Functional Description and Control Logic – Discs Filtration System

1. Introduction:

The aim of this document is to describe the control philosophy for a Disc filtration system.

The instructions are related to hardware and software.

Customer is highly welcome to contact us with any questions or clarifications.

2. Project Information:

Project Name	4687 AIMS Seasim Expansion Project
Filter Model	111003-000524 6 x 3" SK filter battery 130 µm SW
Quantity	2 batteries
Flow	75 m3/hr per filter battery
Inlet Pressure	3.5 Bar(min)@130M ; 4 Bar(min)@70M
Service	Pre-membrane filtration
OC	396416
Production Date	2024

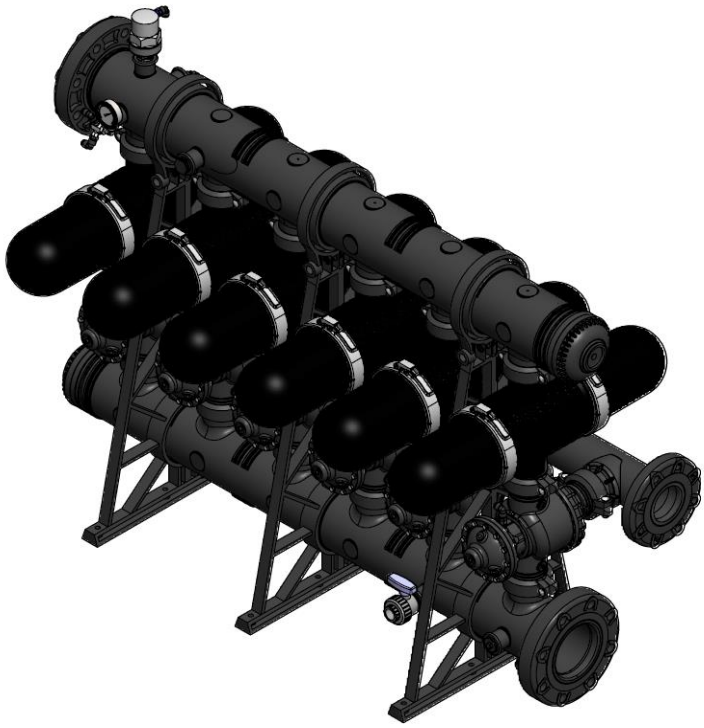
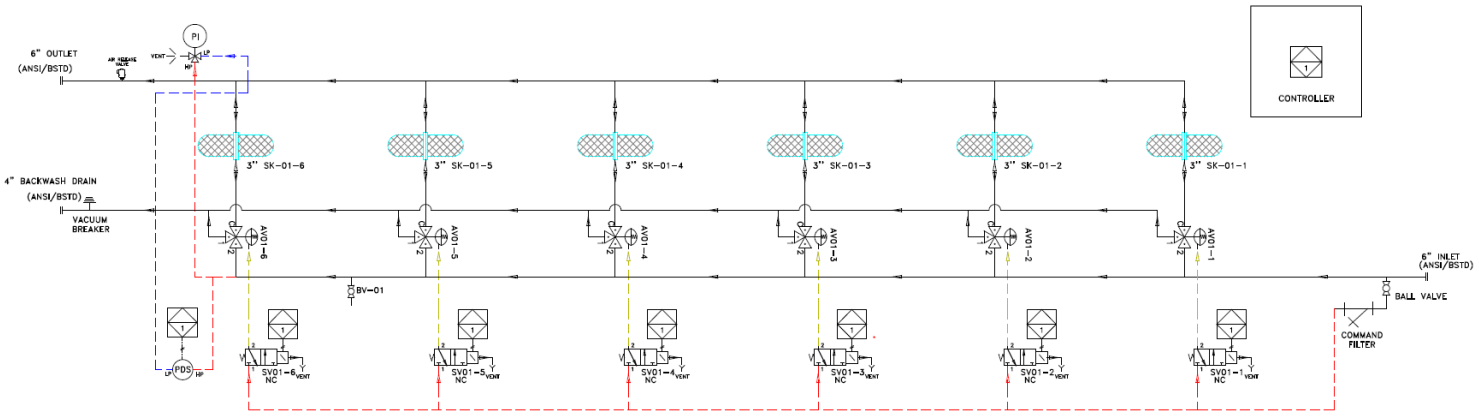


Figure 1 111003-000524 6 x 3" SK filter battery 130 µm SW

Amiad Water Systems Ltd.
D.N. Galil Elyon 1, 1233500, Israel
Tel: 972 4 690 9500
Fax: 972 4 814 1159
E-mail: info@amiad.com
Web: www.amiad.com

Reference P&ID



3. System Description:

Main components are:

Amiad Disc Filtration System

- 6 x 3" SK Internal Source filter batteries (6 pods in each filter battery X 2 batteries)
- Each Pod has one (1) external 3-way Hydraulic Backwash Valve: Bermad 3" series 350 diaphragm valve SW.

Description of the Filtration Process

During the filtration stage, water flows through the INLET manifold and is distributed through the 3" backwash valves into the Spin Klin filters.
The water then passes through the filtration elements to the outlet manifold for consumer use.

Description of the Backwashing Process

1. The controller transmits an electrical command to the first solenoid according to either differential pressure or time.
2. The solenoid then sends a pressure command to the backwash valve, moving it from the filtration mode to the backwash mode.
3. Filter pod #1 is then backwashed with filtered water supplied from the outlet manifold in reverse flow through the filtration element to the drain. Contaminated water and impurities flow out through the drain manifold.
4. On completion of the allotted backwashing time, the controller releases the backwash command, and filter pod #1 returns to the filtration mode.
5. Filter pod #2 then enters the backwash mode, and the process is repeated until all the filters in the battery have been backwashed.
6. After all the filter pods have been backwashed the battery returns to the filtration mode, until the next backwash cycle.

Amiad Water Systems Ltd.
D.N. Galil Elyon 1, 1233500, Israel
Tel: 972 4 690 9500
Fax: 972 4 814 1159
E-mail: info@amiad.com
Web: www.amiad.com

4. Electrical components:

	Components	Data	Qty per battery	Qty Total	Tag numbers
1.	3/2 N.C. Solenoids		6	12	(By Others)
2.	Pressure transmitters (outside of Amiad Scope)	4-20 mA	0	0	Optional (by others)
3.	Compressed air pressure switch (outside of Amiad Scope)	4-20 mA	0	0	Optional (by others)

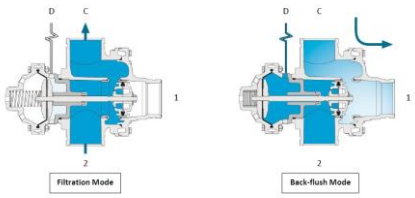
5. Digital Inputs

	Components	Data	Qty	Tag numbers
1.	Differential Pressure Digital dry touch		1	Optional (by others)

6. Analog Inputs

	Components	Data	Qty	Tag numbers
1.	DP	Signal for Backwashing from Pressure Transmitters (calculated DP= Inlet Pressure – Outlet Pressure)	1	(by others)
2.	APS - AIR PRESSURE OK	Compressed air supply indication	1	Optional (by others)

7. Digital outputs/Communication commands

	Item	Function	Tag	Remarks
	GENERAL FAULT LINE 1	ON if there are one or more critical faults that do not allow Line 1 operation		Specific fault reason appears on HMI
	GENERAL FAULT LINE 2	ON if there are one or more critical faults that do not allow Line 1 operation		Specific fault reason appears on HMI
	FAULT	Red LED on local panel		HMI notification
	Solenoids 1-12	Change the filter's 3-way valves position: **Filtration**: inlet + outlet open; drain closed **Backwash**: outlet + drain open; inlet closed 		Each filter pod requires 1 (one) solenoid to command the pod's respective valve

8. Backwash cycle Sequence:

Step	Output	Status	Description (Overlap mode)
1.			Start Backwash signal
2.	T1		Programmable delay (0-30 seconds)
3.			**Backwash Cycle "On Indication"**
4.	T2		Programmable delay (0-6 seconds)
5.		ON	Activate SV1 – Pod#1
6.	T3		Programmable delay (0-6 seconds)
7.	T4		Backwashing (0-30 seconds)
8.	T5		Programmable delay (0-6 seconds)
9.		OFF	Turn Off SV1 – Pod#1
10.	T6		Programmable delay (1-60 seconds)
11.		ON	Activate SV2 – Pod#2
12.	T3		Programmable delay (0-30 seconds)
13.	T4		Backwashing (0-30 seconds)
14.	T5		Programmable delay (0-6 seconds)
15.		OFF	Turn Off SV2 – Pod#2
16.	T7		Programmable delay (0-25 seconds)
17.			**The steps 5-10 repeat for the following solenoids until SV6 (pod #6) finishes and this is the end of the Backwashing cycle for battery 1**
18.			**The process (steps 1-17) repeats for battery 2 in the same way until all pods finish and this is the end of the Backwashing cycle for the filtration system**
19.			**Backwash Cycle "On Indication" turns Off**

Refer to below chart for backwash process.

Amiad Water Systems Ltd.
D.N. Galil Elyon 1, 1233500, Israel
Tel: 972 4 690 9500
Fax: 972 4 814 1159
E-mail: info@amiad.com
Web: www.amiad.com

LEGEND:

ON = Energize

OFF = De-energize

PT1 = Pressure Transmitter 1 (common inlet manifold)

PT2 = Pressure Transmitter 2 (common outlet manifold)

PD = Pressure Differential

PDT = Pressure Differential Contact Timer

T1 = Backwash Duration Timer

T2 = Dwell Timer

T3 = Interval Timer (backwash on time basis)

S.P. = Set point

SV11 = Skid 1, Solenoid SV01-1 (Pod 1)

SV12 = Skid 1, Solenoid SV01-2 (Pod 2)

SV13 = Skid 1, Solenoid SV01-3 (Pod 3)

↓ ↓

SV16 = Skid 1, Solenoid SV01-6 (Pod 6)

SV21 = Skid 2, Solenoid SV02-1 (Pod 1)

SV21 = Skid 2, Solenoid SV02-2 (Pod 2)

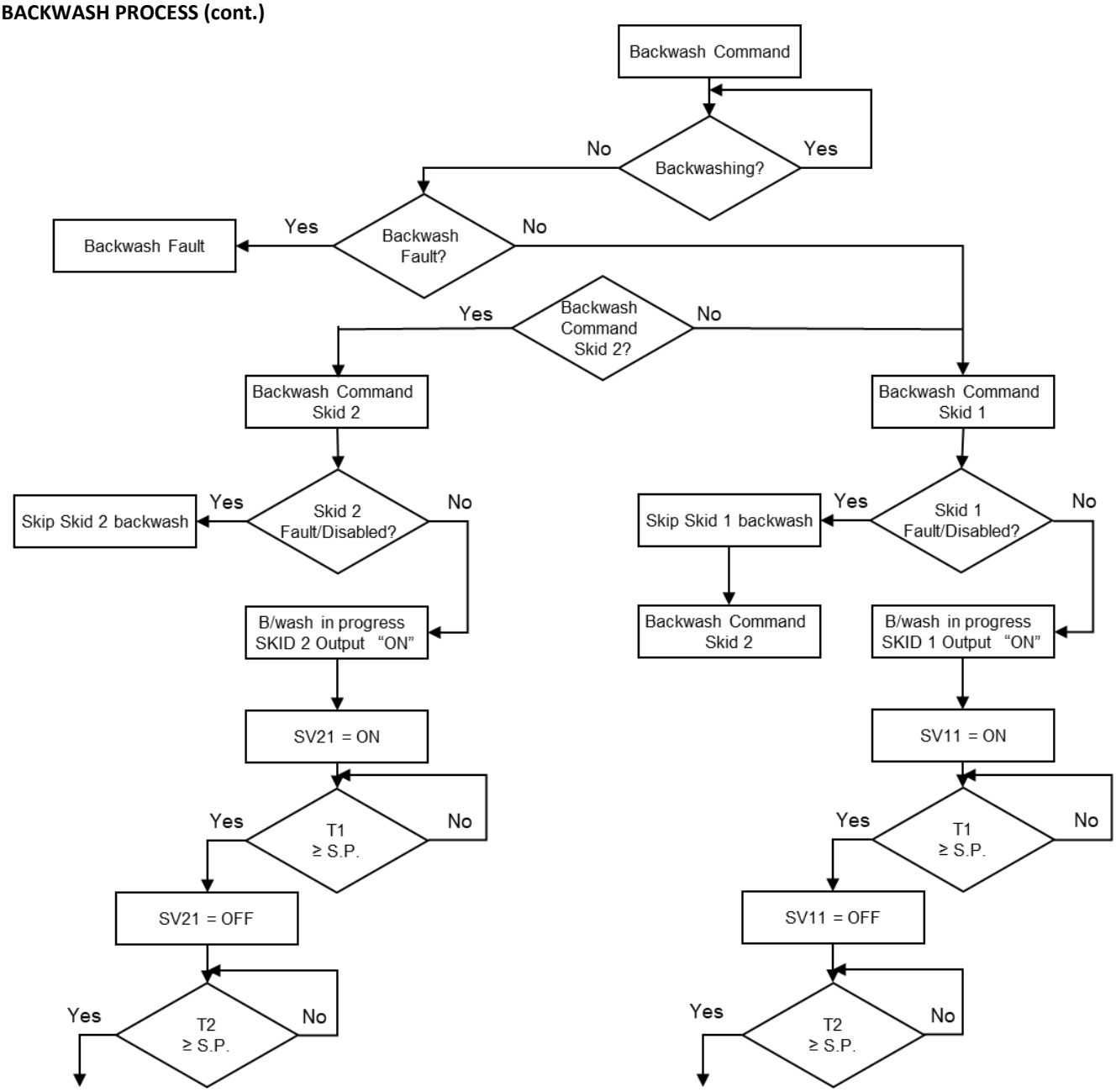
SV23 = Skid 2, Solenoid SV02-3 (Pod 3)

↓ ↓

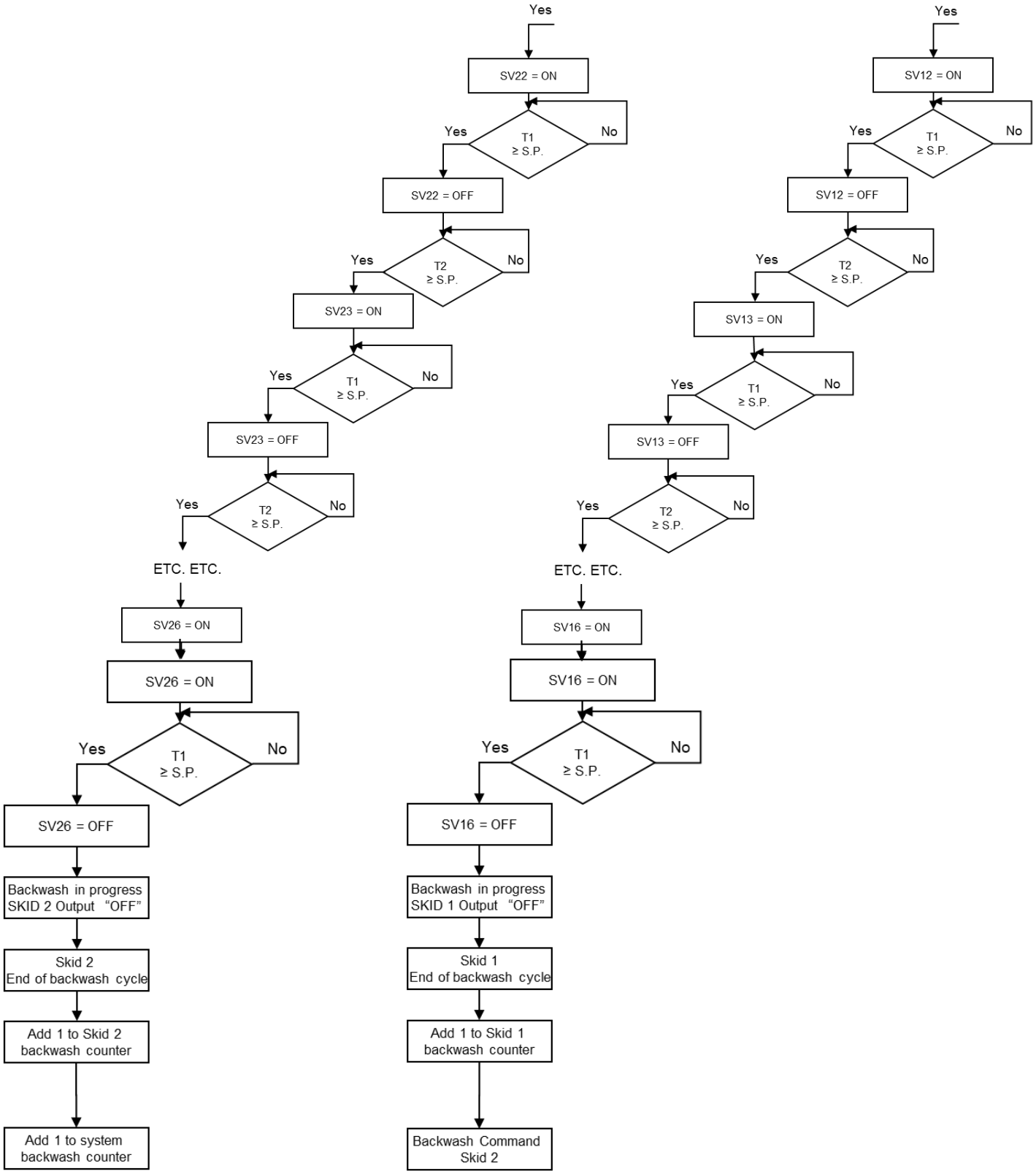
SV26 = Skid 2, Solenoid SV02-6 (Pod 6)

Amiad Water Systems Ltd.
D.N. Galil Elyon 1, 1233500, Israel
Tel: 972 4 690 9500
Fax: 972 4 814 1159
E-mail: info@amiad.com
Web: www.amiad.com

BACKWASH PROCESS (cont.)



BACKWASH PROCESS (cont.)



9. Initiation of Backwash Cycle:

Backwash Cycle may start as a result of any of the following:

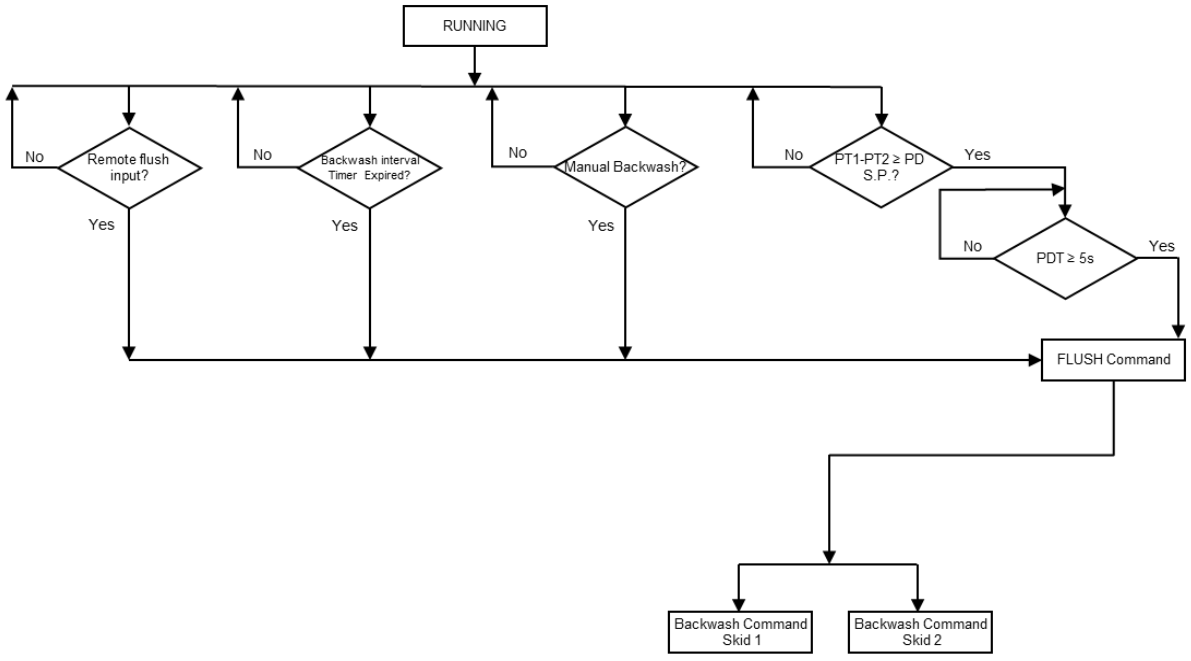
- Differential Pressure:
  The DP will be calculated by the pressure in PTS1 minus the pressure in PTS2
  PD signal should be considered ON if the PD Value is ≥ Pre-Set value for at least 0-20 seconds.
  The Pre-Set PD value shall be defined through the HMI
  Units: Bar
  Range: 0.10 to 1.00 bar
  Default: 0.5bar

- Time Interval:
  Backwash Cycle starts if the accumulated time from last Backwash Cycle reach the Interval Set-Point.
  The Time counter re-set back to zero when the Backwash Cycle starts regardless if it caused by DP ,by time or manual.
  The Pre-Set Cycle value shall be defined through the HMI.
  Units: Minutes
  Range: 10 to 1440 (0 = Never).
  Default: 120 minutes

- Manual Start from Local Control panel:
  Start Backwash button - starts a Backwashing cycle (HMI on local control panel). The manual mode is limited to the Backwash time parameter as set in the control system and to a single Backwash cycle only.
  Need a manual option in HMI to stop backwash cycle.

- Remote Start from Control Room:
  Remote Start Backwash button - starts a Backwashing cycle from the control room. The remote mode is limited to the Backwash time parameter as set in the control system and to a single Backwash cycle only.
  Need a manual option in HMI to stop backwash cycle.

BACKWASH INITIATION



10. Faults and Alarms:

- Discs Filtration System Clogging Alarm:
  Frequency of Backwash cycles is too high and preventive action should be considered.
  Definition:
  Alarm will turn on if there are 3 x consecutive cycles with less than 20 minutes interval.
  Pre-Set values shall be defined via the HMI
  Action: Indication and message on HMI
  RESET: Local Pushbutton or via HMI
  Parameters: Number of Backwash Cycles @ Minimum Interval
  Default: 3 Backwash Cycles @ 15 minutes.
  Need an option in HMI to disable this function

- Discs Filtration System Clogging Fault (HHDP Fault **Only if PT are used**):
  DP across the Discs Filtration System is above HH set point for more than 15 minutes.
  Pre-Set HH DP value shall be defined through the HMI
  Action: Stop Backwash sequence, Shut-off feed Pump + Indication and message on HMI
  RESET: Local Pushbutton or via HMI
  Units: bar
  Range: 0.3 to 0.9
  Default: 0.7 bar

  Need an option in HMI to disable this function

11. Fault table:

	Fault description	Fault message	Action
1.	Continuous Backwash Cycles	Too many consecutive Backwash cycles - Alarm 3 Backwashes in 10 minutes intervals	HMI notification Check system and Reset the Fault
2.	Compressed Air low pressure	Low compressed air pressure	HMI notification Check system and Reset the Fault

12. HMI considerations: (It is suggested to display on the HMI the following Information)

- Compressed air pressure switch indication.
- Pod mode: filtering / Backwashing
- Battery Status: Filtering / Backwashing / Fault / Alarm.
- Time from Last Backwash
- Time Interval of previous Backwash
- Average time between backwashes in 24 hours
- Average time between backwashes in the past 7 days
- Cause of last Backwash Cycle – DP / Time / Manual Local / Remote.
- Detail of Fault, Detail of Alarm (example: HDP; HHDP;)
- Backwash Cycle Counters:
  - Backwash Cycles by DP
  - Backwash Cycles by Time
  - Backwash Cycles by Manual

Amiad Water Systems Ltd.
D.N. Galil Elyon 1, 1233500, Israel
Tel: 972 4 690 9500
Fax: 972 4 814 1159
E-mail: info@amiad.com
Web: www.amiad.com

13. Parameters setting

The following parameters values should be programmable via the HMI:

Parameter	Units	Range	Default
Filter unit setup			
DP Set point:	Barg	0.10 – 1.00	0.5
HH DP Set point **(If PT are used)** :	Barg	0.3 – 1.20	0.7
T1 =DP Delay	Seconds	0 – 60	10
Interval for Backwash by time:	Minutes	0 – 1440	120 0 = never
Time in HHDP before Fault **(If PT are used)**:	Minutes	1 – 60	15
T2 = Time before start Backwash Cycle	Seconds	0 – 6	1
T3 = valve delay	Seconds	0 – 6	1
T4 = Backwash Time:	Seconds	1 – 30	7
T5 = Valve delay	Seconds	0 – 6	1
T6 = Time before next pod Backwash Cycle	Seconds	1 – 60	20
T7 = Time before Ending Backwash Cycle	Seconds	0 – 25	10

* Final parameters can be changed during the system startup

14. History:

The following data should be stored and can be shown as a graph/trend or as an events log:

- Backwash cycles
- Cause of Backwash cycle (DP, Time, Manual)
- Fault: time and description.
- Alarm: time and description.

Amiad Water Systems Ltd.
D.N. Galil Elyon 1, 1233500, Israel
Tel: 972 4 690 9500
Fax: 972 4 814 1159
E-mail: info@amiad.com
Web: www.amiad.com