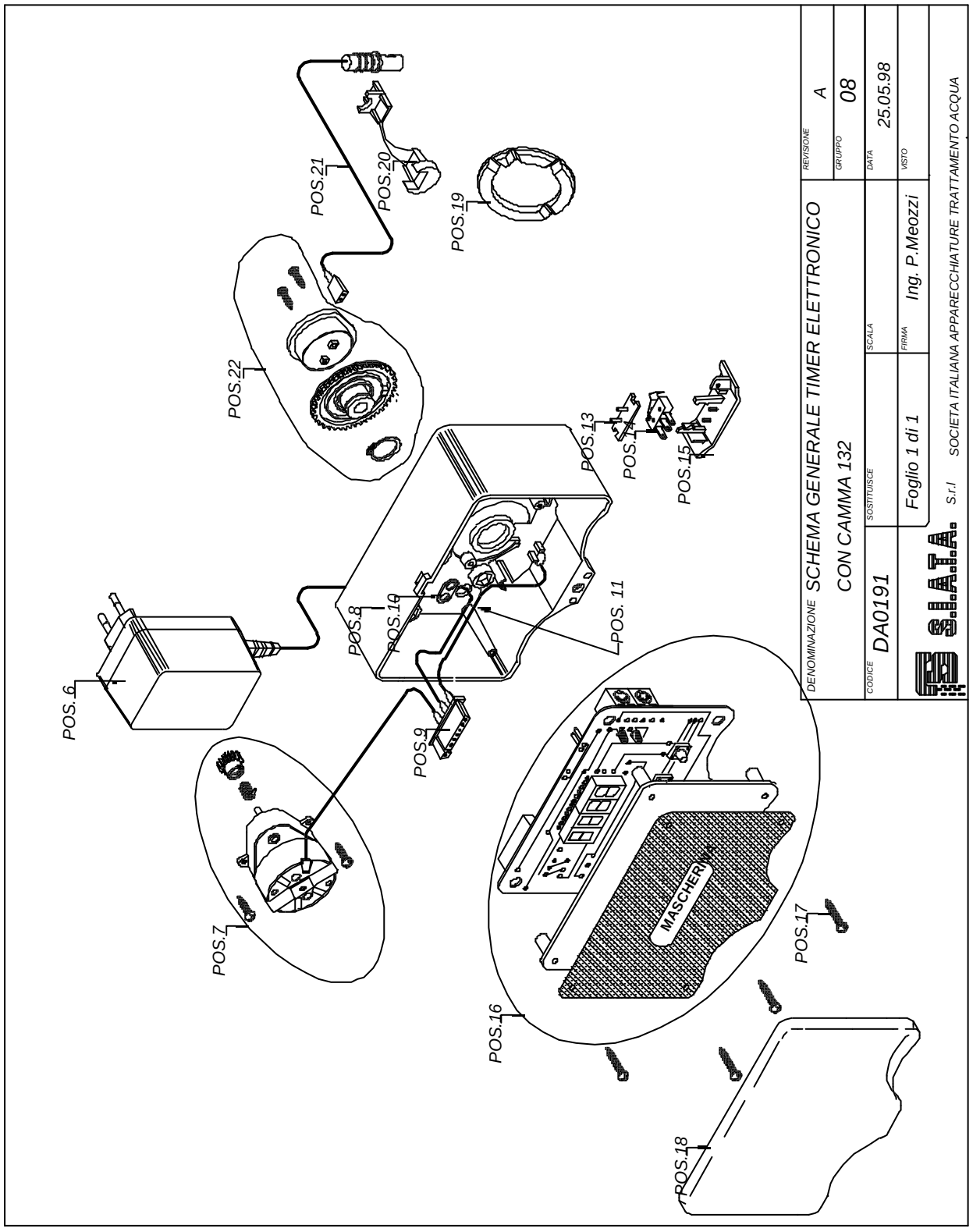
DATA 25.05.98
Foglio 1 di 1
FIRMA Ing. P.Meozzi
VISTO
SIATA S.r.l SOCIETA ITALIANA APPARECCHIATURE TRATTAMENTO ACQUA


POS.6
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POS.20
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POS.22
MASCHERINA
DENOMINAZIONE SCHEMA GENERALE TIMER ELETTRONICO CON CAMMA 132
CODICE DA0191
SOSTITUISCE
SCALA
Foglio 1 di 1
FIRMA Ing. P.Meozzi
DATA 25.05.98
VISTO
REVISIONE A
GRUPPO 08
SIATA S.r.l SOCIETA ITALIANA APPARECCHIATURE TRATTAMENTO ACQUA