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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) contains the current wiring schematics for IMPROVE sampling and controller modules. IMPROVE samplers are constructed at the University of California at Davis by Air Quality Group personnel. There are several type of modules in use.

- **Satellite Sampling Module:** These modules require a separate signal from a controller to start and stop sampling. There are two variations of the satellite module: PM_{2.5} and PM₁₀. These are identical except the PM_{2.5} module has a fine inlet and a cyclone, while the PM₁₀ module has either a Sierra or Wedding PM₁₀ inlet.
- **Independent Controller Module (IC):** These non-sampling modules control multiple satellite sampling modules. There are several versions with minor variations. One major variation is the addition of a lock-out circuit to prevent a second sample collected without an intervening sample change.
- **Single Independent Module (SIM):** This sampling module includes the clock controller in the sampling module. It cannot control satellite sampling modules.
- **SIM-Controller (SC):** This sampling module includes the clock controller in the sampling module, plus the relays to control satellite sampling modules. This module is now used in place of the independent controller module.

The various configurations of the controller modules are listed in Table 1.

Table 1 Controller Module Configurations.

code	pump relay voltage	multiple pump relay location	pump outlet location	thermostat and position	lock-out device
IC1	24V	external	box in pump house		no
IC1L	24V	external	box in pump house		yes
IC2	110V	internal	box on module		no
IC2L	110V	internal	box on module		yes
IC3	24V	internal	box on module		no
IC3L	24V	internal	box on module		yes
SIM1	24V	none	1 on module	under	no
SIM2	24V	none	1 on module	on	no
SIM2L	24V	none	1 on module	on	yes
SC1	24V	external	box on module	on	no
SC1L	24V	external	box on module	on	yes

IC Independent Controller non-sampling, controls satellite sampling modules
 SIM Single Independent Module sampling, self-controlling only
 SC SIM-Controller sampling, controls self and satellite sampling modules

thermostat and position: under: under the heater panel with relays
 on: on the heater panel

2.0 RESPONSIBILITIES

2.1 **Field Specialist**

The field specialist shall:

- Maintain accurate wiring schematics for existing aerosol samplers.
- Maintain records of which wiring schematic is in use at each sampling site.

2.2 **Technician**

The technician shall:

- Review wiring schematics prior to maintenance or troubleshooting procedures

3.0 **REQUIRED EQUIPMENT AND MATERIALS**

None

4.0 METHODS

The wiring schematics for each of the configurations in the IMPROVE network are listed in the following sections.

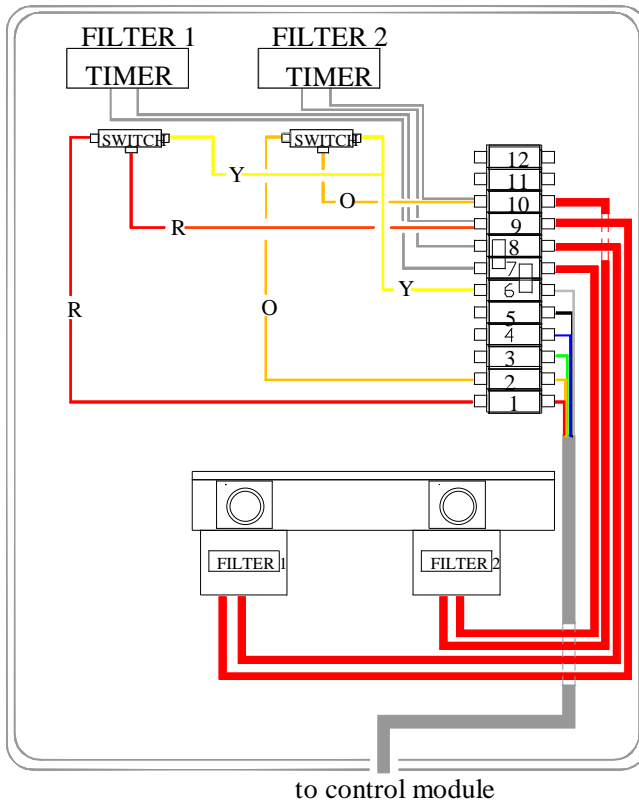
- 4.1 Satellite Sampling Module Wiring Schematic
- 4.2 Single Independent Module (SIM) Wiring Schematics
- 4.3 Single Independent Module (SIM) Wiring Schematics
- 4.4 Independent Controller Module Wiring Schematics

4.1 Satellite Sampling Module Wiring Schematic

All Satellite Sampling Modules, whether PM_{2.5} or PM₁₀, follow the wiring schematic of Figure 1.

1. The procedures for attaching additional satellite Sampling modules follows.
 1. Install the additional Satellite Sampling module on the sampler support structure next to a functioning Satellite Sampling module.
 2. Cut a length of insulated six wire cable sufficient to reach from terminal strip position 6 of the functioning Satellite Sampling module to terminal position six of the newly installed Satellite Sampling Module.
 3. Turn off the power to the sampler. For an IMPROVE controller, remove the fuse in the lower right hand side of the module.
 4. Disconnect the gray six wire cable from the controller module at the terminal strip in the functioning Satellite Sampling Module.
 5. Remove the panduit connectors, and strip the ends of the six wires in the gray cable from the functioning Satellite Sampling Module if necessary.
 6. Strip the ends of the six wires in the new section of cable.
 7. Connect wires having the same color from the two cables by inserting them into a single female panduit and crimping them in position. This connection is termed a“double panduit”. Check to ensure neither wire is loose.
 8. Install the double panduit connections on the terminal strip, following the color code listed in Figure 1.
 9. Install female panduit on the six wires at the free end of the new cable, crimping the panduit in place firmly and checking to verify the wire will not pull out of the panduit.
 10. Install the panduit on the free end of the six wire cable on the terminal strip of the new Satellite Sampling Module, following the color code listed in Figure 1.

Figure 1 Satellite Sampling Module Wiring Schematics



WIRE IDENTIFICATION:

R = RED - filter 1 signal (24 VAC)
 O = ORANGE - filter 2 signal (24 VAC)
 G = GREEN - filter 3 signal (not used)
 B = BLUE - filter 4 signal (not used)
 Bk = BLACK - 24 VAC hot
 W = WHITE - 24 VAC common
 Y = YELLOW - 24 VAC common
 Gy = GREY - elapsed timers (24 VAC)

TERMINAL STRIP GUIDE:

pos	WIRES ON LEFT	WIRES ON RIGHT
2	R from switch	R from cable
3	O from switch	O from cable
4	none	G from cable
5	none	B from cable
6	none	Bk from cable
7	Y from switch	W from cable
8	Gy from timer 1	R from solenoid 1
9	Gy from timer 2 R from switch	R from solenoid 2 R from solenoid 1
10	Gy from timer 1 O from switch	R from solenoid 2
11	Gy from timer 2	
12	none	none
	none	none

4.2 SIM wiring schematics

The schematics for the three versions of the SIM sampler are shown in Figures 2-4.

Figure 2 SIM1 SIM Version 1 Wiring Schematic

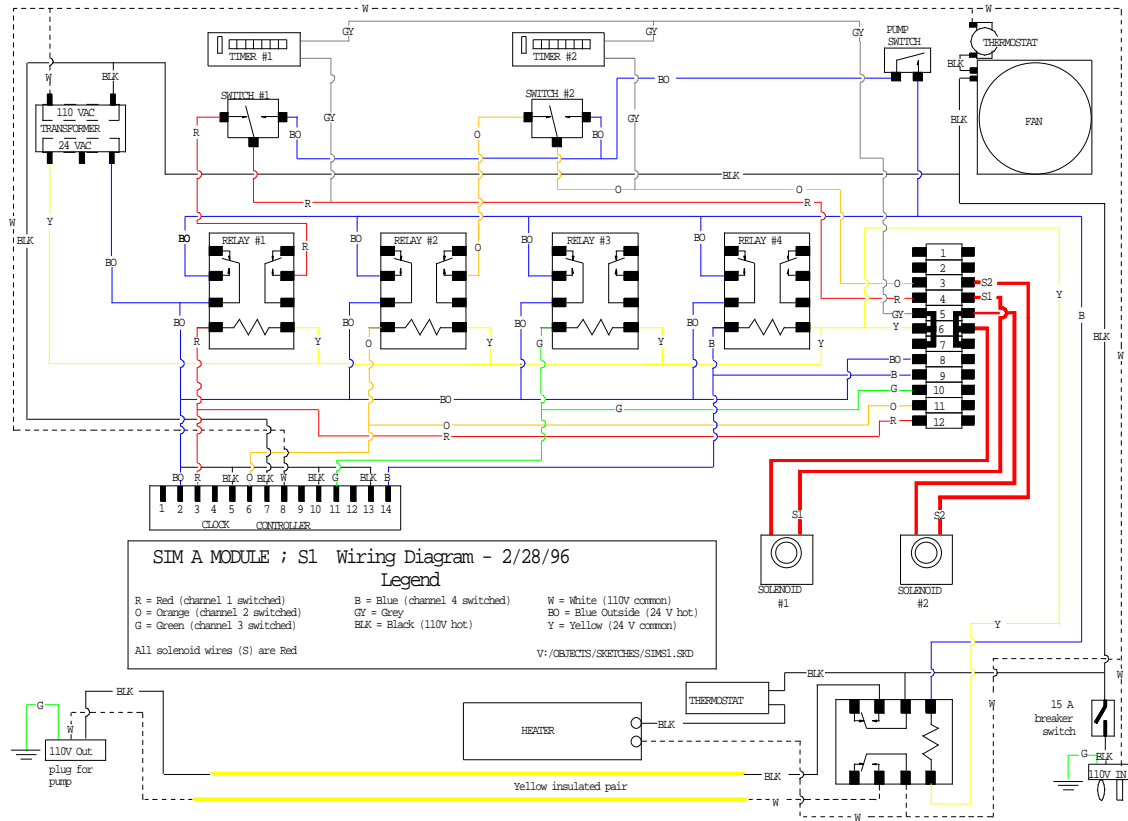


Figure 3 SIM1L SIM Version 1 with Lock-Out Relay Wiring Schematic

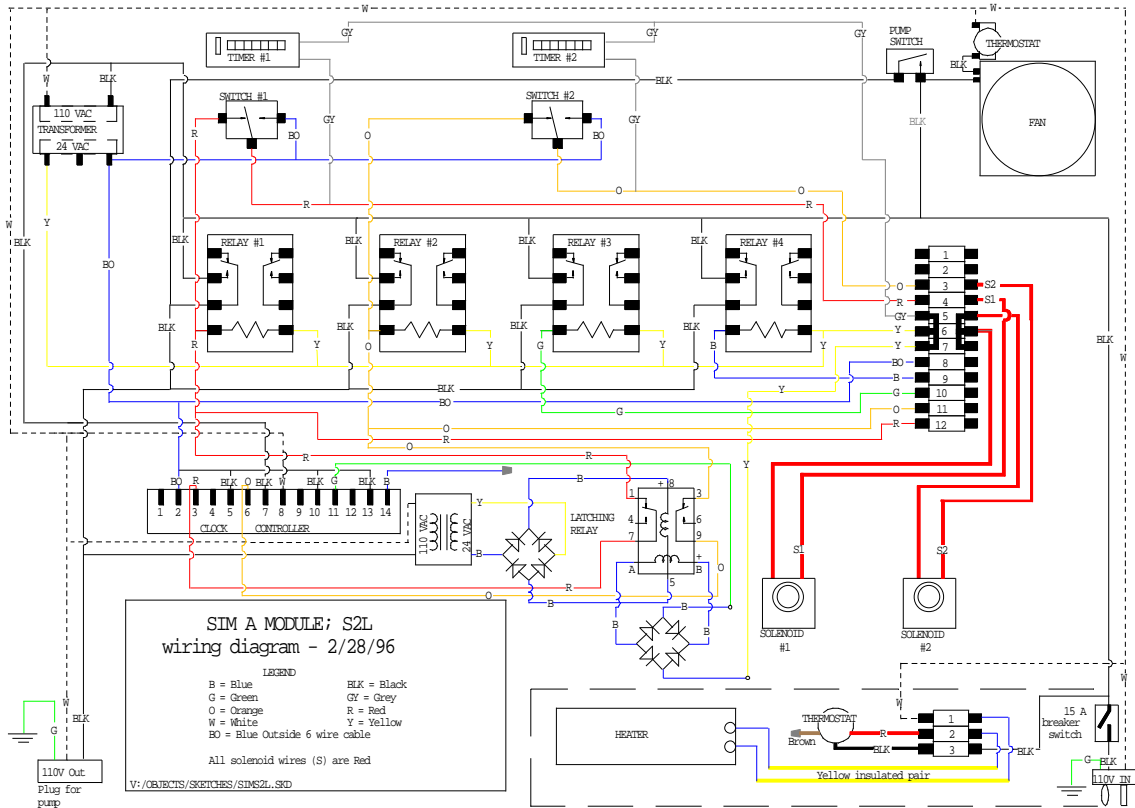
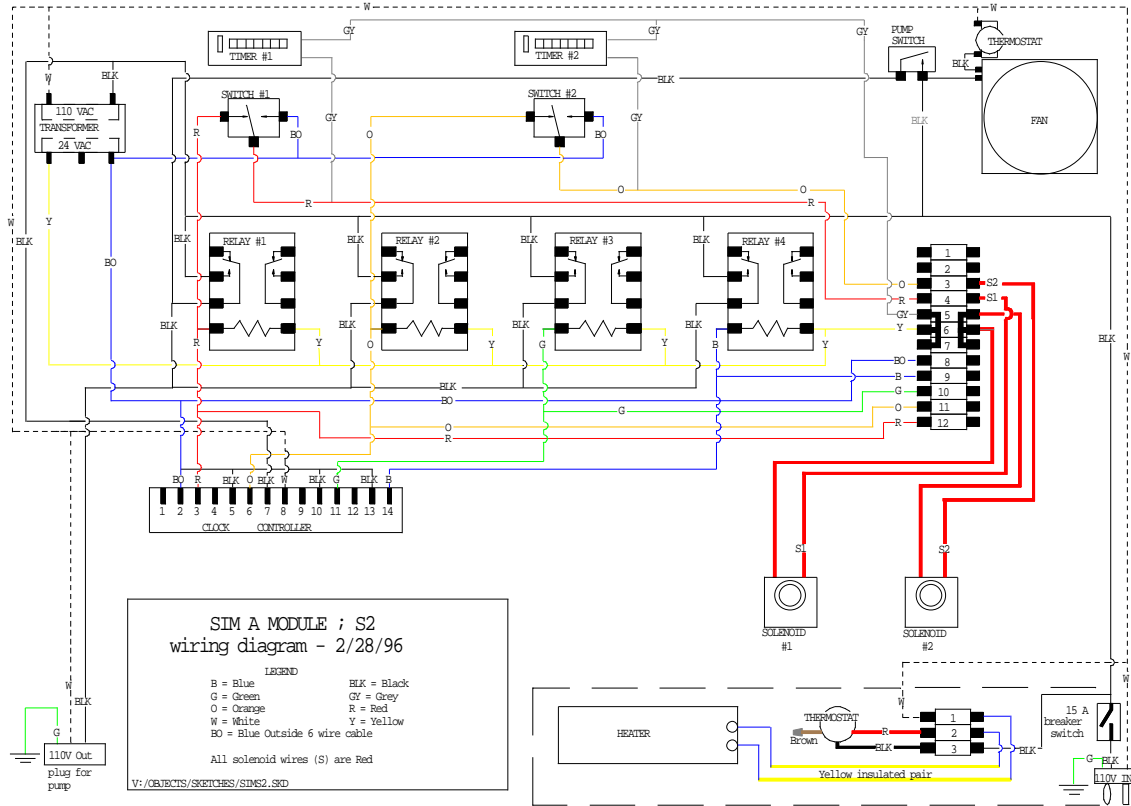


Figure 4 SIM2 SIM Version 2 Wiring Schematic



4.3 SIM-Controller wiring schematics

The schematics for the two versions of the SIM-Controller sampler are shown in Figures 5-6. The wiring schematic for the pump relay box is shown in Figure 7.

Figure 5 SC1 SIM Controller Module Version 1 Wiring

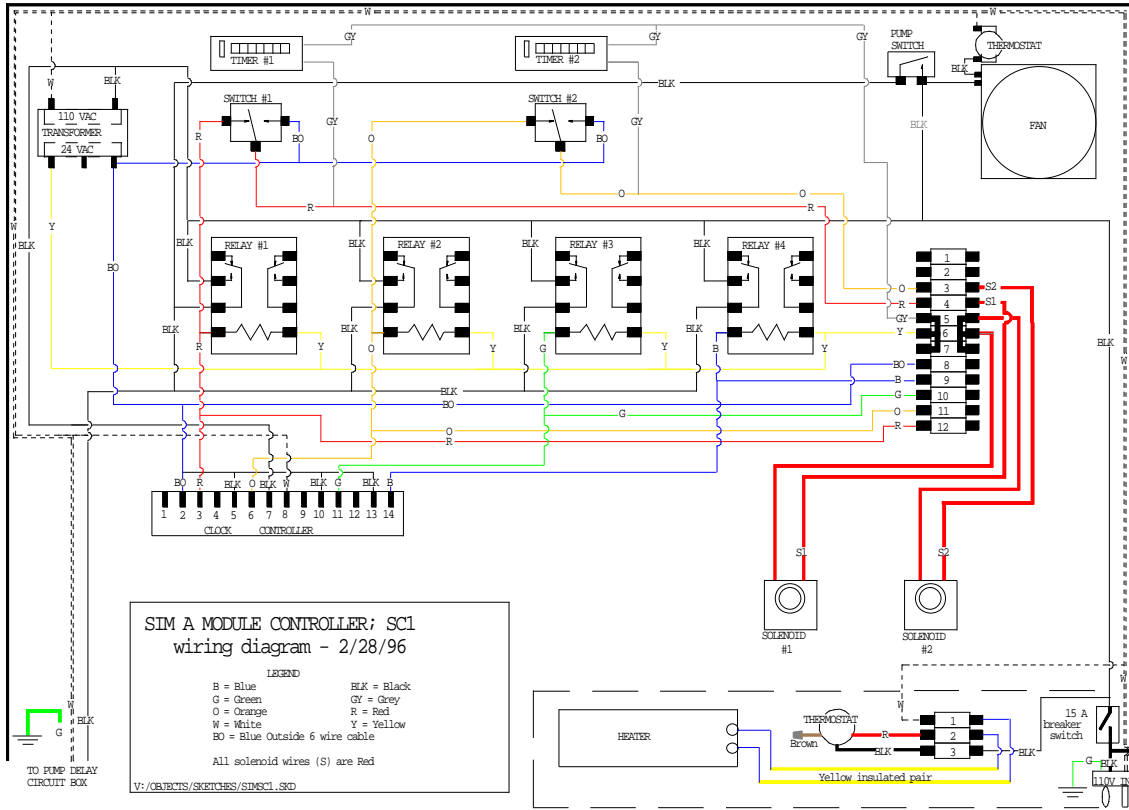


Figure 6 SC1L SIM Controller Module Version 1 with Lock-Out Relay Wiring Schematic

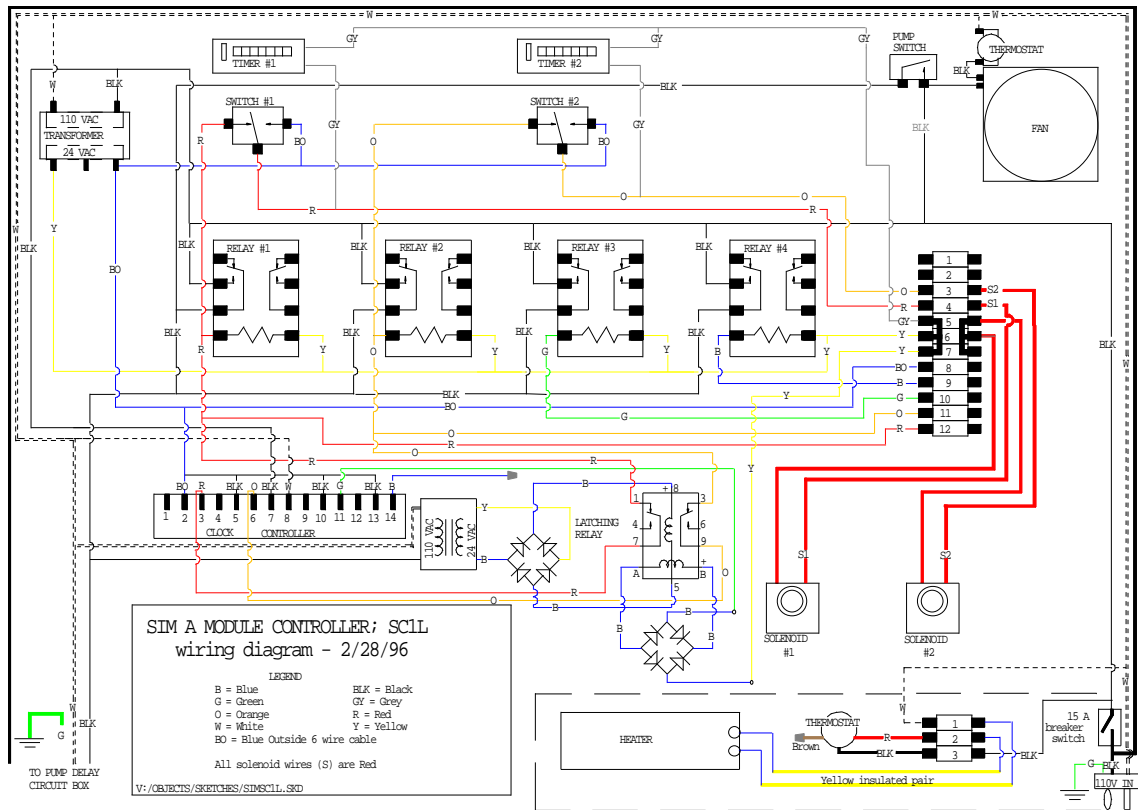
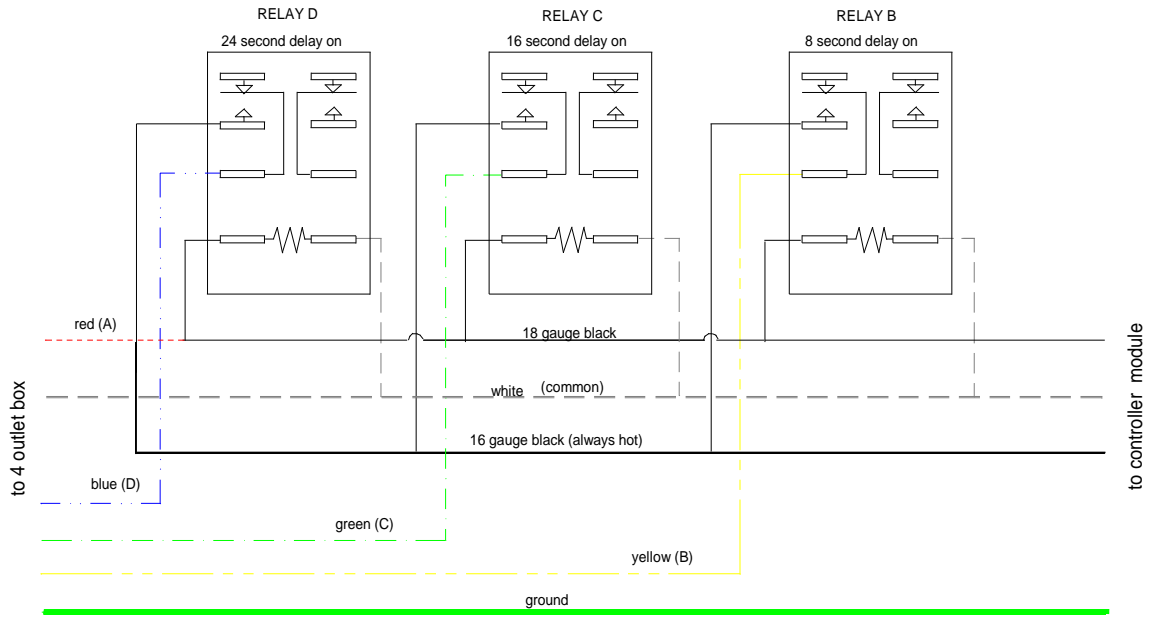


Figure 7 Pump Delay Relay for SIM-Controller Wiring Schematic



25% TOLERANCES _____ FRACTIONS 1/64 _____ DECIMALS +0.05 _____ DECIMALS +0.00 _____ ANGLES +1 DEG _____		CROCKER NUCLEAR LABORATORY UNIVERSITY OF CALIFORNIA - DAVIS	
PROJECT AIR QUALITY - IMPROVE		PART NAME PUMP DELAY RELAY BOX CIRCUIT	
CHANGE DATE 	APPROVED BY 	SCALE 	DRAWN BY Campbell
MATERIAL 	CHECKED BY 	DATE 	DATE 10/03
# OF PARTS 	DRAWING NUMBER C76-NPS-2403	SHEET 2 of 2	

4.4 Independent Controller Module Wiring Schematics

The six variations on the Independent Controller Module are visually similar, following the style shown in Figure 8. Electrical schematics for the two version 1 modules are shown in Figures 9-10. Wiring schematics for the various different Independent Controller Module versions follow in Figures 11 through 14. Note that for all Independent Controller Modules, positions 2A through 2F are identical to positions 1A through 1F respectively. 1A is connected to 2A, 1B is connected to 2B, etc.

Figure 8 Independent Controller Module Diagram

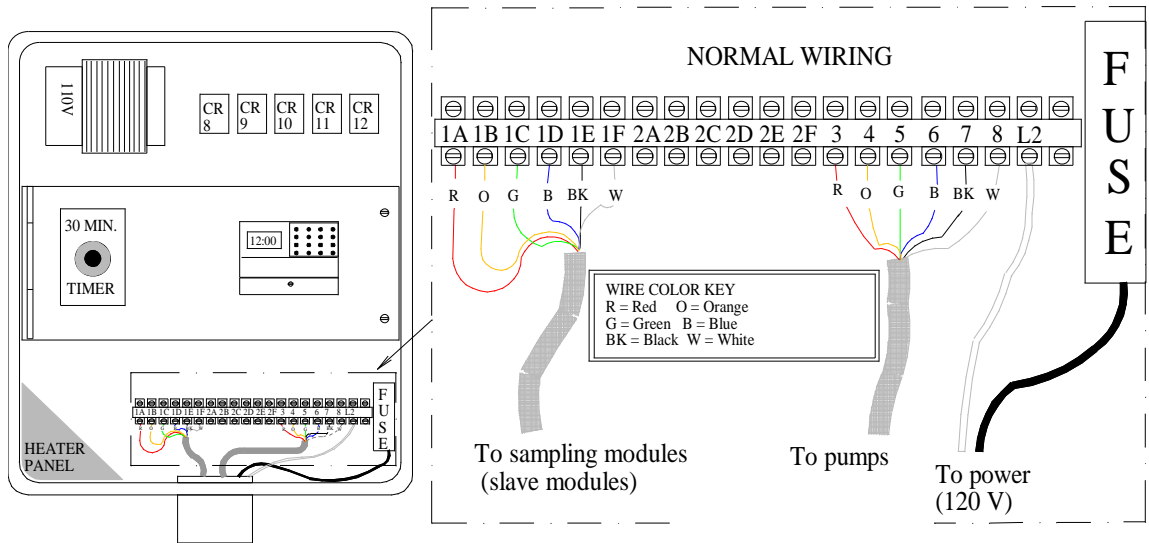


Figure 9 IC1 Independent Controller Version 1 Electrical Schematic

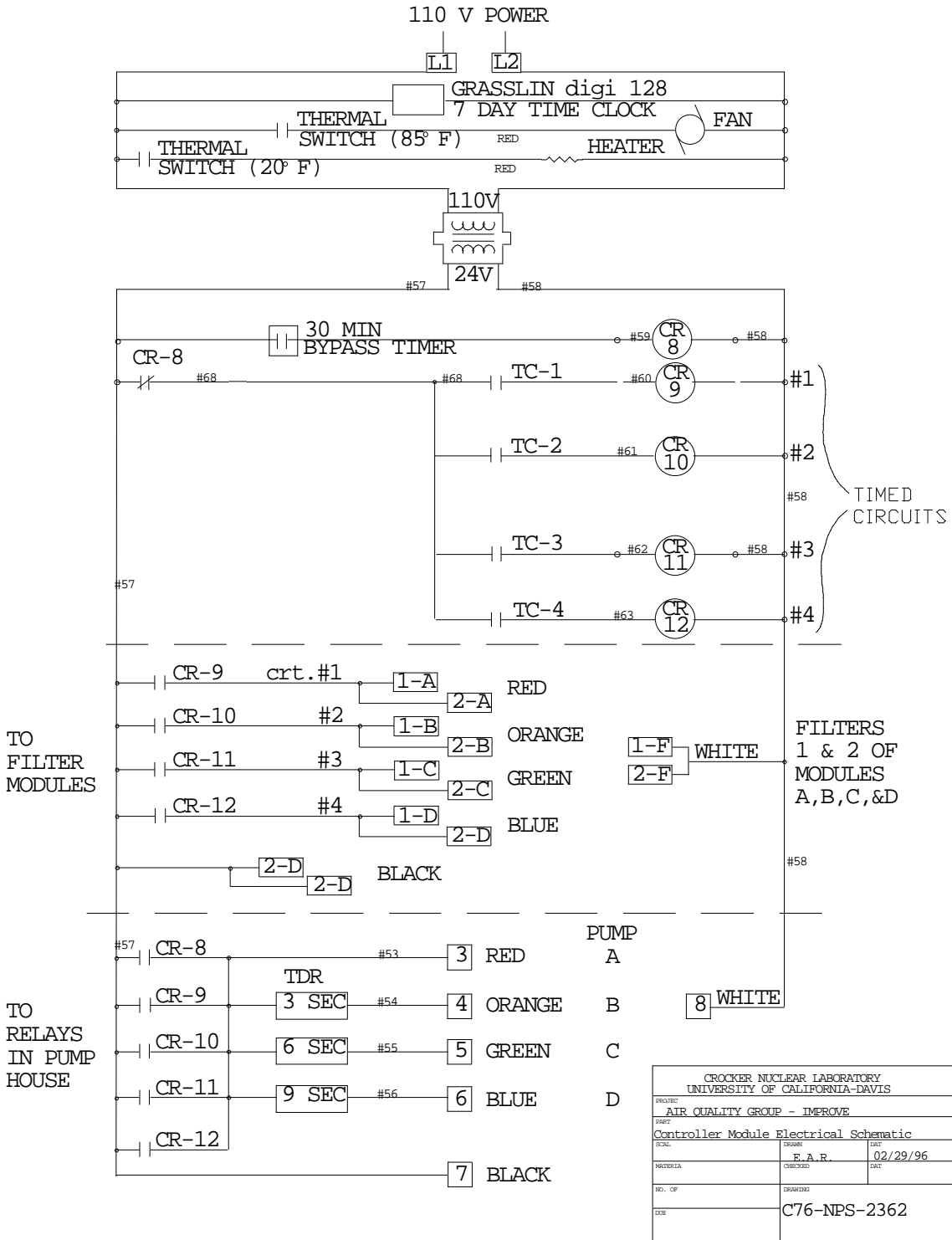


Figure 10 IC1L Independent Controller Version 1 with Lock-Out Relay Electrical Schematic

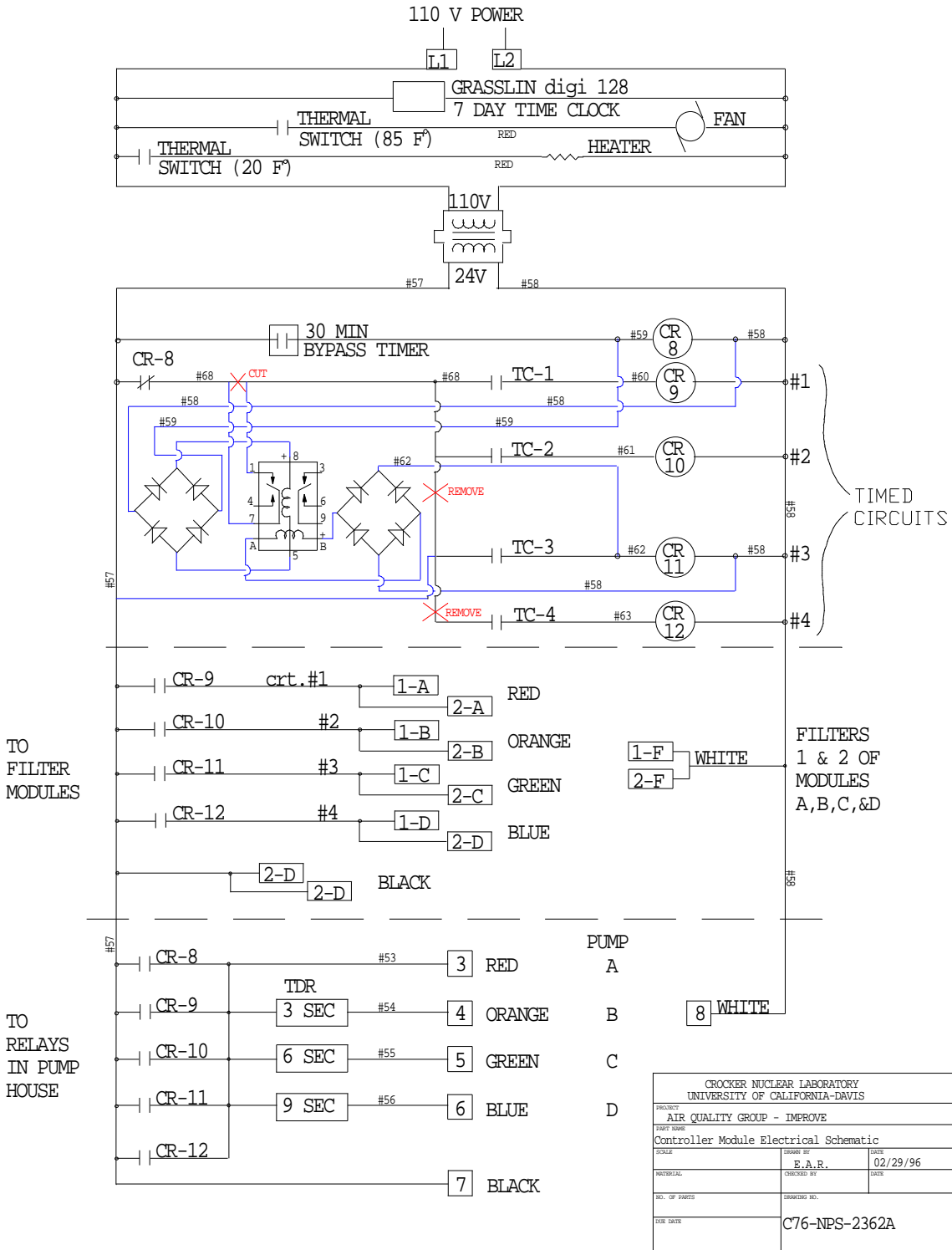


Figure 11 IC1 Independent Controller Version 1 Wiring Schematic

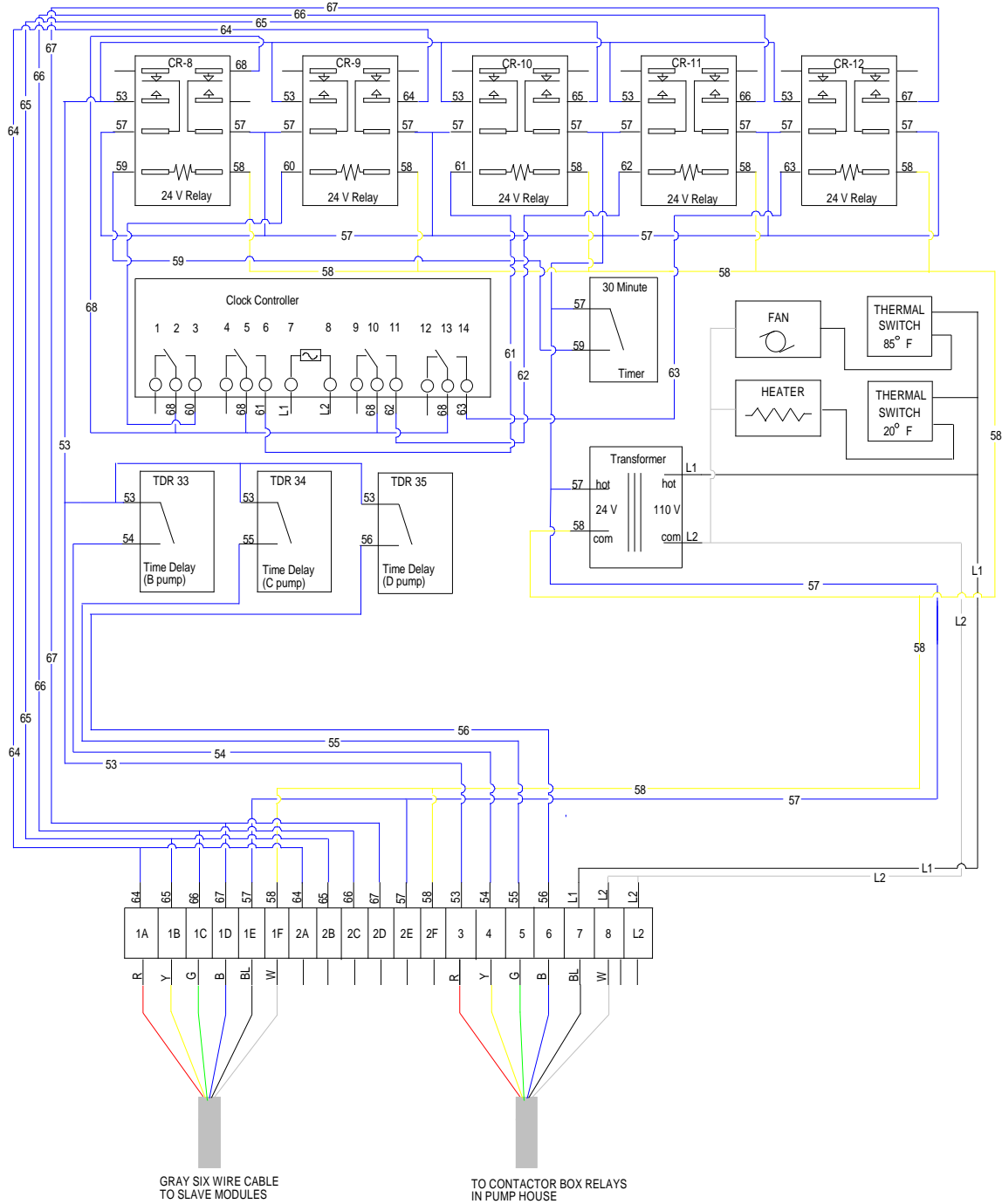


Figure 12 IC1L Independent Controller Version 1 with Lock-Out Relay Wiring Schematic

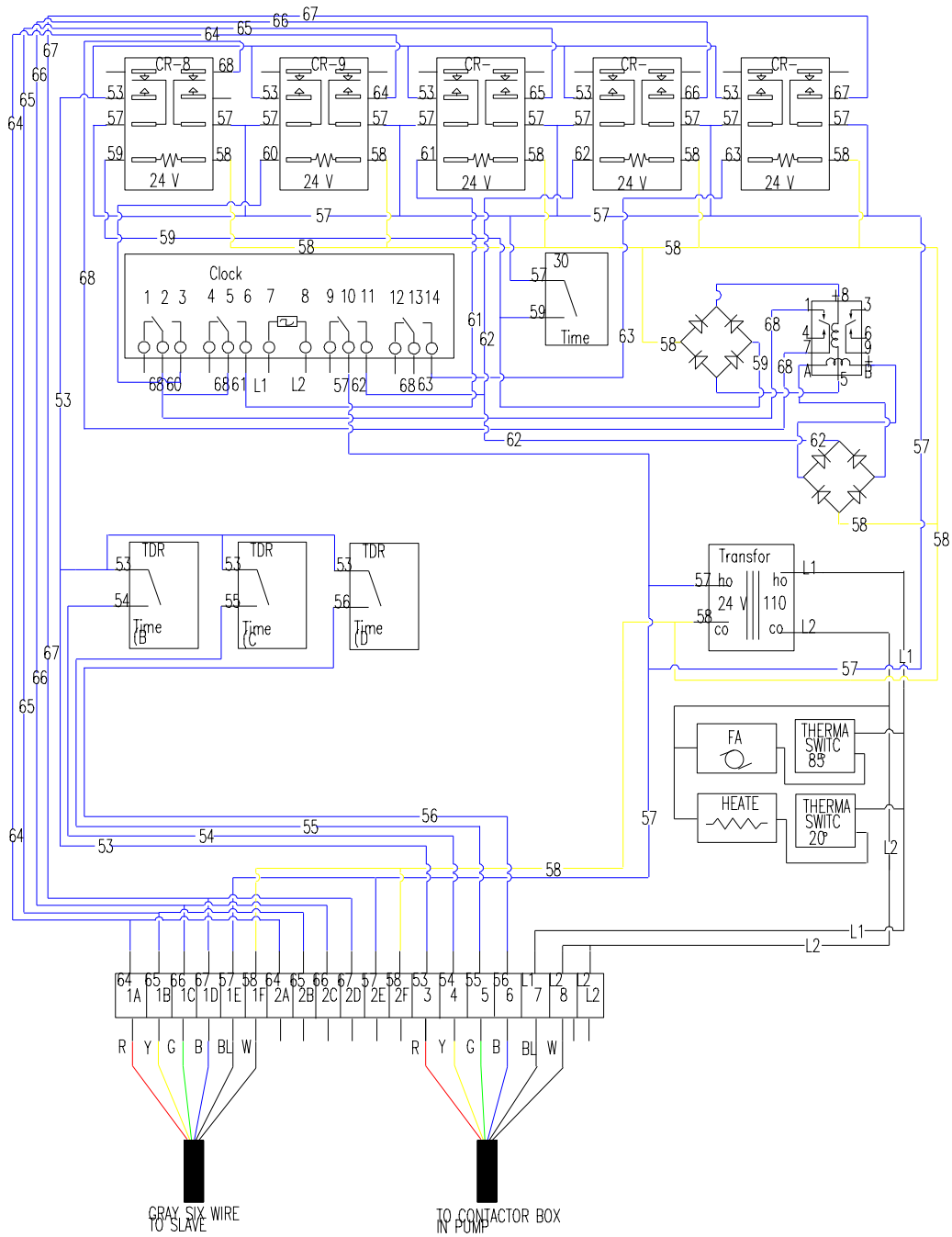


Figure 13 IC2 Independent Controller Version 2 Wiring Schematic

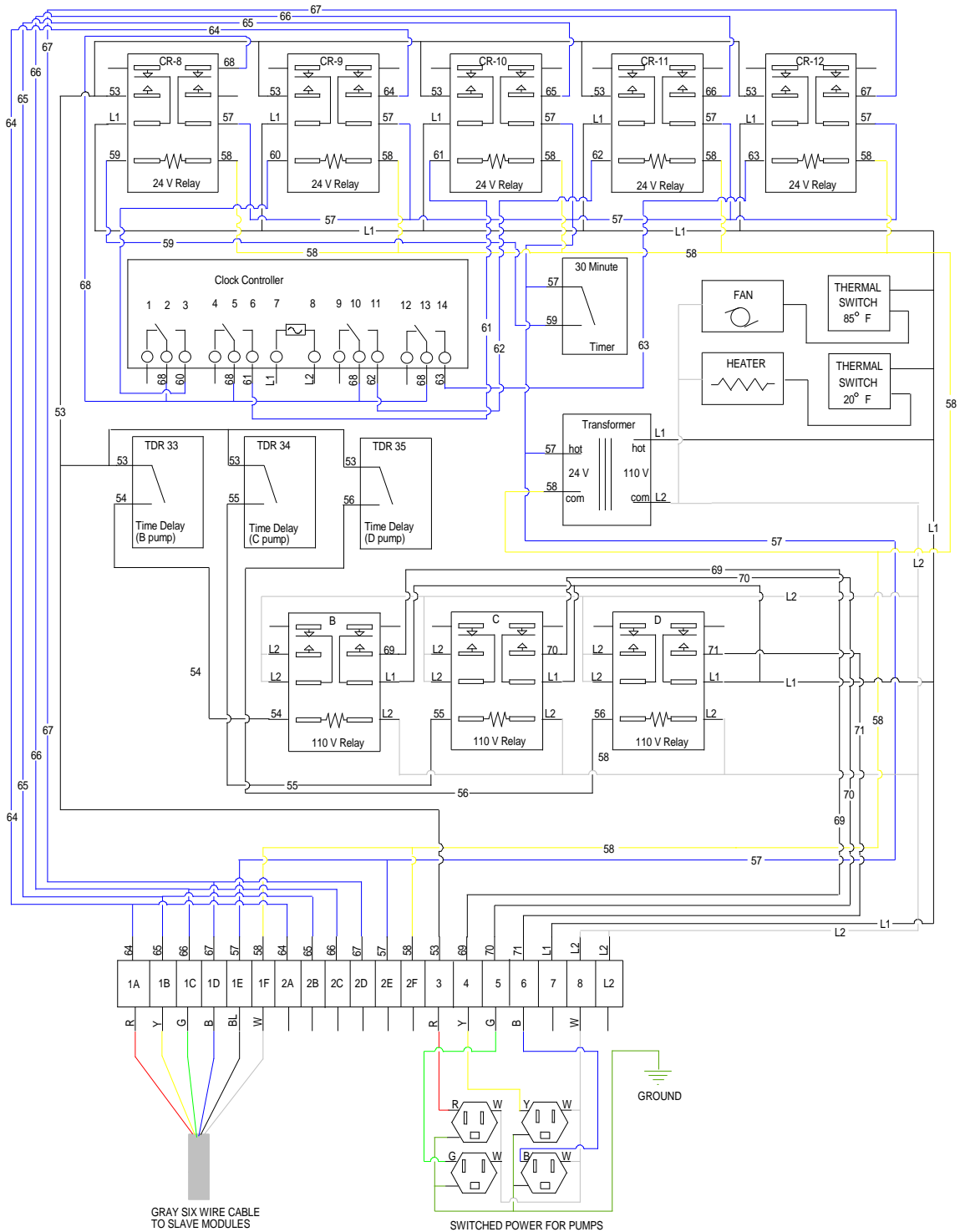


Figure 14 IC3 Independent Controller Version 3 Wiring Schematic

