Service Manual for Volumetric Pump

green stream$^{®}$ VO-P

ARGUS 414

Made in Switzerland

$C\epsilon$ 0120

IMPORTANT

This service manual is intended for the exclusive use of authorized persons who have been trained by ARGUS Medical AG in the maintenance and repair of the infusion apparatus mentioned above.

ARGUS Medical AG shall not assume any responsibility for any manipulations which have been carried out on the unit by a non-authorized person.

ARGUS Medical AG, CH-3627 Heimberg/Switzerland
(A member of the CODAN group)

1   Drip chamber
2   External drop detector
3   Air detector
4   Tube guide
5   Door (opened)
6   Door handle
7   Stop flow lock
8   Display "infusion rate"
9   Display "total"
10 "100"-key
11 "10"-key
12 "1"-key
13 Battery discharged
14 Occlusion/bottle empty
15 ALARM
16 Line operation
17 Battery operation
18 Drop indicator
19 KVO-operation
20 "ON/OFF"-key
21 "MODE"-key
22 "START/STOP"-key
23 Air
24 Display "Pressure"

green stream VO-P ARGUS 414

ml total
ml inf.
h. min

ml h

ALARM

C

KVO
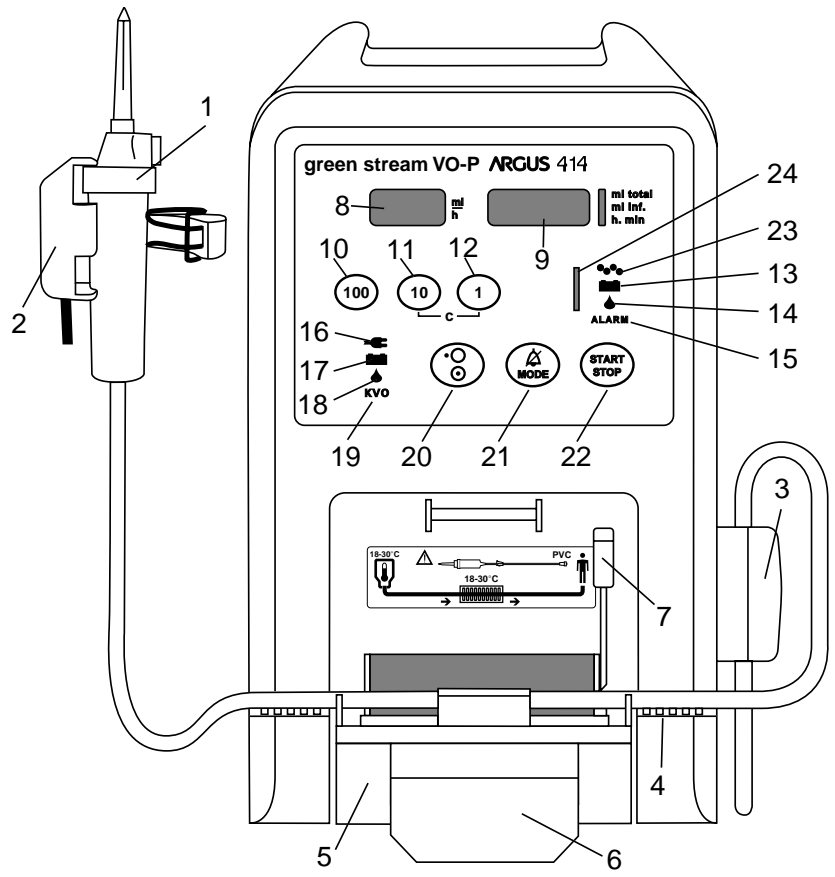
30 Bottle holder
31 Staff alert connector
32 Interface connector RS232
33 External drop detector connector
34 Spindle for clamp
35 Screw for bottle holder
36 Line plug
37 Line fuse
38 Ground terminal
39 Clamp

RS 232
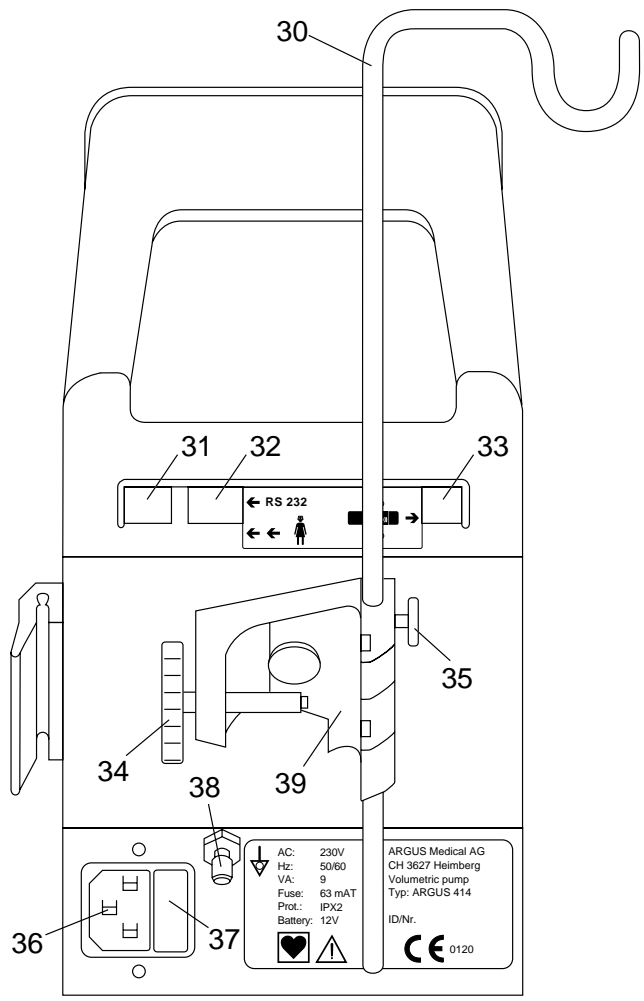
AC:	230V
Hz:	50/60
VA:	9
Fuse:	63 mAT
Prot.:	IPX2
Battery:	12V

ARGUS Medical AG
CH 3627 Heimberg
Volumetric pump
Typ: ARGUS 414

ID/Nr.

CE 0120

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1   Special key inputs and configurations

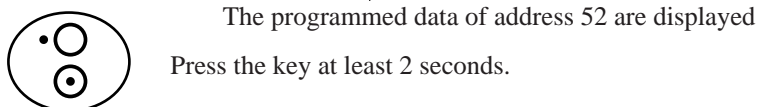1.1   Special key inputs:

Configuration

CAUTION!   The configuration possibilities mentioned below constitute a modification of the pump and
        may only be carried out by authorized persons.

If the decimal points are flashing in a display, this display is ready to accept an input by means of the keys
"100, 10, 1".

Input of the address in display (2)   Input of the values in display (3)

a   Interrogation mode

 Hold both keys pressed

Important!
Do not release the keys "MODE" and "START/STOP"

 Enter the requested address (eg. 52).

The programmed data of address 52 are displayed

Press the key at least 2 seconds.
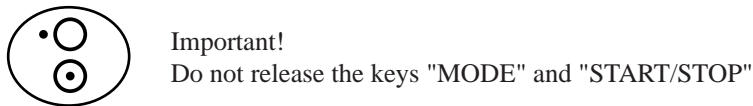
1.2   Configuration mode without PIN code

(MODE) + (START STOP)   **Hold both keys pressed**

(•O ⊙)   Important!
Do not release the keys "MODE" and "START/STOP"

| 4 14 ml/h | Prog | ml total / ml inf. / h. min |

(START STOP)

| . .0. ml/h | 0 | ml total / ml inf. / h. min |

(MODE)

| 0 ml/h | . . .0. | ml total / ml inf. / h. min |

(START STOP)

| Cod ml/h | – – – – | ml total / ml inf. / h. min |

(MODE)

| Cod ml/h | 0 | ml total / ml inf. / h. min |

(START STOP)

| . .0. ml/h | 0 | ml total / ml inf. / h. min |

(100) (10) (1)   Enter the requested address (eg. 5).

| 5 ml/h | 0 | ml total / ml inf. / h. min |

(MODE)

| 5 ml/h | . . .0. | ml total / ml inf. / h. min |

(100) (10) (1)   Enter the requested data (eg. 1).

| 5 ml/h | . . . 1. | ml total / ml inf. / h. min |

(START STOP)   If the data are accepted, entry changes to the left display.

| . .5. ml/h | 1 | ml total / ml inf. / h. min |

(•O ⊙) +

1.3 Programming mode: first input of write protection (code)
IMPORTANT ! Remember to make a note of your code and keep it in a safe place.

	Key	Description	Display (8)	Display (9)
1	"MODE" & "START/STOP"	Keep both keys pressed before switching the unit on.	"414"	"prog"
2	"START/STOP"	Acknowledgement (write protection is inactive)	". . 0."	" 0"
3	"MODE"	Switch over to display (9)	" 0"	". . . 0."
4	"START/STOP"	Acknowledgement	"Cod"	"- - - - "
5	"MODE"	Switch over to display (9)	"Cod"	" 0"
6	"START/STOP"	Acknowledgement	". . 0."	" 0"
7	"MODE"	Switch over to display (9)	" 0"	". . . 0."
8	"100;10;1"	Enter 1 to 4 digit code	" 0"	" C.C.C.C."
9	"START/STOP"	Acknowledgement (write protection is active) Code is never visible	". . 0."	" 1"
10	"ON/OFF"	End of programming mode		

1.4 Programming mode with active write protection (code)
CAUTION! Only the code holder can carry out modifications when the write protection is active.

	Key	Description	Display (8)	Display (9)
1	"MODE" & "START/STOP"	Keep both keys pressed before switching the unit on.	"414"	"prog"
2	"START/STOP"	Acknowledgement (write protection is active)	". . 0."	" 1 "
3	"MODE"	Switch over to display (9)	" 0"	". . . 1."
4	"START/STOP"	Acknowledgement	"Cod"	"- - - - "
5	"100;10;1"	Enter code	"Cod"	" X X X X"
6	"START/STOP"	Acknowledgement	". . 0."	" 1"
7	"100;10;1"	Enter requested address Programmed data appear in display (9)	"A.A.A."	"X X X X"
8	"MODE"	Switch over to display (9)	" A A A"	" X.X.X.X."
9	"100;10;1"	Enter requested data	"A A A"	" Y.Y.Y.Y."
10	"START/STOP"	Acknowledgement. If the data are accepted, entry changes to display (8)	"A.A.A."	" Y Y Y Y"
11	"ON/OFF"	End of programming mode		

1.5   List of the interrogation- and configuration functions:
       CAUTION! Before you make a new configuration or replace an EPROM or the mainboard make a note of
                 the programmed values. Afterwards you can re-enter the old not writeprotected values.

Address (#)	Write prot.	Default Value	Function	
0		0 = No	PIN code active	
1		1 = Yes	Run indication by running decimal point	
2		0 = No	Key "ON/OFF" only at STOP valid	
3		0 = No	Rate change only at STOP valid	
4		0 = No	Key "STOP" delayed (time at #361)	
5		0 = No	2nd entry of rate (#3=1), rate calculation disabled.	
6		0 = No	Static alarm (staff alerting system)	
7		0 = No	Display elapsed time in run mode (#8=0)	****
8		0 = No	Select remaining time (#7=1)	
9		1 = Yes	Alternative time input (10h, 1h, 1/4h)	
10		0 = No	Operation without drop detector	
11		1 = Yes	Recall "ml/h" (rate) at next power on	
12		0 = No	Recall "ml total" (end volume) at next power on	
13		0 = No	Recall "ml inf." (volume inf.) at next power on	
14		0 = No	SBS Step By Step function	
15		0 = No	Display VTBI (Volume To Be Infused)	
16		0 = No	Display "SEt -X-"' if only 1 set enabled	
17		1 = Yes	KVO (KOR), mode see #60	
18		0 = No	Drop alarm only if bottle is empty (#10=0)	
19		1 = Yes	Buzzer at start	
20		0 = No	Menu "CLr" (clear "ml inf.") (#15=0)	****
21		0 = No	Menu "uOP" (Micro operation)	****
22		0 = No	Menu "trA" (transport) (#10=0 and #18=0)	****
23		1 = Yes	Menu "PrL" (pressure alarm limit)	****
24		1 = Yes	Menu "CAP" (battery capacity)	****
25		0 = No	Menu "SEt Fill"	****
26		0 = No	Menu "InF" ("ml inf." since last power on)	****
27		0 = No	Menu "dLo" (data-lock)	****
28		0 = No	Menu "Stb" (stand-by)	****
29		0 = No	Menu "MEd" (medication number)	****
30		0 = No	Menu "tM " (timer alarm)	****
31		0 = No		
32		0 = No	Menu "boL" (release bolus)	****
33		0 = No	Menu "boLr" (bolus rate) (#32=1)	****
34		0 = No	Menu "tot" (bolus total) (#32=1)	****
35		0 = No		
36		0 = No		
37		0 = No		
38		0 = No	Bolus application automatic (#32=1 and #34=1)	
39		0 = No		
40		0 = No	Demo mode (all menus enabled)	****
41		0 = No	Clear "ml/h" after infusion completed	
42		0 = No	Clear "ml total" after infusion completed (#41=1)	
43		0 = No	Air volume accumulated (1ml over 0.5 hrs)	
44		1 = Yes	Automatic pressure release after occlusion	
45		1 = Yes	Pressure display 20/40/60/80/100% (Bargraph ON)	
46		0 = No	Bargraph with indicator (25% steps, #45=1)	
47		0 = No	Standby- and battery prealarm low volume	
48		1 = Yes	Flashing numeric display at alarm	
49		0 = No	Alarm acknowledge only with key "MODE"	

Address (#)	Write prot.	Default Value	Function
50		0 = No	Start with >= 1bar allowed
51		1 = Yes	Start without infusion set
52		1 = Yes	High resolution if calculated rate <100 ml/h
53		0 = No	Micro mode after power on as default (Clear = 0.0 ml/h)
54		0 = No	
55		0 = No	
56		0 = No	
57		0 = No	
58		0 = No	
59		0 = No	
60		0 = No	KVO only after infusion completed
61		0 = No	
62		0 = No	
63		0 = No	
64		0 = No	
65		0 = No	Clear and continue (#15=0)
66		0 = No	
67		0 = No	
68		0 = No	
69		0 = No	
100		0 = No	
101		1 = Yes	Set 1 enabled
102		0 = No	Set 2 enabled (Pressure sensor and volume calibration requested)
103		0 = No	Set 3 enabled (Pressure sensor and volume calibration requested)
104		0 = No	Set 4 enabled (Pressure sensor and volume calibration requested)
105		0 = No	
106		0 = No	
107		0 = No	
108		0 = No	
109		0 = No	
200		0 = No	
201		0 = No	
202		0 = No	
203		0 = No	
204		0 = No	
205		0 = No	
206		0 = No	
207		0 = No	
208		0 = No	
209		0 = No	Set 1 definition
210		0 = No	
211		0 = No	
212		0 = No	
213		0 = No	
214		0 = No	
215		0 = No	
216		0 = No	
217		0 = No	
218		0 = No	
219		0 = No	

Address (#)	Write prot.	Default Value	Function
220		0 = No	
221		0 = No	
222		0 = No	
223		0 = No	
224		0 = No	
225		0 = No	
226		0 = No	
227		0 = No	
228		0 = No	
229		0 = No	Set 2 definition
230		0 = No	
231		0 = No	
232		0 = No	
233		0 = No	
234		0 = No	
235		0 = No	
236		0 = No	
237		0 = No	
238		0 = No	
239		0 = No	
240		0 = No	
241		0 = No	
242		0 = No	
243		0 = No	
244		0 = No	
245		0 = No	
246		0 = No	
247		0 = No	
248		0 = No	
249		0 = No	Set 3 definition
250		0 = No	
251		0 = No	
252		0 = No	
253		0 = No	
254		0 = No	
255		0 = No	
256		0 = No	
257		0 = No	
258		0 = No	
259		0 = No	
260		0 = No	
261		0 = No	
262		0 = No	
263		0 = No	
264		0 = No	
265		0 = No	
266		0 = No	
267		0 = No	
268		0 = No	
269		0 = No	Set 4 definition

Address (#)	Write prot.	Default Value	Function	
270		0 = No	Set 4 definition	
271		0 = No		
272		0 = No		
273		0 = No		
274		0 = No		
275		0 = No		
276		0 = No		
277		0 = No		
278		0 = No		
279		0 = No		
300		0		
301		0		
302		0		
303		0		
304		0		
305		0		
306	X	0	Infused sum in ml (xxxxyyyy)	[xxxx . . . . ml]
307	X	0	Infused sum in ml (xxxxyyyy)	[. . . . yyyy ml]
308	X	0	Operating time in min (xxxxyyyy)	[xxxx . . . . min]
309	X	0	Operating time in min (xxxxyyyy)	[. . . . yyyy min]
310		999	Max. rate in ml/h (1...999 ml/h)	
311	IV set -1-	999	Prime rate in ml/h (1...999 ml/h)	
312		999	Max. bolus rate in ml/h (1...999 ml/h)	
313		10	Max. bolus total in ml (1...99 ml)	
314		0		
315		4	Pressure limit "PrL" default value micro mode	(1..10 * 100 mbar)
316		7	Pressure limit "PrL" default value	(1..10 * 100 mbar)
317		250	Airbubble size (50...1000 µl)	
318		20	Drop-rate window centre in drops/ml (10...65)	
319		1000	Correction (850...1150) ((actual/nominal)*1000)	
320		999	Max. rate in ml/h (1...999 ml/h)	
321	IV set -2-	999	Prime rate in ml/h (1...999 ml/h)	
322		999	Max. bolus rate in ml/h (1...999 ml/h)	
323		10	Max. bolus total in ml (1...99 ml)	
324		0		
325		4	Pressure limit "PrL" default value micro mode	(1..10 * 100 mbar)
326		7	Pressure limit "PrL" default value	(1..10 * 100 mbar)
327		250	Airbubble size (50...1000 µl)	
328		20	Drop-rate window centre in drops/ml (10...65)	
329		1000	Correction (850...1150) ((actual/nominal)*1000)	
330		999	Max. rate in ml/h (1...999 ml/h)	
331	IV set -3-	999	Prime rate in ml/h (1...999 ml/h)	
332		999	Max. bolus rate in ml/h (1...999 ml/h)	
333		10	Max. bolus total in ml (1...99 ml)	
334		0		
335		4	Pressure limit "PrL" default value micro mode	(1..10 * 100 mbar)
336		7	Pressure limit "PrL" default value	(1..10 * 100 mbar)
337		250	Airbubble size (50...1000 µl)	
338		20	Drop-rate window centre in drops/ml (10...65)	
339		1000	Correction (850...1150) ((actual/nominal)*1000)	

Address (#)	Write prot.	Default Value	Function	
340		999	Max. rate in ml/h (1...999 ml/h)	
341		999	Prime rate in ml/h (1...999 ml/h)	
342		999	Max. bolus rate in ml/h (1...999 ml/h)	
343		10	Max. bolus total in ml (1...99 ml)	
344		0		
345		4	Pressure limit "PrL" default value micro mode	(1..10 * 100 mbar)
346		7	Pressure limit "PrL" default value	(1..10 * 100 mbar)
347		250	Airbubble size (50...1000 µl)	
348		20	Drop-rate window centre in drops/ml (10...65)	
349		1000	Correction (850...1150) ((actual/nominal)*1000)	
360		0		
361		500	Key "ON/OFF" delay (0...3000 msec), (additional key "STOP"] if #4=1)	
362		3	Display brightness (1...3)	
363		10	Buzzer alarm volume (5...10)	
364		0		
365		0		
366		0		
367		0		
368		270	Battery discharge time incl. 15 min prealarm (45...615 min)	
369		5	Automatic menu fall back delay time	(5...30 s)
370		0	Clock seconds	(0...59)
371		0	Clock minutes	(0...59)
372		0	Clock hours	(0...23)
373		0		
374		0	Clock days	(1...31)
375		0	Clock months	(1...12)
376		0	Clock years	(2000...2099)
377		0		
378		0		
379		0		
380	X		Last failure number (F-XX)	
381	X		Last infusion rate at failure	
382	X		2. last failure number (F-XX)	
383	X		2. last infusion rate at failure	
384	X		3. last failure number (F-XX)	
385	X		3. last infusion rate at failure	
386	X		4. last failure number (F-XX)	
387	X		4. last infusion rate at failure	
388	X		5. last failure number (F-XX)	
389	X		5. last infusion rate at failure	
390		0	Last service date (yyww, year and week)	
391	X	0	2. last service date	
392	X	0	3. last service date	
393		0	Service interval in months (1..24, 0 = disabled)	
394		0	Service interval in hours (1..9999, 0 = disabled)	
395		0	Own address for SCI (0=no address, or 1...127)	
396		0	Inventory-no. of the pump (xxxx yyyy)	[xxxx . . . .]
397		0	Inventory-no. of the pump (xxxx yyyy)	[. . . . yyyy]
398		0		
399	X	414	Data xxxx -> clears protection key	

IV set -4- (label spanning addresses 343–346)

1.6   Special configuration options

- Configuration of a reminder alarm for the safety standard check:
  First the service interval has to be configured either in months or in hours of operation, or both (addresses 393, 394).
  Next the last service date has to be entered on address 390. Any value higher than 0 entered at the adresses 393 and/or 394 will release the reminder alarm after the set service interval has elapsed (check also the correct settings of the internal clock).

- PC configuration tool "AConfig":
  With this additional software the pump may be configured from a PC over the serial port. This software may be available from your local distributor or our service department.

- IV-set definition:
  Allows the individual calibration of up to 4 dedicated IV-sets over the full infusion rate range. Please contact your local distributor or our service department for further information.

After changing the configuration a function check and a control measurement has to be made!

2   History and pump configuration printout

2.1   Connecting of the ARGUS414 to the serial interface

Caution: The infusion pump must be disconnected from the patient <u>before</u> any connection over the serial interface can be done.

A connection of the ARGUS414 to a computer is useful to the read the actual configuration or history of the pump. Even a simple monitoring of the pump can be done over the serial interface RS-232.
The connection of the infusion pump with your computer over the interface can be done by connecting the interface cable and adapter (part 12.011 and part 12.012) and the following steps:

- Connect the RS-232 interface cable to outlet (32) of the infusion pump and to the serial port of your PC. Note in which port (COM1 or COM2) you have pluged in.
- Start your terminal program on your computer. A simple terminal program, e.g. "Hyper Terminal" is included in every MS-Windows 9x and Windows NT systems, but must be installed first if necessary.
- Be sure that you have selected the right serial port (COM1 or COM2) and set the following communication parameters:

    Bits per second: 4800 Baud
    Data bits: 8 bits
    Parity: None
    Stop bits: 1 bit
    Protocol: None

- Go to the next step in one of the further chapters, depending on your intention.

2.2   Configuration printout
- Switch the pump on while keeping the keys "MODE" and "START/STOP" pressed and go in the configuration mode.
- Select address **399** on the left hand display.
- Start capturing text received over the serial interface, e.g. by selecting "capturing text..." in the menu of the Hyper terminal. A text file which contains the actual configuration printout will now be generated.
- Enter the data **3456** on the right display of the pump.
- Press the "START/STOP" key.
- The pump will now transfer the actual configuration of the pump in the format mentioned below.
- Stop the capturing of the text received; this will also close the text file generated.
- The generated text file can be opened and printed out by any text program.

```
Pump configuration printout (sample)

/***** Configuration profile *****/        Wed 19-Jan-2002 11:29:55


Pump type                 : ARGUS414
Inventory number          : 0000 0000
Software release          : V1.00 (000719-4061)
Infused sum               : 678ml
Operating time            : 5h32min
Last service date         : 2000 week 12


00=0    50=0    100=0   300=0   320=0400   340=0000   360=0000   380=0000
01=1    51=0    101=0   301=0   321=0000   341=0000   361=0000   381=0000
02=0    52=0    102=0   302=0   322=0000   342=0000   362=0000   382=0000
03=0    53=1    103=1   303=0   323=0000   343=0000   363=0000   383=0000
etc.
```

2.3   History printout
The transfer of the last events made on the pump can be done either by this way:
- Switch the pump on while keeping the key "100" pressed.
Or by this way:
- Switch the pump on while keeping the keys "MODE" and "START/STOP" pressed and go in the configuration mode.
- Select address **399** on the left display of the pump.
- Start capturing text received over the serial interface, e.g. by selecting "capturing text..." in the menu of the Hyper terminal. A text file which contains the history printout will now be generated.
- Enter the data **4567** on the right display of the pump.
- Press the "START/STOP" key.
- The pump will now transfer the last events made on the pump in the format mentioned below.
- Stop the capturing of the text received; this will also close the text file generated.
- The generated text file can be opened and printed out by any text program.

```
History printout (sample)

/***** History *****/        Mon 28-Aug-2000 08:42:44

Pump off                                              Mon 28-Aug-2000 11:54:38
Rate   =  123.0ml/h        IV-Set  = 3
Total  = 0050.0ml          PrLimit = 0500mbar
Infsum = 0054.0ml          Status  = 0x0000

Pump on                                               Mon 28-Aug-2000 15:01:58
Rate   =  010.0ml/h        IV-Set  = 3
Total  = 0050.0ml          PrLimit = 0500mbar
Infsum = 0009.0ml          Status  = 0x0000
etc.


The possible messages are:

Battery defective          PC configuration done    Too many drops, pump stop
Battery low prealarm       Pump has detected failure Inf-set change
Battery low, pump stop     Pump off                  Timer alarm, pump stop (KVO)
Bolus start                Pump on                   Total volume reached, pump stop (KVO)
Bolus stop                 Pump start                Datalock off
External power off         Pump stop (KVO)           Datalock on
External power on          Rate change               Infsum cleared
Bolus total reached        Enter setup mode          No drops, pump stop
Occlusion, pump stop       Exit setup mode           Not enough drops, pump stop
PrLimit change             Transport off             Door open, pump stop
PC configuration failure   Transport on              Air bubble, pump stop
```

2.4   Monitoring of the ARGUS414

Caution: The monitoring of the infusion pump ARGUS414 over the serial interface of a PC is only for demonstration purposes; any connection with patients has not been tested under the conditions of EN 60601-1 and are not allowed.

- Switch the pump on with an inserted filled infusion set.
- Enter one of the following command directly in your terminal window or transmit the corresponding ASCII
  code over your own monitoring program. A short sample of a monitoring session is mentioned at the end of this chapter.

Command	Keystrokes in terminal	ASCII code	Description
ENQ	Ctrl+E	05H	Request status (see format below)
SO	Ctrl+N	0EH	Sets pump in remote mode
STX	Ctrl+B	02H	Start of data entry (see format below)*
'data'	Data	-	Data*
ETX	Ctrl+C	03H	End of data entry*
DC2	Ctrl+R	12H	Start infusion*
DC4	Ctrl+T	14H	Stop infusion*
SI	Ctrl+O	0FH	Sets pump in local mode
ACK	Ctrl+F	06H	Alarm suppression (2min)*
FS	Ctrl+\	1CH	Enables/disables KVO*
BEL	Ctrl+G	07H	Toggle "Buzzer at start mode"*
CAN	Ctrl+X	18H	No start tests at next start*
ESC	Ctrl+[	1BH	Next character following ESC ("Ctrl+[") will select the pump with address ,"addr", if more than one is connected to the serial interface
"addr"	-	0-127	Address (must be the same as in the pump configuration on address 395)*

* Only valid in remote mode

Format of "data" entry: **STX   0   1   2   0   0   2   0   0   ETX**

The digits correspond to: Rate 1E2, Rate 1E1, Rate 1E0, Rate 1E-1, Total 1E3, Total 1E2, Total 1E1, Total 1E0

Format of "status", which will be returned by the pump after typing "Ctrl+E" in the terminal:

STX 0 1 2 0 0 2 0 0 0 0 0 1 0 7 0 0 0 0 A B C D E ETX

The digits correspond to: Rate 1E2, Rate 1E1, Rate 1E0, Rate 1E-1, Total 1E3, Total 1E2, Total 1E1, Total 1E0, Infused sum 1E3, Infused sum 1E2, Infused sum 1E1, Infused sum 1E0, PrL 1E3, PrL 1E2, PrL 1E1, PrL 1E0, Medicament 1E1, Medicament 1E0, Statusbyte-1, Statusbyte-2, Statusbyte-3, Statusbyte-4, Statusbyte-5

Format statusbyte-1:

P 1 X X X X X X

P	1	X	X	X	X	X	X
Parity	Always high	Pump type (0 = A414)	Reserved	Battery active	Battery low prealarm	Battery low, pump stop	Battery defective

Format statusbyte-2:

P 1 X X X X X X

P	1	X	X	X	X	X	X
Parity	Always high	Occlusion, pump stop	Reserved	Reserved	Reserved	Bottle empty, pump stop	Airbubble, pump stop

Format statusbyte-3:

P 1 X X X X X X

P	1	X	X	X	X	X	X
Parity	Always high	Remote mode active	Reserved	Global Alarm	Door open	Pump stop (KVO)	KVO active

Format statusbyte-4:

P 1 X X X X X X

P	1	X	X	X	X	X	X
Parity	Always high	Reserved	Bolus active	Data lock active	Total volume reached, pump stop (KVO)	Timer alarm, pump stop (KVO)	Standby alarm active

Format statusbyte-5:

P 1 X X X X X X

P	1	X	X	X	X	X	X
Parity	Always high	Pressure indicator (adress 46)	Bargraph-LED upper	Bargraph-LED lower+3	Bargraph-LED lower+2	Bargraph-LED lower+1	Bargraph-LED lower

A sample of a monitoring session:
- Switch the pump on with an inserted filled infusion set.
- Type "Ctrl+N" to set the pump in remote mode.
- Type "Ctrl+B", then "01200200" and then "Ctrl+C" which sets the rate to 12.0 ml/h and an infusion total of 200 ml. The rate should now be shown in the left display of the pump.
- Type "Ctrl+R" to start the infusion.
- Type "Ctrl+T" to stop the infusion.

3 Fault finding

The fault code in case of a failure is displayed by pressing "MODE" key (21). (F-XX) appears in display (9), and the source of the failure is listed in the table below:

Error	Error reason	Assembly group
F-21...22	ROM test	Mainboard
F-23...24	RAM test	Mainboard
F-25	CPU test	Mainboard
F-26	Invalid function menu	
F-27	EEPROM data invalid	Mainboard
F-28	RTC (real time clock) data invalid	Mainboard
F-29	Stepper motor power test	Mainboard
F-31	1.2 Volt supply out of range	Mainboard
F-32	5 Volt supply out of range	Mainboard
F-33	30 Volt supply out of range	Mainboard
F-41	Pressure sensor test failed	Pressure sensor or mainboard
F-42	Air detector test failed	Air detector or mainboard
F-43	Air bubble size invalid	Mainboard
F-44...45	Address invalid for EEPROM	Mainboard
F-46	Frequency from µC or RTC out of range	Mainboard
F-47	Displayboard not present	
F-48	Key(s) too long active	Displayboard
F-49	Set correction invalid	Mainboard
F-50	Pressure monitor	Mainboard or pressure sensor
F-51...56	Rotation control	- Mainboard
		- Hallboard
		- Motor
		- Clutch
F-57...59	Volume control	Mainboard

Exceptionally a fault code may appear, which is not included in this list. In this case we recommend to change the main board.

4 Replacement of parts

4.1   Disassembly of the pump

   NOTE: The exploded views in the appendix show the individual mounting steps.

   CAUTION!
   Switch the unit off and disconnect the mains cable from the power outlet before opening the housing. The antistatic protection have to be strictly adhered to when the ARGUS infusion pump is disassembled (the use of an antistatic table mat and a grounded clip are recommended, for example).

   a Disassembly of the hood:
      Remove the four screws on the side and on the rear wall, lift hood up and disconnect the plug-type connector of the drop barrier.

   b Disassembly of the main printed board assembly:
      Disconnect the plug-type connector of the main printed board assembly and unscrew the two lateral attachment screws. Please refer to the wiring diagram in the appendix.

   c Disassembly of the front panel:
      Use a ball-headed hexagon screwdriver to unscrew the two attachment screws from the rear and remove the front panel. This special screwdriver can be obtained from the service department on request.

   d Disassembly of the pump unit:
      By unscrewing the four attachment screws, the whole pump unit can be removed from the front panel.

   e Remove the pump door:
      The pump door can be remove without any tools by pulling it out in the direction of the arrow according to the drawing. For the dismounting and the mounting the opening angle from 30 to 45° has to be kept.
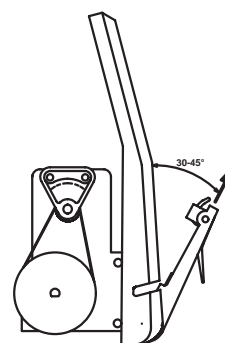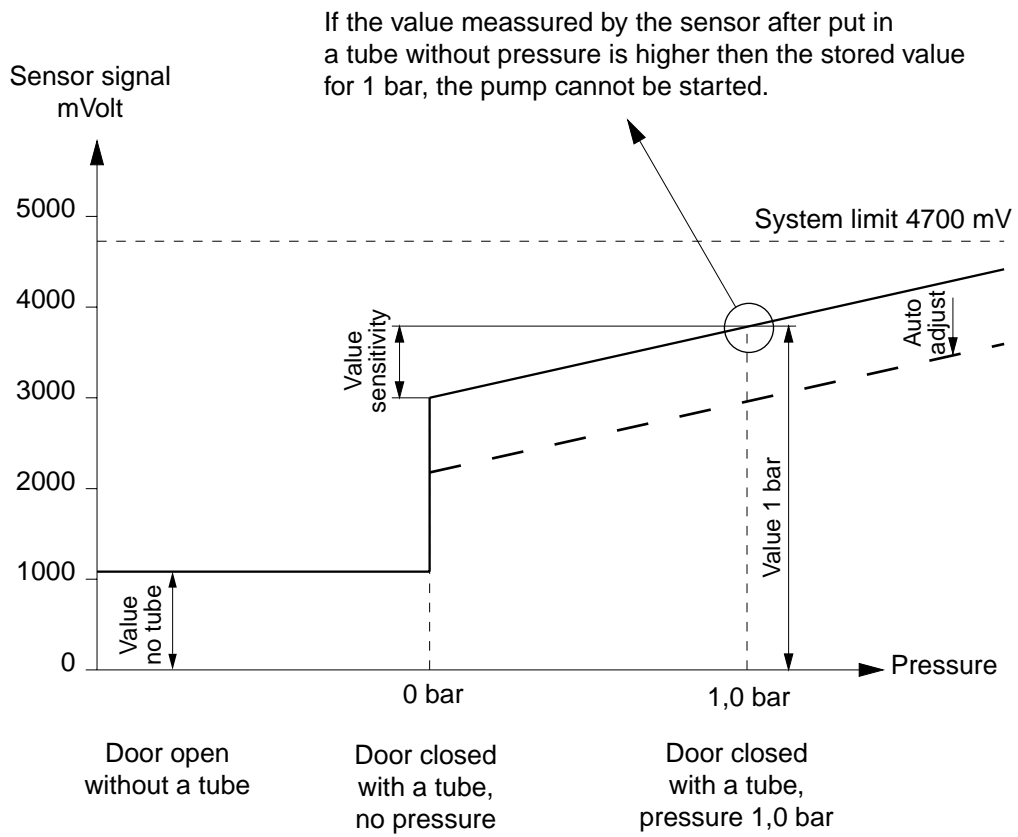

4.2   Replacement of the EPROM or the display board
   a Software updates may reset automatically the default values in the EEPROM. You are requested to write down the actual contents of the addresses before you replace the EPROM or the display board. Afterwards you have to re-enter these values in the program mode. If a write protection code has been used before, the same code has to be programmed again.

   b A pressure sensor calibrating is necessary when replacing the pressure sensor, a pressure sensor calibration and a volume calibration are necessary when replacing the EPROM or the display board. Be careful and carry out the described instructions step by step.

4.3   Pressure sensor calibration

1   Go to the program mode (without IV-administration set).

2   Enter in address **399** the value **1234**.

3   Press the key "START/STOP"
     The display shows e.g. [**Set**] [**-2-**]. Choose the IV set (no. 1 to 4) by pressing the key [1].

4   Press the key "START/STOP" (The pump mechanic runs with a rate of ca. 200 ml/h).
     The display shows [**CAL.**] [**door**]. By pressing the key "1" it is possible to show the stored value in mV
     in the display.

5   Press the key "START/STOP". The offset voltage, without IV-set, will be stored.
     The stored value will be acknowledged by a sound.

6   Press the key "MODE".
     The display shows [**CAL.**] [**0bAr**]. By pressing the key "1" it is possible to show the stored value in mV
     in the display.

7   Install an used (milled) IV-administration set (Open the roller clamp).

8   Start the pressure build-up by occluding the tube on the patient side to control the mechanical pressure
     limit.
     Minimum 1.2 bar has to be reached for a successful calibration.

9   Gradually decrease the pressure by removing the occlusion.

10   Wait ca. 30 sec., then activate the key "START/STOP". The reference value for sensitivity calculation will
     be stored. The stored value will be acknowledged by a sound.

11   Press the key "MODE".
     The display shows [**CAL.**] [**1bAr**]. By pressing the key "1" it is possible to show the stored value in mV
     in the display.

12   Start the pressure build-up again, wait until the manometer shows 1 bar, then activate the
     key "START/STOP". The absolute value at 1 bar will be stored. The stored value will be acknowledged
     by a sound.

13   Gradually decrease the pressure.

14   Turn the pump off- and on again.

15   Select the rate at 500 ml/h.

16   Press the key "START/STOP".

17   Start the pressure build-up to control the electronic pressure limit.

18   The alarm must be activated at ca. 700 mbar ± 100 mbar if the default value = "7".
     If the result is not satisfactory repeat the sensor calibration.

19   Switch the pump off.

4.4   Pressure sensor signal

If the value meassured by the sensor after put in
a tube without pressure is higher then the stored value
for 1 bar, the pump cannot be started.

Sensor signal mVolt

5000 — System limit 4700 mV

4000

Value sensitivity

3000

Value 1 bar

Auto adjust

2000

1000

Value no tube

0 — Pressure

0 bar   1,0 bar

Door open
without a tube

Door closed
with a tube,
no pressure

Door closed
with a tube,
pressure 1,0 bar

4.5   Volume calibration general

1   Go into the program mode.

2   Decide which IV set should be calibrate and check its release address.
    - address 101 for IV set no. -1-
    - address 102 for IV set no. -2-
    - address 103 for IV set no. -3-
    - address 104 for IV set no. -4-

    Set the correction value in one of the following address to **1000**:
    - address 319 for IV set no. -1-
    - address 329 for IV set no. -2-
    - address 339 for IV set no. -3-
    - address 349 for IV set no. -4-
    Switch the pump off and on.

3   Select the IV set you like to calibrate and make the following pump settings (for warm up the peristaltic system): Rate = 999 ml/h; volume "total" = 10 ml
    Start the pump by pressing "START/STOP" once. Switch the pump off and on again after the volume "total" is reached.

4   The next pump settings are:
    Rate = 100 ml/h; volume "total" = 25 ml
    Start the pump by pressing "START/STOP" once. Switch the pump off immediately after the volume "total" is reached, the net weight result must be 25 g +/-5%.

5   Calculate the correction factor with the equation:
    Correction factor = (measured volume / preset volume) * 1000

6   Go into the program mode and select address for the correction value (see point 1)
    Press "MODE" to enter the correction factor in the right hand display.
    Press "START/STOP"] to acknowledge the correction factor.
    Switch the pump off.

7   Make a control measurement with the same settings as mentioned in point 4, using the IV-set for which the correction factor has been changed. Perform an occlusion pressure check (see chapter "Pressure sensor calibrating", point 15-19) to verify the pressure alarm level.

4.6   Volume calibration by the integrated program

1   Go to the program mode.

2   Enter in address 399 the value 123.

3   Press the key "START/STOP".
    The display shows e.g. [**Set**] [**-2-**]. Choose the IV set (no. 1 to 4) by pressing the key [1].

4   Press the key "START/STOP".
    The display shows [**bAL.**] [**tArA**]. The right hand display is flashing.
    The pump delivers a volume of 5 ml by a rate of 250 ml/h to warm up the tube.

5   The display shows [**bAL.**] [**tArA**].
    Re-zero the balance.

6   Press the key "START/STOP".
    The display shows [**tM**   ] [**xxx**].
    The pump delivers a volume of 15 ml by a rate of 250 ml/h.

7   The display shows [**bAL.**] [**12.75**].
    Enter the value of the balance into the pump e.g. 14.65.

8   Press the key "START/STOP".
    The display shows e.g. [**Cor.**] [**977**].

9   Press the key "START/STOP".
    The display shows e.g. [**Set**] [**-2-**] and an acknowledgement sound occurs.
    The correction factor has been stored in the address of the choosed IV set (see point 3).

10 Switch the pump off.

11 Make a control measurement with the same settings as mentioned in point 4 using the IV-set for which the
    correction factor has been changed. Perform an occlusion pressure check (see chapter "Pressure sensor
    calibrating", point 15-19) to verify the pressure alarm level.

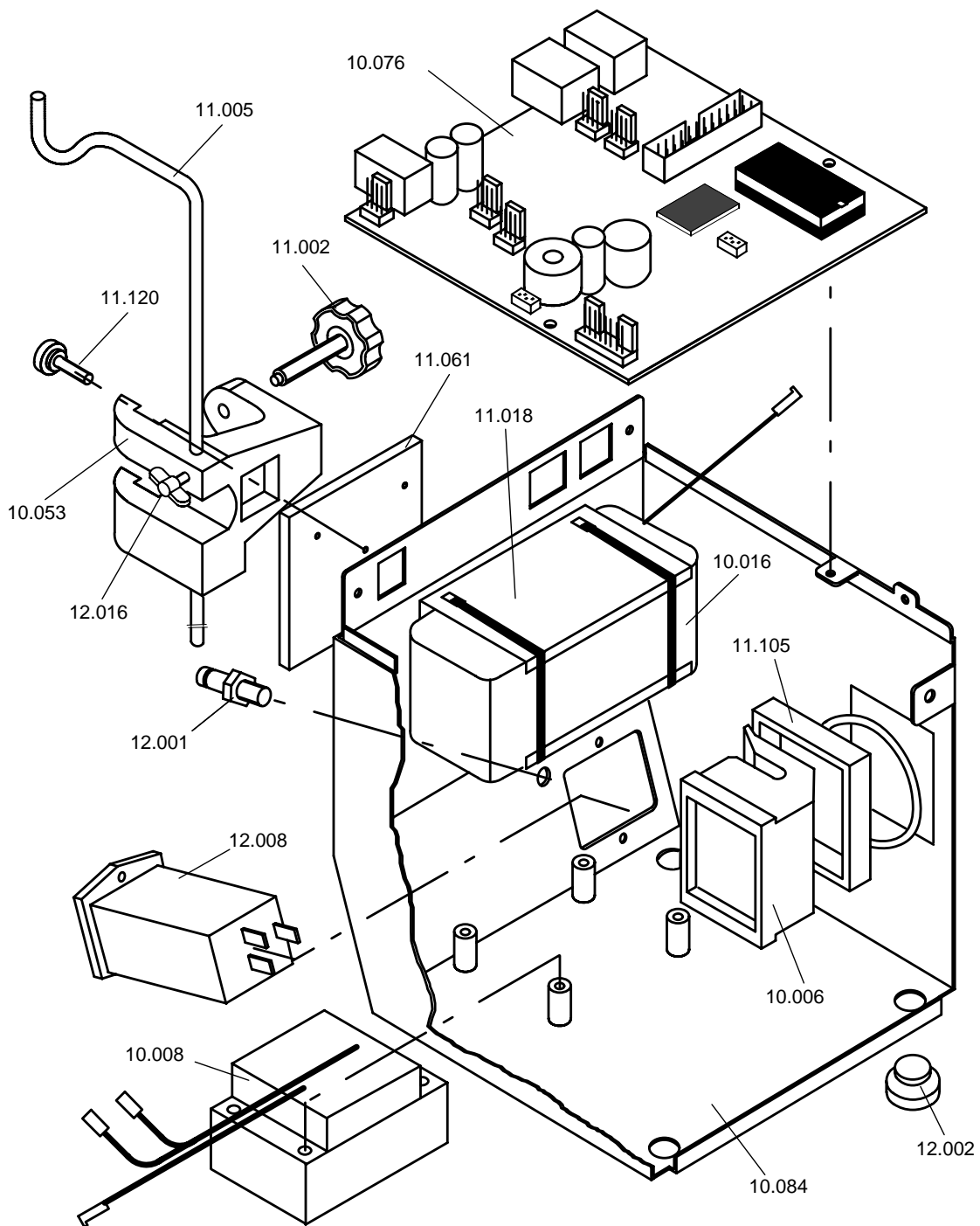4.7   Calibration of the battery capacity
        Each battery is subject to a chemical process with a slowly decreasing running time. After many charge and
        discharge cycles the battery may not have the capacity which provided the running time shown in the menu
        "CAP".
        To adjust the running time of the used battery please follow the steps mentioned below:

-   Go in the configuration mode of the pump.
-   Select address "368" in the left display.
-   Enter the data "615" in the right display and press the "START/STOP" key to accept the data. This will set
    the battery discharge time to the maximum of >10 hours.
-   Switch the pump off.
-   Be sure you have unplugged the line connection.
-   Switch the pump on normally and let the pump running in battery mode until its self switching off.
-    Load the battery for more than 16 hours by plug in the line.
-   Switch on the pump and start an infusion with a rate of 60ml/h. The infused sum at this rate is now equal to
    battery operating time in minutes.
-   Leave the pump running until the pump its self switching off again.
-   Switch the pump on while keeping the key "1" pressed. The right display now shows the capacity of the
    battery in minutes. Multiply this time x 0.8 and enter the result on address "368" in the configuration mode.
    This time defined from now on the running time of the pump including a 15 minutes pre-alarm (only after a
    full charge).
-   If this time is less than 4 hrs, you should replace the battery (part 10.016). If the specific time > 4hrs is not
    necessary, the battery has to be changed only if the time less than 3hrs, with respect to environ pollution.

5   Safety standard check

Safety standard check	**ARGUS 200**	O	**ARGUS Medical AG**
	ARGUS 400	O	
	ARGUS 404	O	
Serial-no:	**ARGUS 414**	O	

Hospital/Dept./Customer: ....

....

The safety standard check has to be performed at least every 24 months or after 10000 hours of operation. The check has to be done in accordance to the operation- and service manuals.

1	Visual check for damage, cleanness and completeness:	- Housing, labels, accessories, connectors, power cable, etc.	☐
2	Test the function of the stop flow lever:		☐

3	Keep key "START" (ARGUS 200/400/404) or "MODE" (ARGUS 414) pressed while switching on the pump.	- Display shows the software release: **V** ....
		- Display of 2, 4, 7, F., ml total, ml inf., h.min
		- Test of the red alarm LEDs:
		  Pressure display, air, battery, drops, ALARM
		- Test of the green operation LEDs:
		  Line, battery, drops, KVO
			☐

4	Place a filled tube in the air detector:	- LED air alarm disappeared	☐
5	Set rate to 111 ml/h, press "START/STOP" (without drop detector):	- After 12 sec. the acoustical alarm and LED drop-alarm + LED ALARM released	☐
6	Press key "MODE":	- Acoustical alarm switches off	☐
7	Simulate drops manually:	- LED drops (green) lights up	☐
8	Check of the occlusion-alarm-pressure: Infusion set: Codan ..... Pressure increase to ≥1.1 bar? Test of the occlusion-alarm-pressure	- See Service manual "Replacement of parts" Braun ..... Other .... Preset level: .... mbar Measured: .... mbar	☐
9	Check of the pump accuracy: Rate: 250 ml/h Preset volume: 25 ml	- See service manual "Replacement of parts" Measured volume: .... ml	☐
10	Test the pump at max. rate (999 ml/h):	- Running smooth?	☐

11	Battery check by setting the rate to 60 ml/h, disconnect the line and start the pump:
	
	Running time: .... min
	(If the specified typical 4hrs of operation are not required, the battery has to be changed only if the time is <3 hrs, due to environmental pollution)
		- Green LED battery light?
		- Battery prealarm after typ. 4 hrs?
		  (Red LED battery alarm + acoustical alarm)
		- Battery alarm 15 min. after prealarm
		  (Red LED battery alarm + ALARM + alarm acoustically)
		- After 6 min. the pump switches off
			☐

12	Charge the battery min. 16 hrs.		☐
13	Check the external connections:	- Staff alerting system	☐
		- External drop detector	☐
		- Computer interface RS232	☐
14	Electrical test according to EN60601-1 (all measurements made with a power cable 2,5 m)	- Measurements attached	☐
	The pump has passed the safety standard check and is safe for use.		☐

Date: ....   **Name:** ....   **Signature:** ....

Casing A414

10.006	Air detector with O-sealing
10.008	Transformer 230V
10.016	Battery 12V/1,2Ah
10.053	Clamp with screws
10.076	Main board ARGUS 414
10.084	Casing with rubber foot
11.002	Spindle for pole clamp
11.005	Bottle holder 450mm
10.084	Casing with rubber foot
11.018	Battery holder

|	
11.105	Sealing
11.061	Clamp holder
11.127	Identification plate ARGUS 414
11.120	Fixing screw M5x20 black
12.001	Equipotential plug
12.007	Cable staff alert (opt.)
12.008	Mains plug with filter
12.011	RS 232 cable
12.012	RS 232 adapter
12.016	Srew for bottle holder

11.128

11.081

10.036
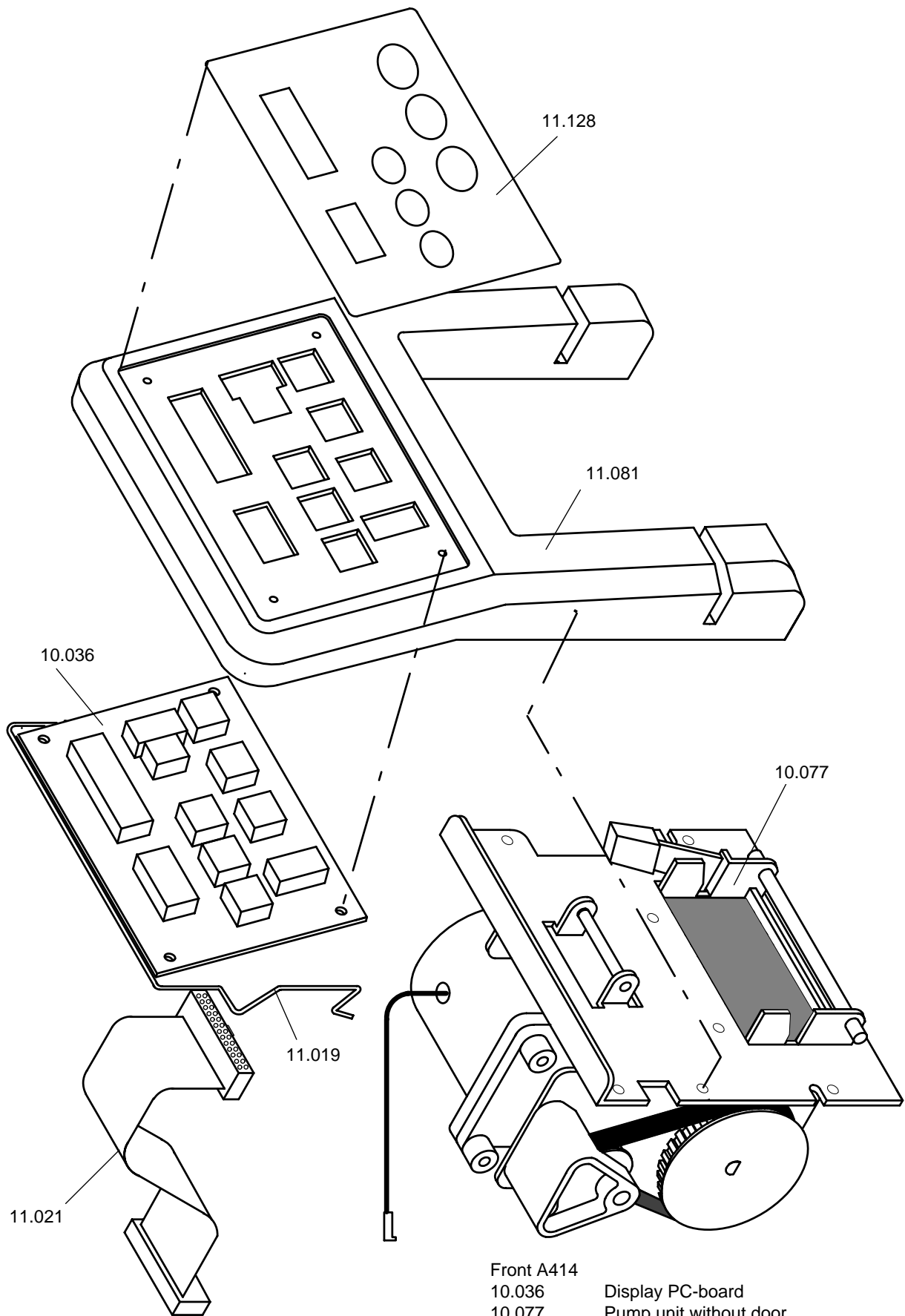
10.077

11.019

11.021

Front A414
|	
10.036	Display PC-board
10.077	Pump unit without door
11.019	Spring (Front-housing)
11.021	Cable assy 26pol
11.081	Front PVC
11.128	Frontpanel A414
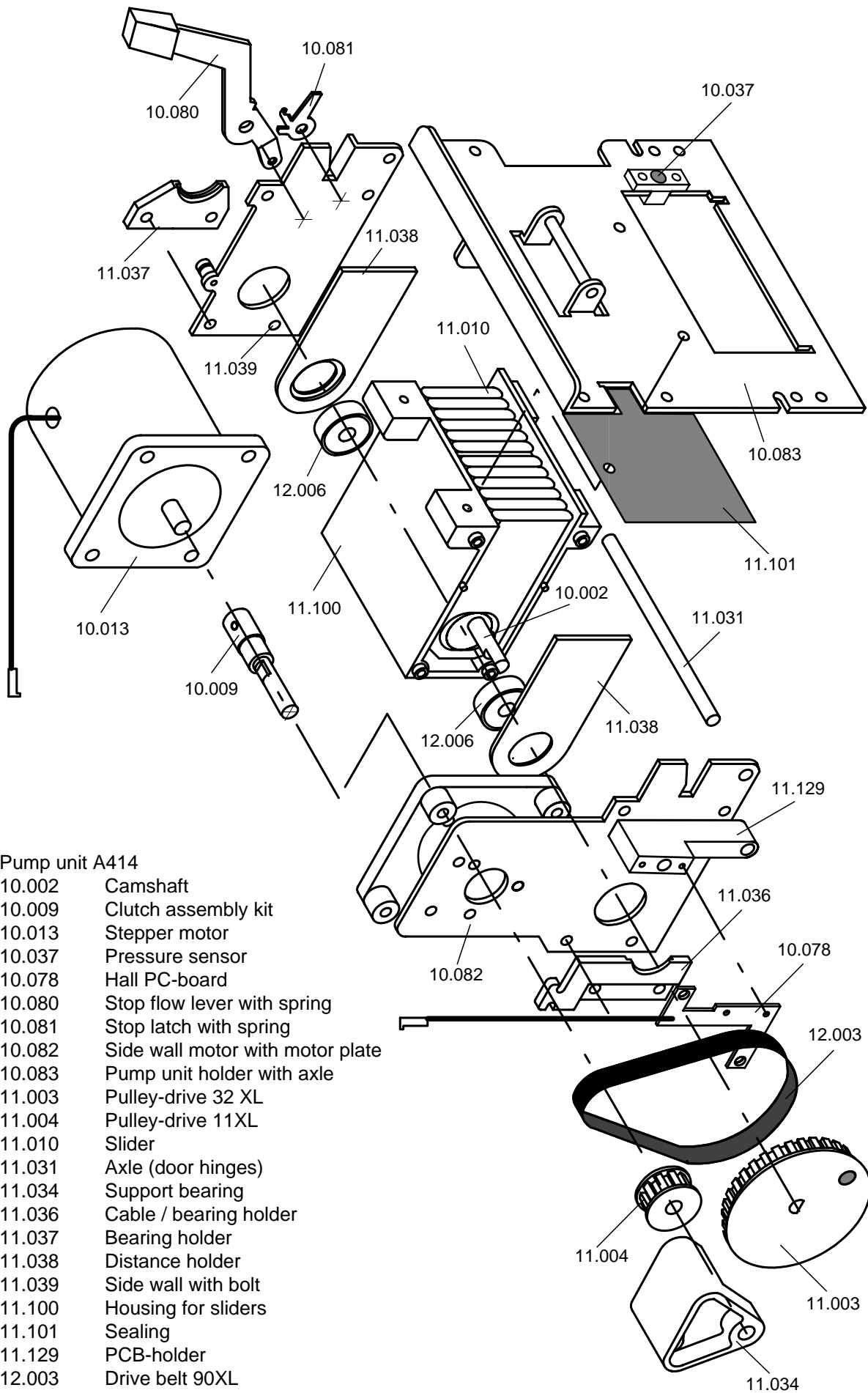
Pump unit A414

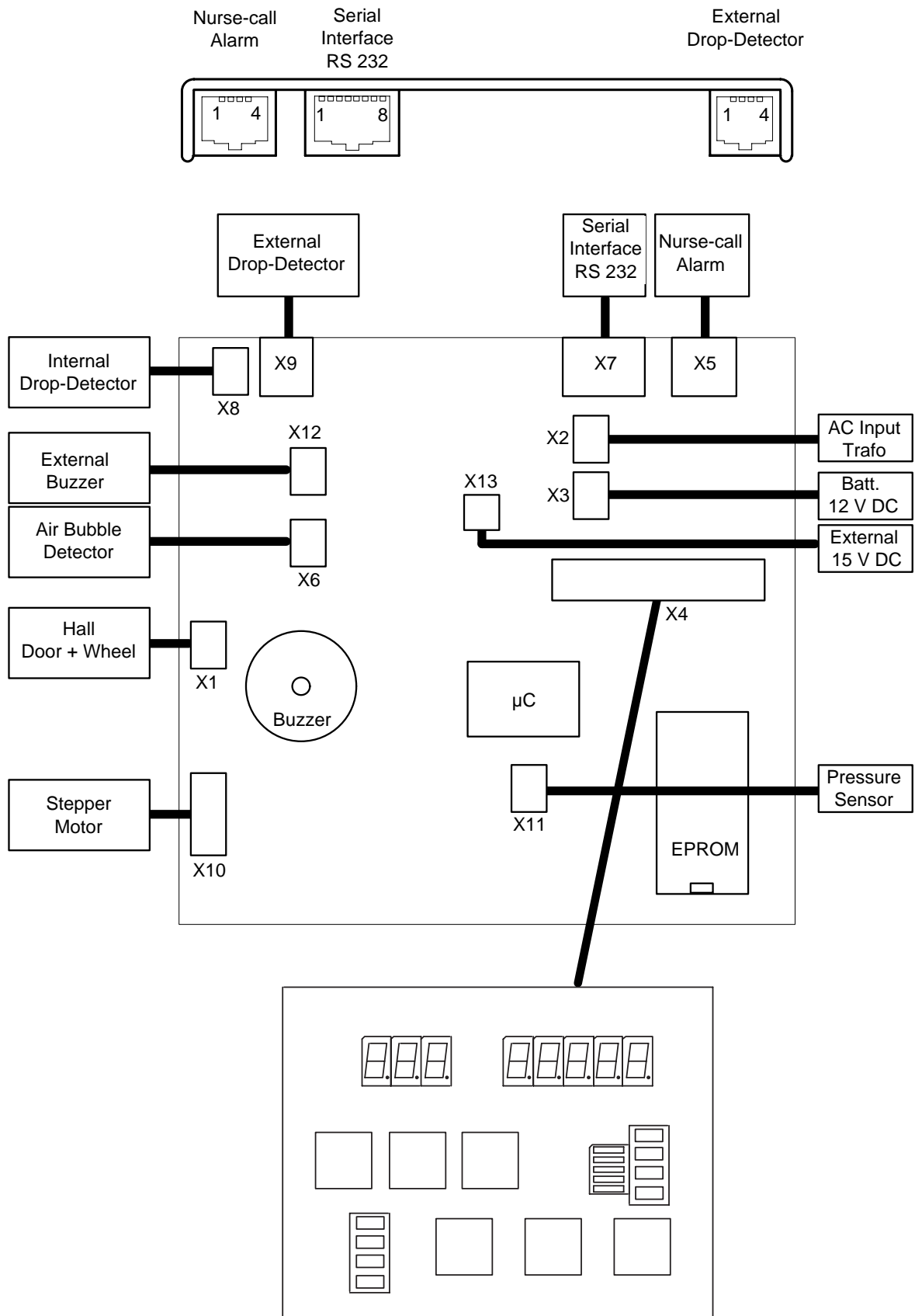|	
10.002	Camshaft
10.009	Clutch assembly kit
10.013	Stepper motor
10.037	Pressure sensor
10.078	Hall PC-board
10.080	Stop flow lever with spring
10.081	Stop latch with spring
10.082	Side wall motor with motor plate
10.083	Pump unit holder with axle
11.003	Pulley-drive 32 XL
11.004	Pulley-drive 11XL
11.010	Slider
11.031	Axle (door hinges)
11.034	Support bearing
11.036	Cable / bearing holder
11.037	Bearing holder
11.038	Distance holder
11.039	Side wall with bolt
11.100	Housing for sliders
11.101	Sealing
11.129	PCB-holder
12.003	Drive belt 90XL
12.006	Ballbearing
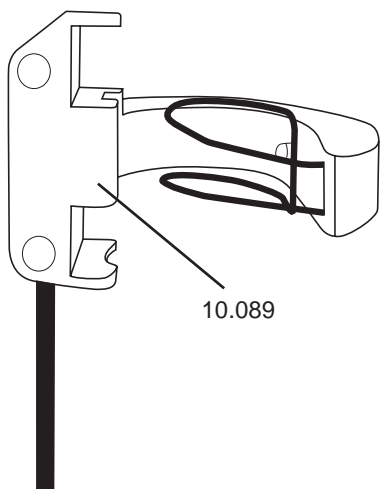
10.089
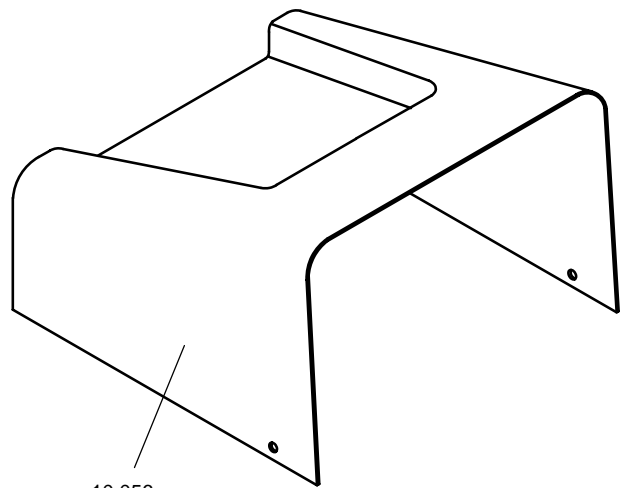
10.056
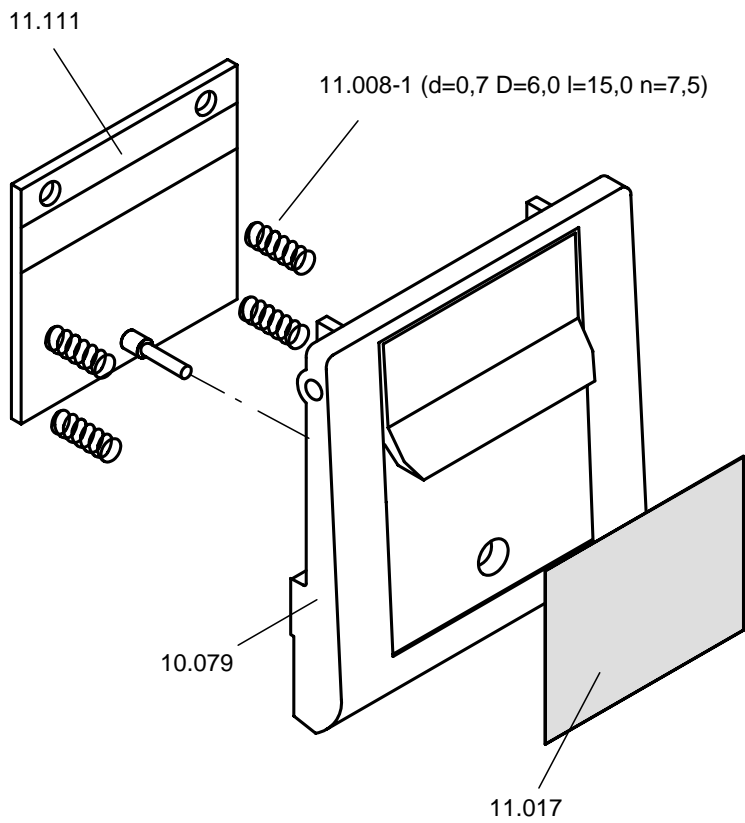
11.111
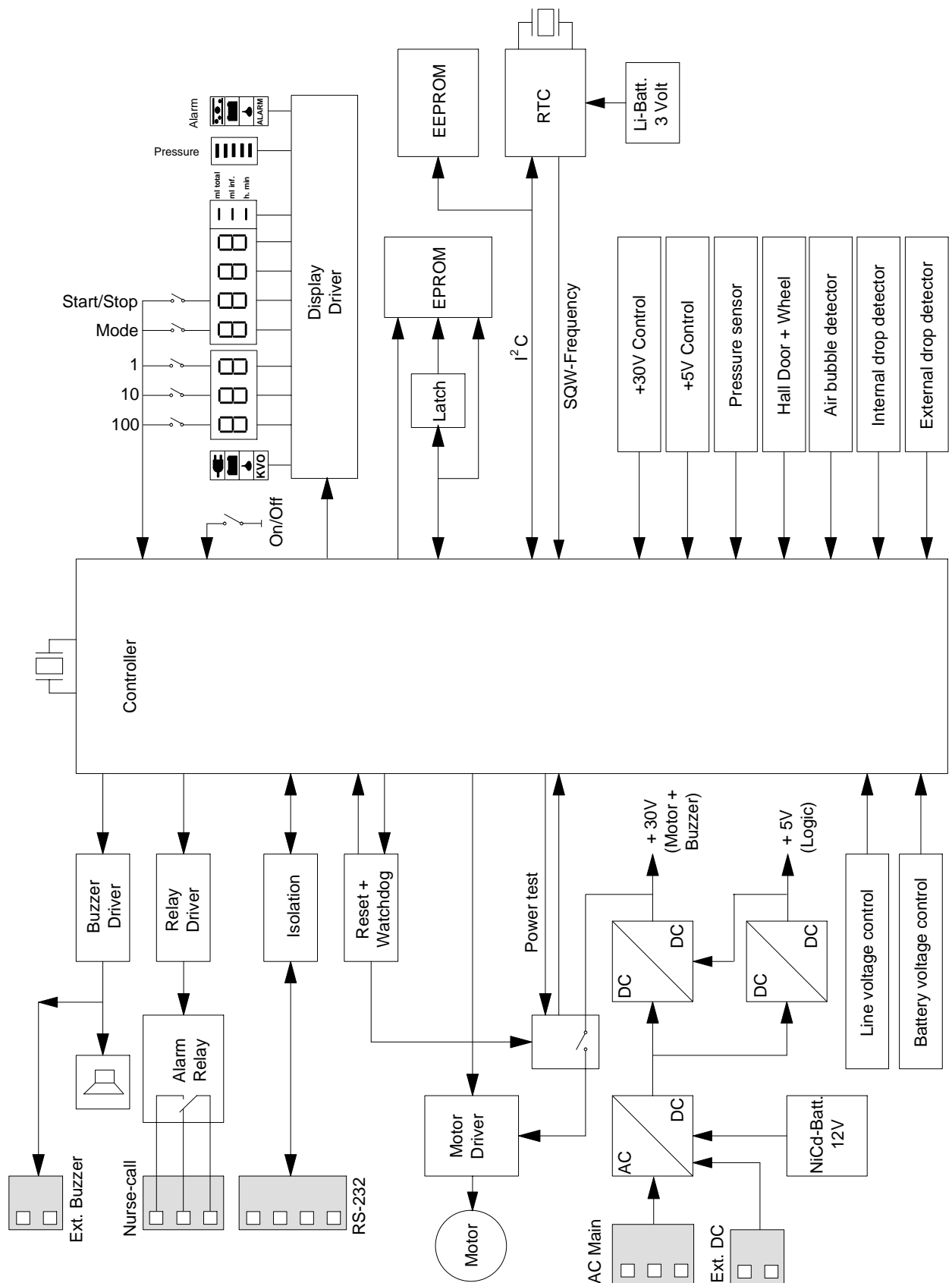
11.008-1 (d=0,7 D=6,0 l=15,0 n=7,5)

10.079

11.017

Cover and Door A414

10.056	Cover with magnet
10.050	Door complet
10.079	Door with handle
10.089	External drop detector 01
11.008-1	Pressure spring no. 1
11.017	Door cover
11.111	Counter plate

Nurse-call
Alarm

Serial
Interface
RS 232

External
Drop-Detector

| 1   4 | | 1   8 | | 1   4 |

External
Drop-Detector

Serial
Interface
RS 232

Nurse-call
Alarm

Internal
Drop-Detector

X8   X9

X7   X5

X12

External
Buzzer

X2   AC Input
Trafo

X13

X3   Batt.
12 V DC

Air Bubble
Detector

X6   External
15 V DC

Hall
Door + Wheel

X1

Buzzer

X4

μC

X11   Pressure
Sensor

Stepper
Motor

EPROM

X10

Wiring diagram

Bloc schematic