

# Pumped irrigation controller

**clonk**

2023



# Contents

<b>1</b>	<b>Setup</b>	<b>1</b>
1.1	Installation . . . . .	3
1.2	Configuration . . . . .	3
<b>2</b>	<b>Operation</b>	<b>7</b>
2.1	Run mode . . . . .	7
2.1.1	Dam pump . . . . .	7
2.1.2	Tank pump . . . . .	7
2.2	Manual mode . . . . .	8
<b>3</b>	<b>Outputs</b>	<b>9</b>
3.1	Screen . . . . .	9
3.1.1	Faults . . . . .	9
3.2	Serial . . . . .	10
3.3	Modbus . . . . .	12
<b>4</b>	<b>Trouble-shooting</b>	<b>19</b>
4.1	Alarms . . . . .	19
4.1.1	Alarm 1 - Overflow . . . . .	19
4.1.2	Alarm 2 - Slow flow . . . . .	19
4.1.3	Alarm 3 - Fast flow . . . . .	20
4.1.4	Alarm 4 - High pulse . . . . .	20
4.1.5	Alarm 5 - Dam no flow . . . . .	20
4.2	Warnings . . . . .	20
4.2.1	Warning 1 - Float switches . . . . .	21
4.2.2	Warning 2 - Clock failure . . . . .	21

4.2.3	Warning 3 - No allocations . . . . .	22
4.2.4	Warning 4 - Tank no flow . . . . .	22
4.2.5	Warning 5 - Invalid configuration . . . .	23
4.3	Errors . . . . .	24
4.3.1	Error 1 - Float switches . . . . .	24
4.3.2	Error 2 - I2C2 failure . . . . .	24
4.3.3	Error 3 - I2C3 failure . . . . .	25
4.3.4	Error 4 - Memory failure . . . . .	25
<b>Contact</b>		<b>29</b>

# 1 Setup

Figure 1.1 shows the full extent of the supported setup for this controller. Many of these components can be removed and the rest of the system will continue to safely operate.

## Switching

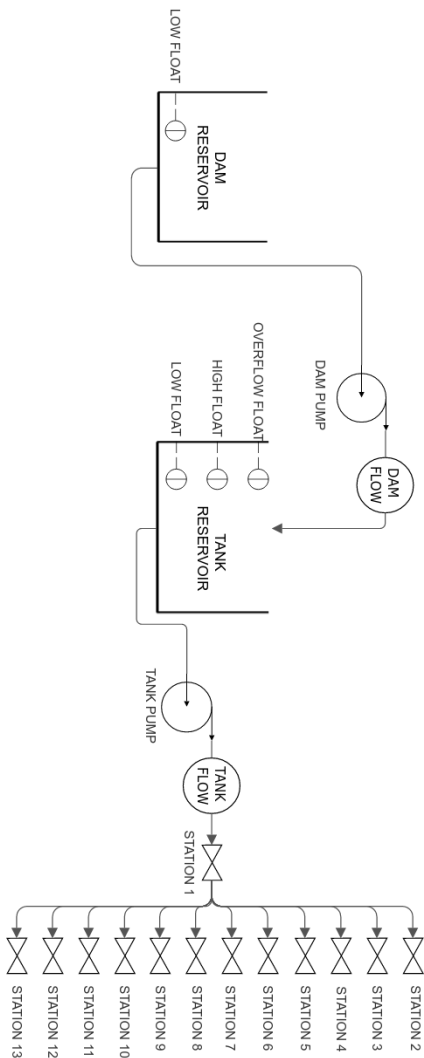
- This controller outputs a 24VAC switched signal to control all pumps and valves.
- Valves should be non-latching.

## Flow sensor inputs

- Both flow meters must output a digital pulse for a set volume. Volume per pulse can be changed as detailed in Section 1.2. 4-20mA signals are not supported.
- Digital pulses should have a frequency of no more than 20Hz.

## Float switch inputs

- Float switches are expected to be CLOSED when the water level is above them and OPEN otherwise.
- Float switches input terminals can be left OPEN or wired CLOSED if unused. This may impair some of the controller's system safety features.



**Figure 1.1:** An illustrative schematic showing the supported system components.  
Note: Station 1 can be used as a master valve (shown) or as an ordinary, independent station.

## 1.1 Installation

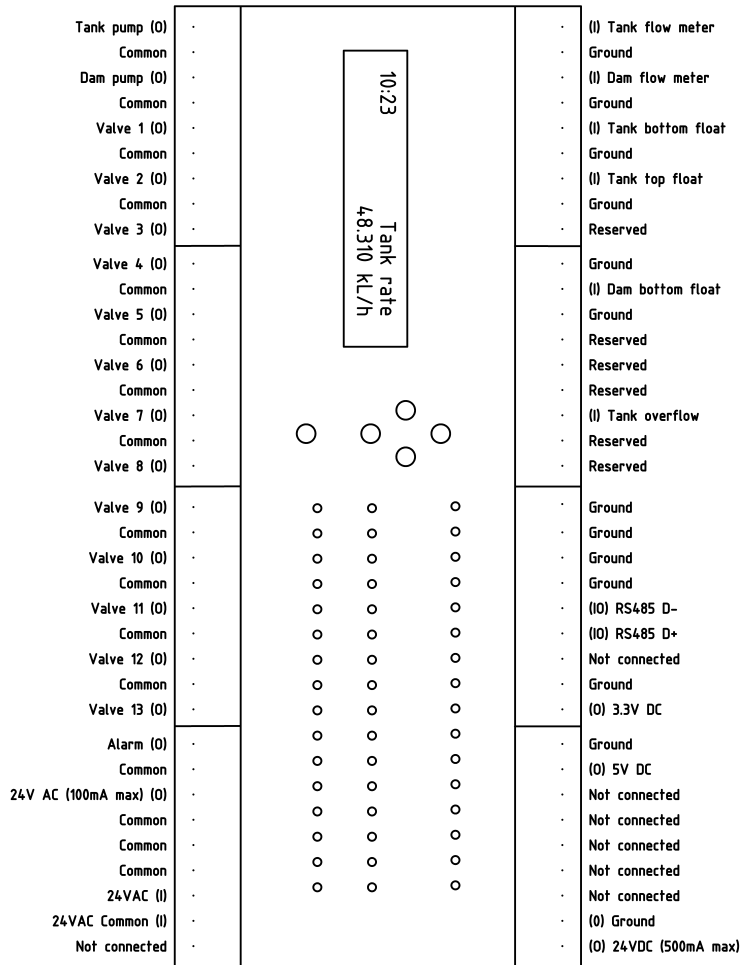
The control unit is compatible with standard DIN rails and should be mounted accordingly. A 24V AC power supply (not supplied) will also be required.

The terminal block arrangement is shown in Figure 1.2.

## 1.2 Configuration

CONFIGURATION mode allows the user to set a wide range of operational parameters.

- **Set time**  
The controller's time and date.
- **Allocation type**  
Each pump can be run with either VOLUME allocations or TIME allocations.
- **Number of valves**  
This is the number of valves connected to the TANK. Not all valves have to be allocated.
- **Valve allocation**  
This is the VOLUME or TIME each valve will be individually allocated. The allocation units can be changed in Allocation type.
- **Configure dam pump**  
This is the start time (24hr clock) of the dam pump and either the volume to deliver (if using VOLUME allocations) or the stop time (if using TIME allocations).



**Figure 1.2:** Terminal block diagram where (O) denotes an OUTPUT and (I) denotes an INPUT.



- **Schedule winter**  
This schedules WINTER mode. WINTER mode deactivates the dam pump between the dates selected.
- **Pulse volume**  
This sets the volume per pulse for each flow meter.
- **No-flow rate**  
This sets the minimum flow rate required to avoid the pump running dry. Each pump's NO-FLOW RATE can be set individually. Set to 0kL/hr to de-activate this protection.
- **Low-flow rate**  
This sets the low flow rate for a given pump. Flow rates below this value will trigger a low flow alarm on that pump and the currently active station. Section 4.1.2 outlines the impact of low flow alarm. Each pump's LOW FLOW RATE can be set independently. Set to 0kL/hr to de-activate this protection.
- **High-flow rate**  
This sets the high flow rate for the system. Flow rates below this value will trigger a high flow alarm on that pump and the currently active station. Section 4.1.3 outlines the impact of high flow alarm. Each pump's HIGH FLOW RATE can be set independently. Set to 0kL/hr to de-activate this protection.
- **Master valve**  
This allows the use of a master valve. If activated, Valve 1 will be set as the master valve.
- **Firmware**  
Displays the firmware version.

- **Fault reset**  
Resets all faults.
- **Factory reset**  
Returns the controller to factory conditions.
- **Save & exit**  
Saves all updated variables and returns to PAUSE mode.

## 2 Operation

### 2.1 Run mode

#### 2.1.1 Dam pump

The DAM PUMP moves water from the DAM reservoir into the TANK. It will begin pumping every day at the configured start time. It will stop pumping when it reaches its daily VOLUME allocation or its configured stop time. The allocation mode, amounts and times can all be changed in the CONFIGURATION menu as detailed in Section 1.2.

WINTER mode sets the DAM PUMP's daily allocations to zero for the duration of WINTER. These dates are configurable in the CONFIGURATION menu.

There are a number of checks that are made before and while the DAM PUMP is turned on in order to protect the system:

1. The DAM PUMP will only start if the TANK is empty or the TANK PUMP is not running.
2. The DAM PUMP will turn off if the TANK becomes full or overflowing.
3. The DAM PUMP will turn off if the DAM becomes empty.

#### 2.1.2 Tank pump

The TANK receives water from the DAM. When the float switches in the TANK register full the TANK PUMP activates and starts se-

quentially delivering each valve its allocation. This will continue until the TANK's float switches register empty. When this happens the TANK PUMP will deliver the remainder of that valve's allocation next time the TANK registers full.

The TANK PUMP can deliver either VOLUME or TIME allocations to each station. Each station's allocation is individually configurable in the CONFIGURATION menu.

## 2.2 Manual mode

MANUAL mode allows the user to turn on all stations including pumps. MANUAL mode is limited to five (5) stations turned on at any one time in order to protect the controller. No other protections exist inside manual mode.

## 3 Outputs

### 3.1 Screen

In RUN mode the screen displays the time, system statistics and relevant alarm codes. Use the UP and DOWN buttons to scroll through the available outputs.

#### 3.1.1 Faults

To clear all faults, enter the menus by holding the LEFT button, select ENTER CONFIG, scroll to FAULT RESET and press the RIGHT button.

The heirachy of faults is as follows from least to most serious:

#### **Alarms**

When an alarm is triggered the current alarm code will be displayed in the top left of the screen and normal operation will continue. The alarm lamp and the alarm terminal will also be turned on. See Section 4.1 for details on different alarm codes.

#### **Warnings**

When a warning is triggered the controller will display the warning code on the screen and turn off all pumps and sta-

tions. The alarm lamp and the alarm terminal will also be turned on. If the warning resolves, normal operation will resume. The configuration menus can still be accessed from a warning state. See Section 4.2 for details on different warning codes.

## Errors

When an error is triggered the controller will display the error code on the screen and turn off all pumps and stations. The alarm lamp and the alarm terminal will also be turned on. The controller cannot recover from an error without human intervention. See Section 4.3 for details on different error codes.

## 3.2 Serial

All controller operations are accompanied by an output over the serial bus. The serial codes follow the general pattern:

HH-MM-SS.mmm->ABC

where 'HH-MM-SS.mmm' is the controller's current time and 'ABC' is the serial code. All fields are fixed length and unlimited.

Serial parameters are described in Table 3.1 and the messages are as described in Table 3.2.

**Table 3.1:** Serial parameters

Detail	Value
Baud rate	19200

**Table 3.2:** Serial messages

Code	Description	Parameters
IAA	Info start	
IFR	Info factory reset	
IES	Info end setup	
IGV	Info globals valid	
ITV	Info tank volume pumped (total)	uint32_t total_volume_pumped
IDV	Info dam volume pumped (total)	uint32_t total_volume_pumped
IOV	Info open valve	int16_t valve_ID
IOM	Info open master valve	int16_t valve_ID
ICV	Info close valve	int16_t valve_ID
ICM	Info close master valve	int16_t valve_ID
ITR	Info tank pump start	
ITP	Info tank pump stop	
IDR	Info dam pump start	
IDP	Info dam pump stop	
IFT	Info top float switch	int16_t switch_state
IFB	Info bottom float switch	int16_t switch_state
IS0	Info status 0	int16_t num_valves
IS1	Info status 1	char use_volume_alloc
IS2	Info status 2	uint32_t volume_per_pulse
IS3	Info status 3	uint32_t pump_no_flow_rate
IS4	Info status 4	uint32_t milliseconds_per_pulse
IS5	Info status 5	char use_master_valve
IS6	Info status 6	int16_t valve_ID, uint32_t valves[i].vol_allocation
IS7	Info status 7	int16_t valve_ID, uint32_t valves[i].time_allocation
IS8	Info status 8	int16_t valve_ID, char is_master

Continued on next page

Table 3.2: Serial messages (Continued)

Code	Description	Parameters
IS9	Info status 9	int16_t valve_ID, char valves[i].is_open (O: open, S: shut)
Axx	Alarm xx	
Wxx	Warning xx	
Exx	Error xx	

### 3.3 Modbus

Most controller statistics can be read over modbus and most configuration parameters can be written. Modbus parameters are described in Table 3.3 and the registers are as described in Table 3.4. The final column of Table 3.4 indicates if the register is read-only (R) or read-write (RW).

Table 3.3: Modbus parameters

Detail	Value
Address	1
Baud rate	19200
Endianness	Big endian

Table 3.4: Modbus registers

Register	Description	RW
0	REGISTER HASH	R
1	RESET COUNT	R
2	CURRENT WARNINGS	R
3	CURRENT ERROR	R
4	FIRMWARE VERSION	R
5	NO FLOW COUNT	R

Continued on next page



**Table 3.4:** Modbus registers (Continued)

Register	Description	RW
6	TANK VOLUME HIGH WORD	R
7	TANK VOLUME LOW WORD	R
8	DAM VOLUME HIGH WORD	R
9	DAM VOLUME LOW WORD	R
10	TANK FLOW RATE HIGH WORD	R
11	TANK FLOW RATE LOW WORD	R
12	DAM FLOW RATE HIGH WORD	R
13	DAM FLOW RATE LOW WORD	R
14	STATIONS HIGH FLOW	R
15	STATIONS LOW FLOW	R
16	STATIONS ALLOCATED	R
17	INPUT STATES	R
18	OUTPUT STATES	R
19	IS WINTER	R
20	RTC FLAGS	R
21	RTC TEMP	R
22	STATION VOLUME TOTAL HIGH WORD 1	R
23	STATION VOLUME TOTAL LOW WORD 1	R
24	STATION VOLUME TOTAL HIGH WORD 2	R
25	STATION VOLUME TOTAL LOW WORD 2	R
26	STATION VOLUME TOTAL HIGH WORD 3	R
27	STATION VOLUME TOTAL LOW WORD 3	R
28	STATION VOLUME TOTAL HIGH WORD 4	R
29	STATION VOLUME TOTAL LOW WORD 4	R
30	STATION VOLUME TOTAL HIGH WORD 5	R
31	STATION VOLUME TOTAL LOW WORD 5	R
32	STATION VOLUME TOTAL HIGH WORD 6	R
33	STATION VOLUME TOTAL LOW WORD 6	R
34	STATION VOLUME TOTAL HIGH WORD 7	R
35	STATION VOLUME TOTAL LOW WORD 7	R
36	STATION VOLUME TOTAL HIGH WORD 8	R
37	STATION VOLUME TOTAL LOW WORD 8	R
38	STATION VOLUME TOTAL HIGH WORD 9	R
39	STATION VOLUME TOTAL LOW WORD 9	R

Continued on next page

**Table 3.4:** Modbus registers (Continued)

Register	Description	RW
40	STATION VOLUME TOTAL HIGH WORD 10	R
41	STATION VOLUME TOTAL LOW WORD 10	R
42	STATION VOLUME TOTAL HIGH WORD 11	R
43	STATION VOLUME TOTAL LOW WORD 11	R
44	STATION VOLUME TOTAL HIGH WORD 12	R
45	STATION VOLUME TOTAL LOW WORD 12	R
46	STATION VOLUME TOTAL HIGH WORD 13	R
47	STATION VOLUME TOTAL LOW WORD 13	R
48	STATION TIME TOTAL HIGH WORD 1	R
49	STATION TIME TOTAL LOW WORD 1	R
50	STATION TIME TOTAL HIGH WORD 2	R
51	STATION TIME TOTAL LOW WORD 2	R
52	STATION TIME TOTAL HIGH WORD 3	R
53	STATION TIME TOTAL LOW WORD 3	R
54	STATION TIME TOTAL HIGH WORD 4	R
55	STATION TIME TOTAL LOW WORD 4	R
56	STATION TIME TOTAL HIGH WORD 5	R
57	STATION TIME TOTAL LOW WORD 5	R
58	STATION TIME TOTAL HIGH WORD 6	R
59	STATION TIME TOTAL LOW WORD 6	R
60	STATION TIME TOTAL HIGH WORD 7	R
61	STATION TIME TOTAL LOW WORD 7	R
62	STATION TIME TOTAL HIGH WORD 8	R
63	STATION TIME TOTAL LOW WORD 8	R
64	STATION TIME TOTAL HIGH WORD 9	R
65	STATION TIME TOTAL LOW WORD 9	R
66	STATION TIME TOTAL HIGH WORD 10	R
67	STATION TIME TOTAL LOW WORD 10	R
68	STATION TIME TOTAL HIGH WORD 11	R
69	STATION TIME TOTAL LOW WORD 11	R
70	STATION TIME TOTAL HIGH WORD 12	R
71	STATION TIME TOTAL LOW WORD 12	R
72	STATION TIME TOTAL HIGH WORD 13	R
73	STATION TIME TOTAL LOW WORD 13	R

Continued on next page

**Table 3.4:** Modbus registers (Continued)

Register	Description	RW
74	STATION ACTIVATION COUNT 1	R
75	STATION ACTIVATION COUNT 2	R
76	STATION ACTIVATION COUNT 3	R
77	STATION ACTIVATION COUNT 4	R
78	STATION ACTIVATION COUNT 5	R
79	STATION ACTIVATION COUNT 6	R
80	STATION ACTIVATION COUNT 7	R
81	STATION ACTIVATION COUNT 8	R
82	STATION ACTIVATION COUNT 9	R
83	STATION ACTIVATION COUNT 10	R
84	STATION ACTIVATION COUNT 11	R
85	STATION ACTIVATION COUNT 12	R
86	STATION ACTIVATION COUNT 13	R
87	CLEAR FAULTS	RW
88	MANUAL STATE REQUEST	RW
89	TANK PUMP ACTIVATION COUNT	RW
90	DAM PUMP ACTIVATION COUNT	RW
91	CONTROLLER RESET	RW
92	MASTER VALVE	RW
93	INVERT INPUT LOGIC	RW
94	MODBUS ADDRESS	RW
95	MODBUS BAUD	RW
96	WINTER START HIGH WORD	RW
97	WINTER START LOW WORD	RW
98	WINTER STOP HIGH WORD	RW
99	WINTER STOP LOW WORD	RW
100	DAM START TIME	RW
101	DAM STOP TIME	RW
102	TANK LITRES PER PULSE	RW
103	DAM LITRES PER PULSE	RW
104	TANK PRIME TIME	RW
105	DAM PRIME TIME	RW
106	TANK NO FLOW RATE	RW
107	DAM NO FLOW RATE	RW

Continued on next page

**Table 3.4:** Modbus registers (Continued)

Register	Description	RW
108	TANK LOW FLOW RATE	RW
109	DAM LOW FLOW RATE	RW
110	TANK HIGH FLOW RATE	RW
111	DAM HIGH FLOW RATE	RW
112	DAM VOLUME ALLOCATION HIGH WORD	RW
113	DAM VOLUME ALLOCATION LOW WORD	RW
114	DAM USE VOLUME ALLOCATION	RW
115	TANK USE VOLUME ALLOCATION	RW
116	CONTROLLER MODE	RW
117	VALVES VOLUME ALLOCATION 1	RW
118	VALVES VOLUME ALLOCATION 2	RW
119	VALVES VOLUME ALLOCATION 3	RW
120	VALVES VOLUME ALLOCATION 4	RW
121	VALVES VOLUME ALLOCATION 5	RW
122	VALVES VOLUME ALLOCATION 6	RW
123	VALVES VOLUME ALLOCATION 7	RW
124	VALVES VOLUME ALLOCATION 8	RW
125	VALVES VOLUME ALLOCATION 9	RW
126	VALVES VOLUME ALLOCATION 10	RW
127	VALVES VOLUME ALLOCATION 11	RW
128	VALVES VOLUME ALLOCATION 12	RW
129	VALVES VOLUME ALLOCATION 13	RW
130	VALVES TIME ALLOCATION 1	RW
131	VALVES TIME ALLOCATION 2	RW
132	VALVES TIME ALLOCATION 3	RW
133	VALVES TIME ALLOCATION 4	RW
134	VALVES TIME ALLOCATION 5	RW
135	VALVES TIME ALLOCATION 6	RW
136	VALVES TIME ALLOCATION 7	RW
137	VALVES TIME ALLOCATION 8	RW
138	VALVES TIME ALLOCATION 9	RW
139	VALVES TIME ALLOCATION 10	RW
140	VALVES TIME ALLOCATION 11	RW
141	VALVES TIME ALLOCATION 12	RW

Continued on next page

**Table 3.4:** Modbus registers (Continued)

Register	Description	RW
142	VALVES TIME ALLOCATION 13	RW
143	RESERVED 1	
144	RESERVED 2	
145	RESERVED 3	
146	RESERVED 4	
147	RESERVED 5	
148	RESERVED 6	
149	RESERVED 7	
150	RESERVED 8	
151	RESERVED 9	
152	RESERVED 10	
153	RESERVED 11	
154	RESERVED 12	
155	RESERVED 13	
156	RESERVED 14	
157	RESERVED 15	
158	RESERVED 16	
159	RESERVED 17	
160	RESERVED 18	
161	RESERVED 19	
162	RESERVED 20	
163	RESERVED 21	
164	RESERVED 22	
165	RESERVED 23	
166	RESERVED 24	
167	RESERVED 25	
168	RESERVED 26	
169	RESERVED 27	
170	RESERVED 28	
171	RESERVED 29	
172	RESERVED 30	
173	RESERVED 31	
174	RESERVED 32	
175	NUMBER OF VALVES	RW

Continued on next page

**Table 3.4:** Modbus registers (Continued)

Register	Description	RW
176	CURRENT ALARMS	RW
177	CURRENT SENSE	R
178	EPOCH TIME HIGH WORD	RW
179	EPOCH TIME LOW WORD	RW
180	UNIQUE ID WORD 0	R
181	UNIQUE ID WORD 1	R
182	UNIQUE ID WORD 2	R
183	UNIQUE ID WORD 3	R
184	UNIQUE ID WORD 4	R
185	UNIQUE ID WORD 5	R

## 4 Trouble-shooting

To clear all faults, enter the menus by holding the LEFT button, select ENTER CONFIG, scroll to FAULT RESET and press the RIGHT button. To factory reset the controller, hold the DOWN button and then press the RESET button. Continue to hold the DOWN button for 5 seconds or until the controller restarts.

### 4.1 Alarms

Alarms only occur in RUN mode and the code is displayed in the top left of the screen. All alarms will activate the alarm lamp and alarm terminal on the controller.

#### 4.1.1 Alarm 1 - Overflow

An overflow alarm indicates that the TANK is currently overflowing. The DAM pump (if running) will be turned off and the TANK pump will be started.

#### 4.1.2 Alarm 2 - Slow flow

A slow flow alarm indicates that one or more of the stations is flowing slower than the LOW-FLOW RATE. This may indicate a blockage on that station. The slow flow station will be indicated by a slow flash on that station's allocation lamp. The system's operation is not otherwise effected.

### **4.1.3 Alarm 3 - Fast flow**

A fast flow alarm indicates that one or more of the stations is flowing faster than the HIGH-FLOW RATE. This may indicate a leak on that station. The fast flow station will be indicated by a fast flash on that station's allocation lamp. This station will be de-activated and will not be turned on again until FAULT RESET has been selected in the CONFIGURATION menu.

### **4.1.4 Alarm 4 - High pulse**

A high pulse alarm indicates that the pulse rate of one or more of the flow meters is approaching the controller's hardware limitations. Flow rates and flow counts at or above this rate may be inaccurate.

### **4.1.5 Alarm 5 - Dam no flow**

A dam no flow alarm indicates that the flow from the DAM PUMP is lower than its specified NO-FLOW RATE. The DAM PUMP will be turned off and will not be turned on again until FAULT RESET has been selected in the CONFIGURATION menu. The TANK PUMP will continue operations as per normal.

The NO-FLOW RATE can be configured in the CONFIGURATION menu and should be the minimum flow rate at which the pump can safely run.

## **4.2 Warnings**

Warnings turn off all pumps and stations to avoid unpredictable behaviour. The warning message will be displayed on the screen. Menus can still be accessed by holding LEFT. If the



detected fault resolves, the controller will resume normal operation.

#### **4.2.1 Warning 1 - Float switches**

An upper float switch has registered as up while a lower float switch has registered as down and therefore the system is in an invalid state. In order to resolve this warning, the system must register a valid float switch state for more than 10 seconds. If this warning occurs three (3) times, the controller will enter an error state. See Section 4.3.1 for details on the error state.

##### **Suggestions**

1. Float switches have been connected incorrectly. Check all float switch terminals at the controller and verify that the corresponding controller lamp responds to each float switch.
2. Faulty switches or connections. Check all connections and switches. Replace or repair as necessary.

#### **4.2.2 Warning 2 - Clock failure**

The controller's internal clock has failed. Please contact supplier.

##### **Suggestions**

1. Factory reset the controller. To do this, hold down the LEFT key, press the RESET button and continue to hold LEFT for five (5) seconds.
2. Contact the supplier.

### 4.2.3 Warning 3 - No allocations

All stations have an allocation of zero units. This could be a configuration problem or could indicate a leak.

Stations are de-queued if fast flow is detected on that station. The SAFE FLOW RATE is used to decide if a station's flow rate is safe and can be configured in the CONFIGURATION menu. If there is a system-wide issue, all stations will be sequentially de-queued as each station fails to flow safely.

#### Suggestions

1. Stations were all given an allocation of zero units by the user. Enter CONFIGURE mode by holding down the LEFT button. Adjust the allocations as required.
2. The SAFE FLOW RATE is too low for this system. Enter CONFIGURE mode by holding down the LEFT button. Increase the SAFE FLOW RATE until it matches your system's normal flow rate.
3. The system is flowing faster than the SAFE FLOW RATE on every valve. This indicates a leak between the pump and the valves.
4. To deactivate SAFE FLOW RATE protection, enter CONFIGURE mode and set SAFE FLOW RATE to 0 L/m.

### 4.2.4 Warning 4 - Tank no flow

The flow rate on the TANK PUMP is less than its specified NO-FLOW RATE.

The NO-FLOW RATE can be configured in the CONFIGURATION menu and should be the minimum flow rate at which the

pump can safely run. This warning can be cleared in the menu under **FAULT RESET**.

### **Suggestions**

1. The measured flow rate is below the **NO-FLOW RATE**. Check for blockages, pump failures, valve failures and flow meter failures.
2. The **NO-FLOW RATE** may be too high. Consult the pump's specifications, enter **CONFIGURE** mode and set **NO-FLOW RATE** to the correct value.
3. The **VOLUME PER PULSE** for your flow meter may be too low. Consult the flow meter's specifications, enter **CONFIGURE** mode and set **VOLUME PER PULSE** to the correct value.
4. The controller is not receiving pulses from the flow meter. Check all controller input terminals.
5. To deactivate **NO-FLOW RATE** protection, enter **CONFIGURE** mode and set **NO-FLOW RATE** to 0 kL/hr.

## **4.2.5 Warning 5 - Invalid configuration**

One or more of the configuration variables is not in the valid range. This is most likely due to the user entering invalid configuration variables.

### **Suggestions**

1. Enter **CONFIGURE** mode by holding down the **LEFT** button. Ensure all variables are reasonable and then enter **RUN** mode again.
2. Factory reset the controller.

## 4.3 Errors

Errors are faults which do not allow the controller to operate. These are usually due to serious hardware faults.

### 4.3.1 Error 1 - Float switches

The TANK's float switches have registered an invalid state and then subsequently recovered three (3) times. Warning 1 in Section 4.2.1 has been upgraded to an error in order to protect the pump. Operator intervention is now required.

#### **Suggestions**

1. Check all float switches. In particular, the HIGH or OVERFLOW switches may be stuck.
2. Reset the controller.

### 4.3.2 Error 2 - I2C2 failure

The controller's internal communications have failed. Please contact supplier.

#### **Suggestions**

1. Factory reset the controller. To do this, hold down the LEFT key, press RESET and continue to hold LEFT for five (5) seconds.
2. Contact the supplier.

### 4.3.3 Error 3 - I2C3 failure

The controller's internal communications have failed. Please contact supplier.

#### **Suggestions**

1. Factory reset the controller. To do this, hold down the LEFT key, press the RESET button and continue to hold LEFT for five (5) seconds.
2. Contact the supplier.

### 4.3.4 Error 4 - Memory failure

The controller's internal memory has failed. Please contact supplier.

#### **Suggestions**

1. Factory reset the controller. To do this, hold down the LEFT key, press the RESET button and continue to hold LEFT for five (5) seconds.
2. Contact the supplier.









# Contact

Email - [support@clonk.au](mailto:support@clonk.au)

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**clonk**