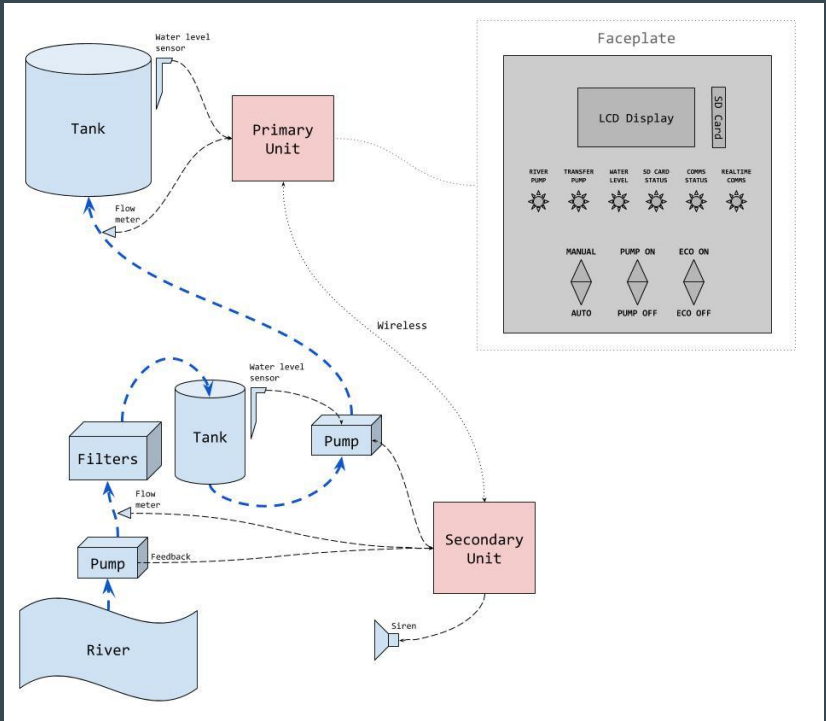
Remote Pump Controller

Waterworks Automation 2019
Fritz Keyzer - fritzkeyzer@gmail.com

System Overview



The primary unit acts as a remote controller for the secondary - which controls a pump to transfer water up the hill.

The primary unit logs all significant data alongside water flow data, for retrospective analysis.

An economic mode is included that avoids pumping during, more expensive - peak electricity time periods.

User interface - LCD Display

The LCD display will cycle through various pages showing different information.

- Date and time.
- Water level and since when last the status changed.
- Transfer pump status (the same as indicated by the LED).
- Eco-mode and if the current time is peak or off-peak.
- If there is a radio communication (comms) error (same as LED).
- If there is a logging error (same as LED)
- And any event will immediately display information.

The SD Card, seen next to the LCD Display will pop out when pressed.
To re-insert press it back in until you feel a click. Making sure you have it the right way around.
More details on the SD Card and logging follow later in this document.

User interface - LEDs

River Pump and Transfer Pump LEDs
- Green - RUNNING
- Red - STOPPED
- Off - unknown (comms error, or secondary lost power)

Water Level LED
- Green - water level is HIGH
- Red - water level is LOW

SD Card Status LED
- Green - OK
- RED - Error (SD Card is not inserted correctly, or is missing)

Comms Status LED
- Green - OK
- Red - Error (Secondary lost power, interference, obstruction, or damage)
- Off - unknown (this should turn green quite quickly, otherwise expect an error)

Comms Realtime LED
- Red Flash - transmitting message
- Green Flash - receiving message

User interface - Switches

Auto / Manual Switch

- Auto - this is the default, this will enable automatic control of the transfer pump
- Manual - this is for manually controlling the transfer pump with the Start / Stop Switch

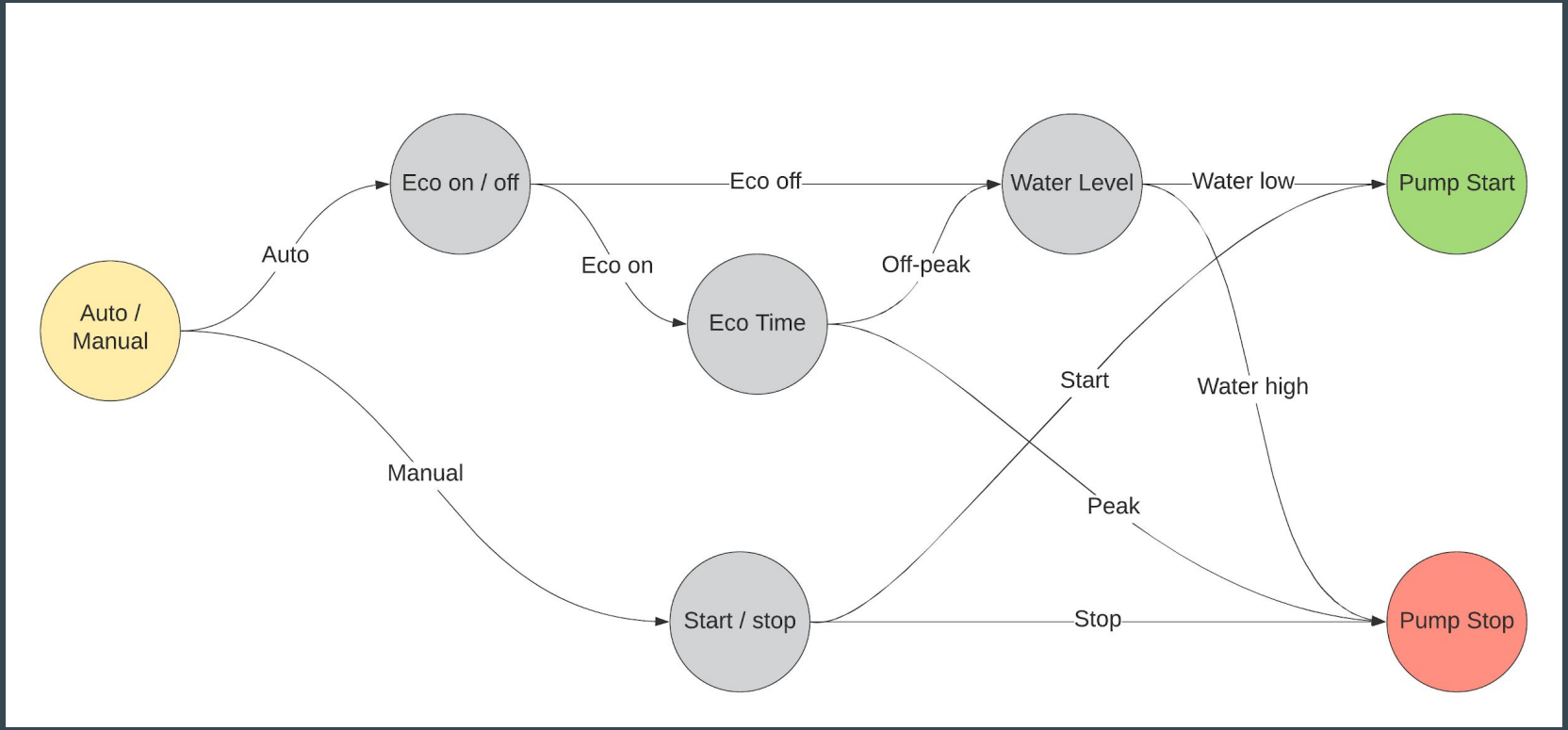
Start / Stop Switch

- Start - this will start the transfer pump (only in manual mode)
- Stop - this will stop the transfer pump (only in manual mode)

Eco Switch

- Eco On - enables the economic mode, which avoids running the pumps during peak electricity times
- Eco Off - disables the economic mode

Control Logic



Eco mode, Low-flow alarm & Comms Errors

Eco mode

- Peak time is between ***6am - 10am*** and ***5pm - 8pm***.
- During this time, if eco mode is enabled, the pump will turn off to save costs on electricity

Low-flow alarm

- Is controlled by the secondary unit.
- The alarm will sound if the flow rate is below ***150 litres/hour for 2 minutes***.
- The alarm will sound each hour until the river pump is turned off - resetting the alarm.
- The alarm can only go off between ***8am - 8pm***

Comms error

- A comms error indicates that Primary unit hasn't "heard" anything from the Secondary for more than ***1 minute***.
- The Secondary unit will also go into a comms error mode, after ***4 minutes***, after which point it will stop the transfer pump.

SD Card logging

Date	Time	Event	Value
2019/08/20	14:41:28	POWER	ON
2019/08/20	14:41:28	MODE	MANUAL
2019/08/20	14:41:28	ECO_MODE	ON
2019/08/20	14:41:28	TIME	DAY
2019/08/20	14:41:28	WATER_LEVEL	LOW
2019/08/20	14:41:28	MANUAL	PUMP_START
2019/08/20	14:41:28	CONTROL	TRANSFERPUMP_START
2019/08/20	15:47:20	POWER	ON
2019/08/20	15:47:20	MODE	AUTO
2019/08/20	15:47:20	ECO_MODE	ON
2019/08/20	15:47:20	TIME	DAY
2019/08/20	15:47:20	WATER_LEVEL	LOW
2019/08/20	15:47:20	CONTROL	TRANSFERPUMP_START
2019/08/20	15:47:27	MODE	MANUAL
2019/08/20	15:47:27	CONTROL	TRANSFERPUMP_STOP
2019/08/20	15:47:28	MODE	AUTO
2019/08/20	15:47:28	CONTROL	TRANSFERPUMP_START
2019/08/20	15:47:29	MODE	MANUAL
2019/08/20	15:47:29	CONTROL	TRANSFERPUMP_STOP
2019/08/20	15:47:30	MODE	AUTO
2019/08/20	15:47:30	CONTROL	TRANSFERPUMP_START
2019/08/20	15:48:19	COMMS	ERROR
2019/08/20	15:48:21	ECO_MODE	OFF
2019/08/20	15:48:22	ECO_MODE	ON

All significant control data and sensor inputs are logged to a **LOG.CSV** file on the SD Card.

This file can be can be deleted without any risk.

This is a regular text file.

It can be opened with excel or google sheets, this is recommended - you can add filters per columns to show only certain data, for example only display comms errors, or volumes pumped.

The volume of water pumped is logged once each hour. "**TRANSFER_PUMP_VOLUME**" Showing how much water was pumped in the last hour.

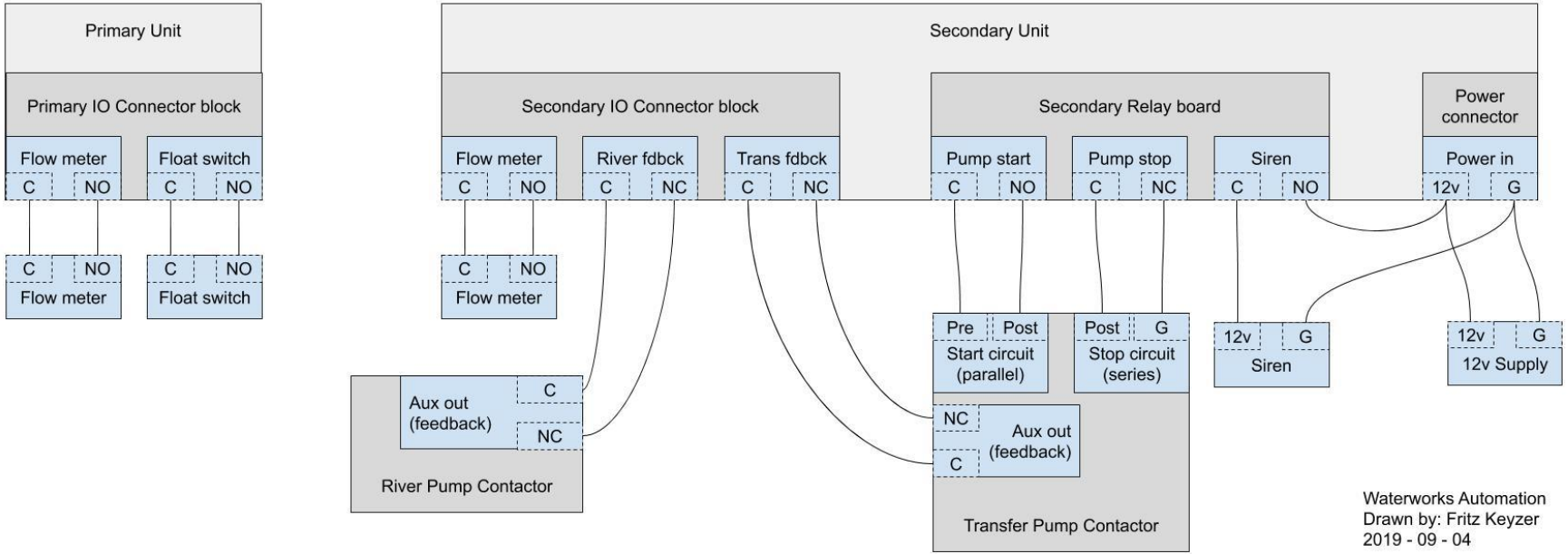
The "**CONTROL**" event shows the result of the Control Logic decision tree. See the previous page for details.

Switching the unit on, logs an event "**POWER**" followed by the current state of all the switches, time of day, and sensor inputs.

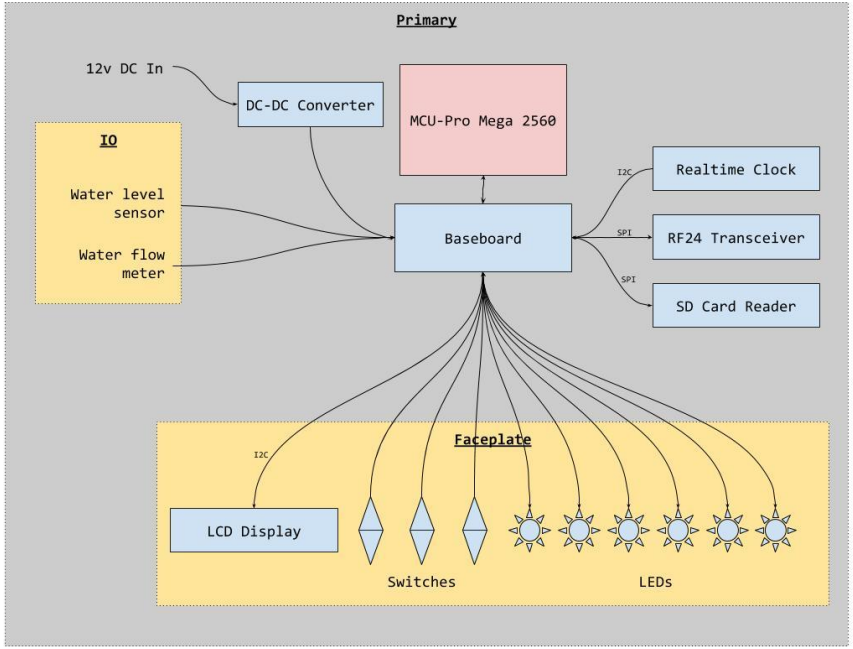
If there are any issues logging to the SD Card the "SD Card Status" LED will turn RED

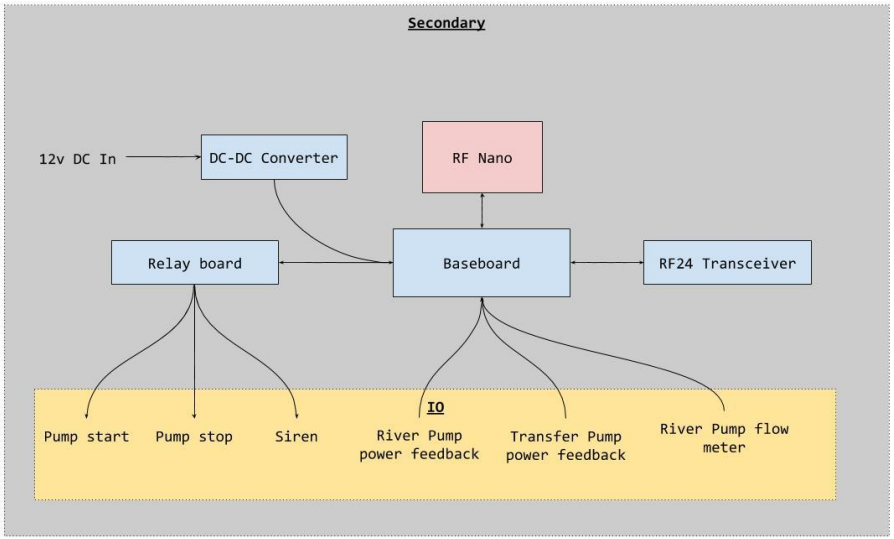
The LED will only return to GREEN if it successfully logs a new event - this can be manually triggered by toggling any of the switches

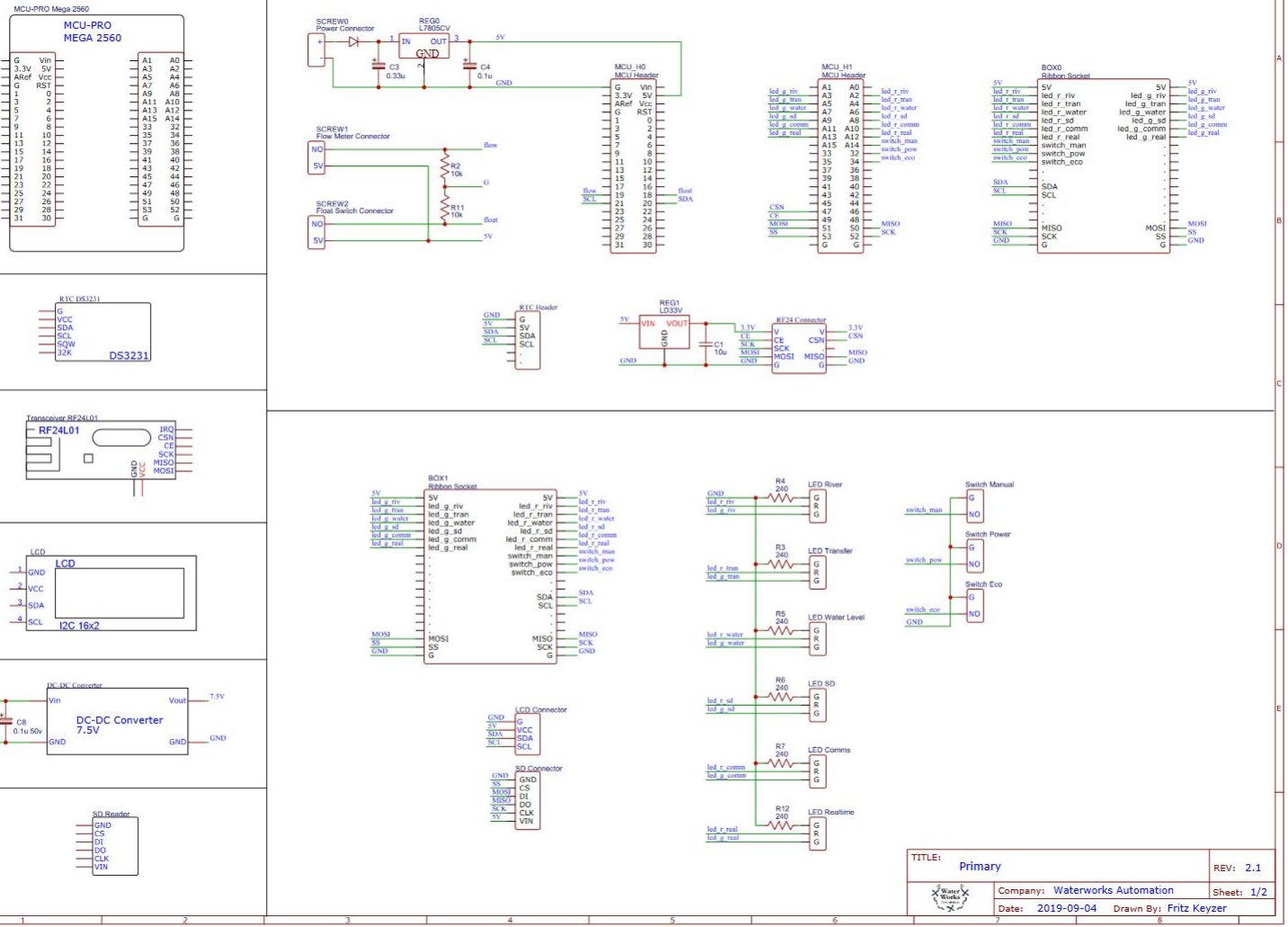
Schematic overview

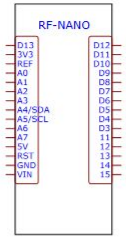


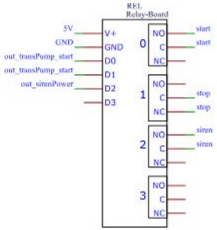
Schematic overview

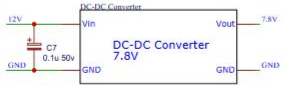


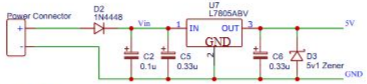


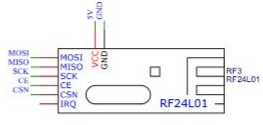

MCU-PRO Mega 2560
MCU-PRO
MEGA 2560
RTC DS3231
DS3231
Transceiver RF24L01
RF24L01
LCD
I2C 16x2
DC-DC Converter
DC-DC Converter
7.5V
SD Reader
SCREW0
Power Connector
REG0
L7805CV
SCREW1
Flow Meter Connector
SCREW2
Float Switch Connector
MCU_H0
MCU Header
MCU_H1
MCU Header
BOX0
Ribbon Socket
RTC Header
REG1
LD33V
RF24 Connector
BOX1
Ribbon Socket
LCD Connector
SD Connector
LED River
LED Transfer
LED Water Level
LED SD
LED Comms
LED Realtime
Switch Manual
Switch Power
Switch Eco
TITLE:
Primary
REV: 2.1
Company: Waterworks Automation
Sheet: 1/2
Date: 2019-09-04
Drawn By: Fritz Keyzer

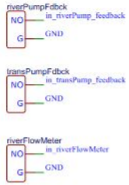


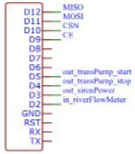


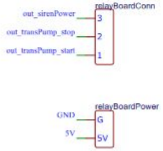












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Company: Waterworks Automation		Sheet: 2/2
Date: 2019-09-04	Drawn By: Fritz Keyzer	