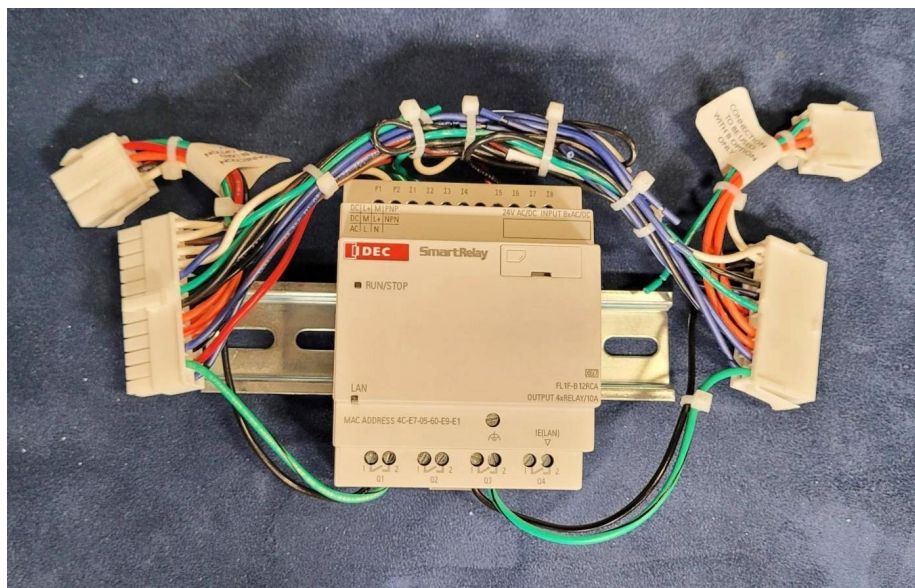# Thermal Edge Inc.™
TEMPERATURE CONTROL SOLUTIONS FOR ELECTRICAL ENCLOSURES

PLR Based Redundant System (Programmable Logic Relay)

Improved Service Life

with balanced run-time and an industry leading warranty

Reliable Cooling

in both normal and heat head load environments.

Ensured Operation

with reduced risk of downtime due a disabled AC unit with a **true failsafe** system

Enhanced Monitoring

with a web-based interface and remote diagnostics

TABLE OF CONTENTS

TABLE OF FIGURES

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com

P a g e 1 | 13

SCOPE

The purpose of this document is to provide information on how the Redundant System Operates as well as guidance on the wiring installation for our redundant air conditioning system combined with other features that utilize a programmable logic relay (PLR). Please take note to follow instructions regarding inspecting, unpacking, handling, and preliminary testing in the User & Technical Manual prior to proceeding with instructions in this document.

DEFINITIONS

1. **Redundant System** – Two air conditioners with staggered set points to provide reduced load on a single air conditioner and provide a backup cooling mechanism in the event of an air conditioner malfunction while maintaining acceptable enclosure temperature.
2. **Set Point** – Enclosure temperature that air conditioner operates to achieve.
3. **Hysteresis** – Number of degrees above set point that triggers air conditioner to operate.
4. **Primary Controller** – Device that receives an input signal for enclosure temperature and compares against set point. When the difference between these two values exceeds a certain value, an output signal is sent to turn on the air conditioner. Lower set point in system.
5. **Secondary Controller** - Device that receives an input signal for enclosure temperature and compares against set point. When the difference between these two values exceeds a certain value, an output signal is sent to turn on the air conditioner. Higher set point in system.

OPERATING CONDITIONS / HOW THE REDUDANT SYSTEM WORKS

When reading the AC Operation charts in the conditions below, please note the following:

1. Y-Axis represents the on or off condition of an air conditioner. 1 indicates the air conditioner is ON and 0 indicates the air conditioner is OFF.
2. X-Axis represents time in minutes.
3. Unit operation is plotted on each graph over time. Note that in some conditions both air conditioners are operating.
4. The Primary controller has a default temperature range of 87°F - 92°F.
5. The Secondary controller has a default temperature range of 90°F - 95°F.

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com
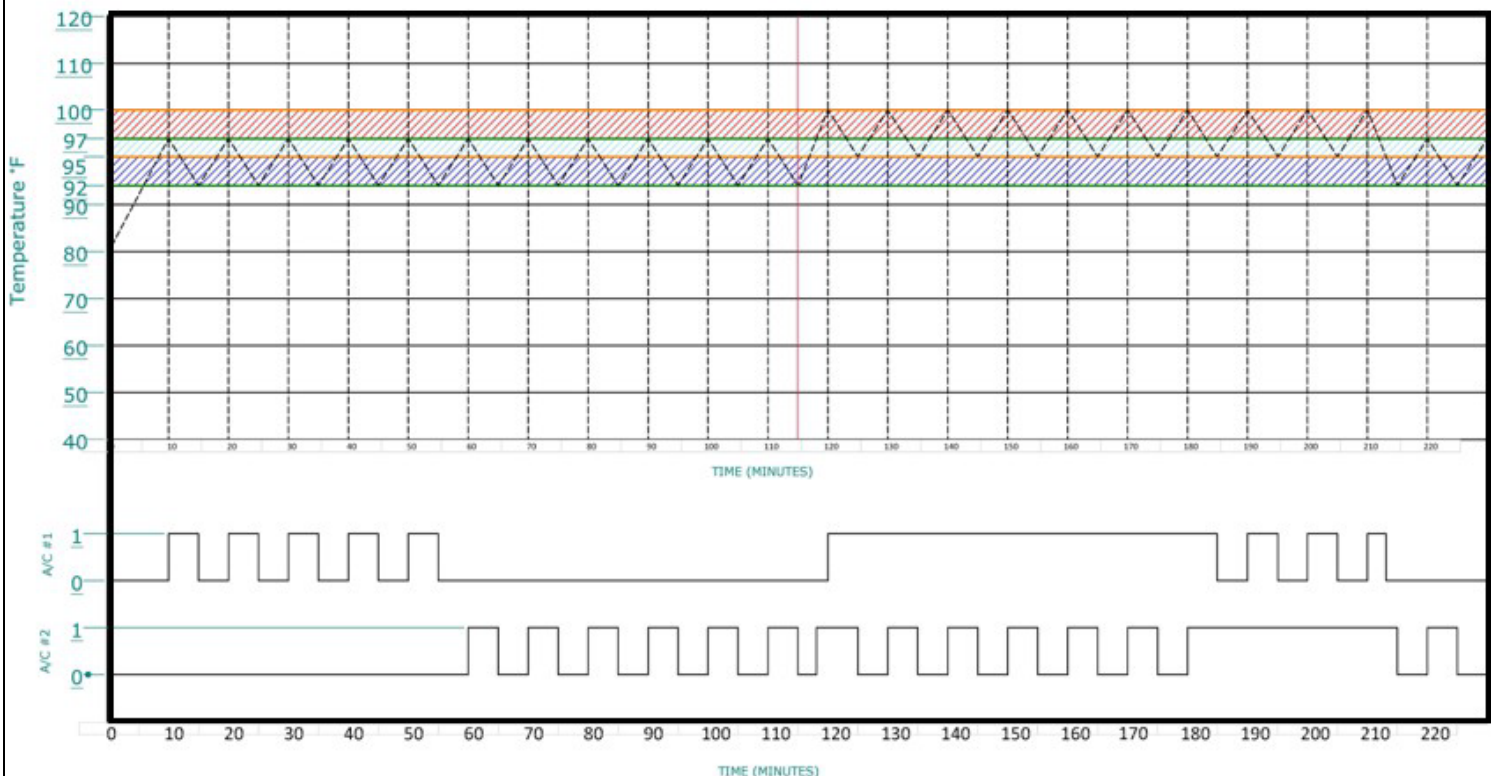
P a g e 2 | 13

CONDITION 1

The capacity of a single air conditioner is **greater than** the heat load of the enclosure.

When the enclosure temperature reaches the primary controller's set point <u>plus</u> hysteresis, one of the two units will be commanded on after a 3-minute delay and operate to meet the set point of the primary controller. When the enclosure temperature reaches the primary controllers' set point, the unit will turn off. The same unit will continue to operate in this manner for the remainder of the hour.

After 1-hour, the first unit previously in operation will remain off. The controller will then call for the Stand-by unit to turn on and operate after a 3-minute delay. The system will continue to operate with this control scheme switching between each unit from hour to hour to maintain an acceptable enclosure temperature thus, evening the run time between each unit throughout the day.

CONDITION 1 DEPICTED BEFORE 114 MINUTES

Area between green Lines above is the primary Dixell controller, with a set point of 92F.
Area between red lines above is the secondary Dixell controller, with a set point of 95F.
The black line with peaks and valleys shows the temperature inside the enclosure as it rises and falls with heat load.
The bottom section shows on/off state of the 2 air conditioners as temperatures vary along a 3+ hour window.
A rising slope in the temperature line means set point was reached and the air conditioners were turned off.
A falling slope means that the turn-on point was reached, and one or both air conditioners are cooling back to the set point. At every peak, one or both air conditioners will turn on. At every valley, one or both will turn off.
Whether it is one or both turning on or off depends on the temperatures inside the cabinet.
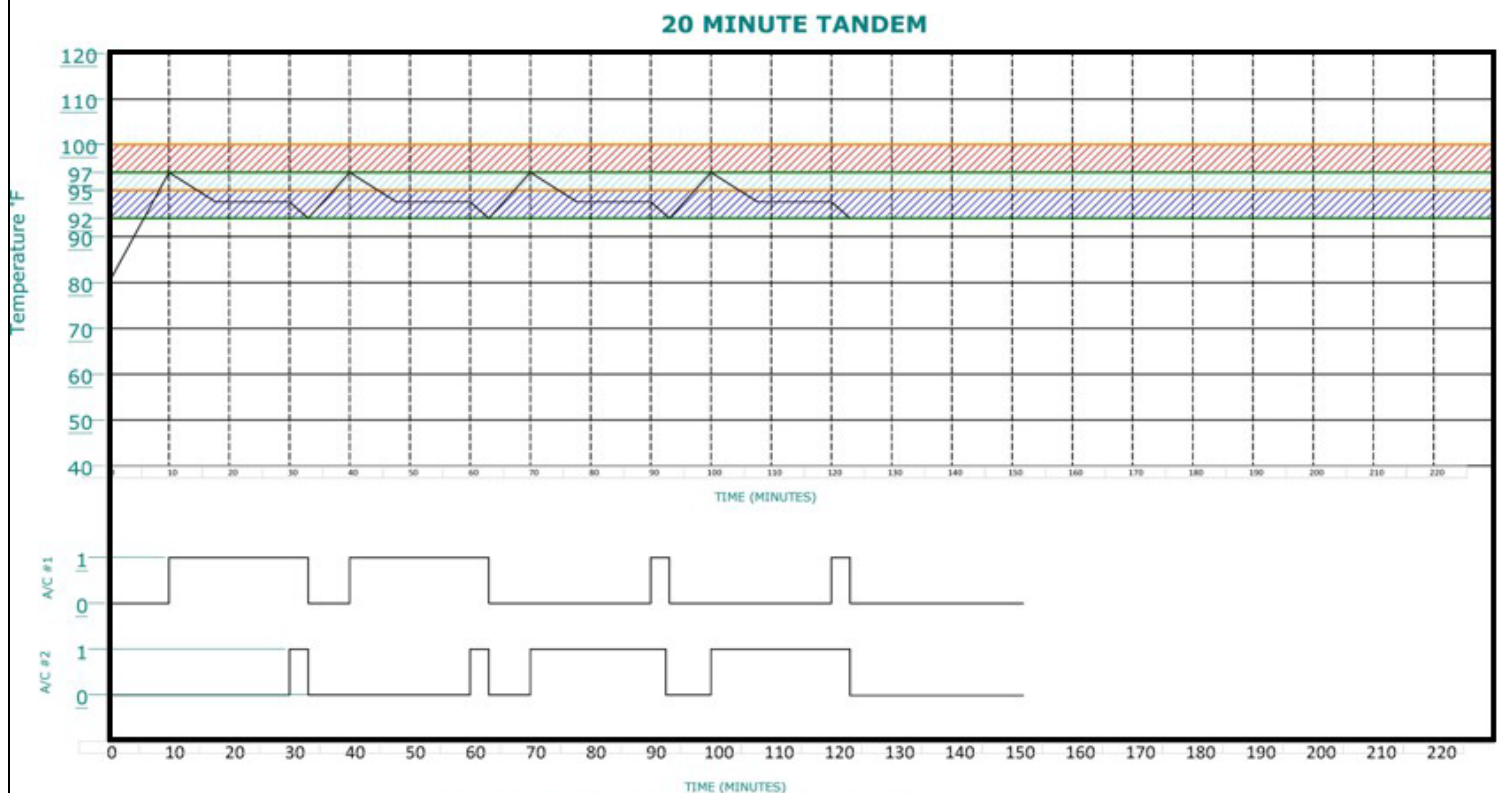
CONDITION 2

The capacity of a single air conditioner is **equal to** the heat load of the enclosure.

When the enclosure temperature reaches the primary turn-on set point, <u>plus</u> hysteresis, one of the two units will be commanded on after a 3-minute delay and operate to meet the set point of the primary controller; the other unit is on stand-by. If the primary controller set point is not reached after 20 minutes due to a dead-band, the Stand-by unit will be commanded on and run in tandem after the 3-minute delay. Once the primary controllers' set point is reached, both units will turn off. Both units will operate in this manner for the remainder of the hour prioritizing only the primary controllers' set points.

After 1-hour, the stand-by unit in the previous operating sequence will now turn on first. Both units will continue to operate with this control scheme to maintain an acceptable enclosure temperature, thus, evening the run time between each unit throughout the day.

20 MINUTE TANDEM

Area between green Lines above is the primary Dixell controller, with a set point of 92F.
Area between red lines above is the secondary Dixell controller, with a set point of 95F.
The black line with peaks and valleys shows the temperature inside the enclosure as it rises and falls with heat load.
The bottom section shows on/off state of the 2 air conditioners as temperatures vary along a 2+ hour window.
A rising slope in the temperature line means set point was reached and the air conditioners were turned off.
A falling slope means that the turn-on point was reached, and one or both air conditioners are cooling back to the set point.
At every peak, one or both air conditioners will turn on. At every valley, one or both will turn off.
Whether it is one or both turning on or off depends on the temperatures inside the cabinet.
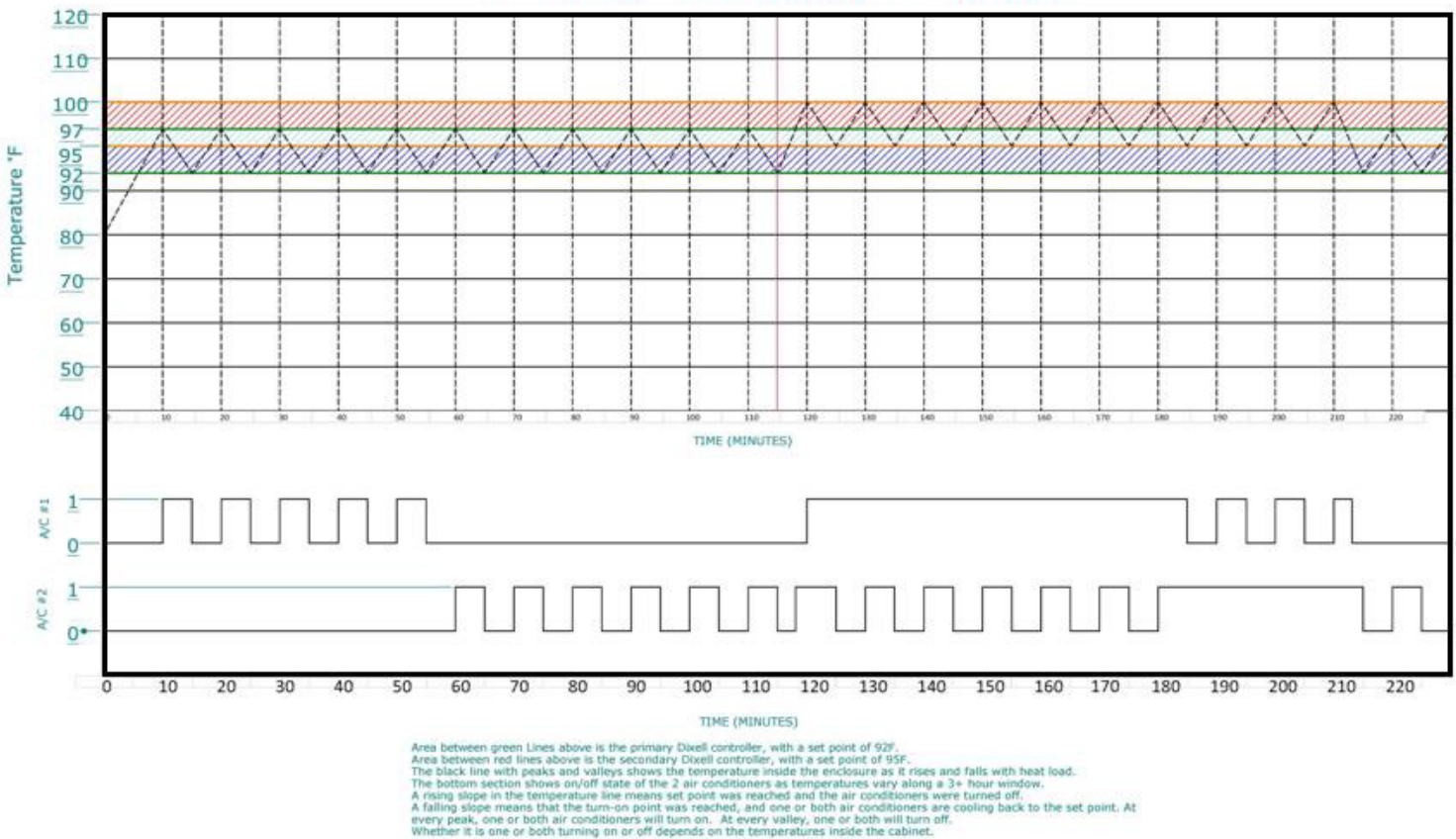
CONDITION 3

The capacity of a single air conditioner is *less than* the heat load of the enclosure.

When the enclosure temperature reaches the primary set point <u>plus</u> hysteresis, one unit will be commanded on and operated to meet the set point of the primary controller. Since the capacity of a single air conditioner in the system is *less than* the heat load of the enclosure, the enclosure temperature will continue to rise. When the enclosure temperature reaches the secondary controller's turn-on set point <u>plus</u> hysteresis value, the first unit will continue to run while the stand-by unit cycles on and off until the secondary controller set point is reached. The system will continue to operate in this manner, prioritizing the secondary controller set points for the remainder of the hour.

After 1-hour, the stand-by unit in the previous operating sequence will now be *commanded on first.* Both units will continue to operate with this control scheme, prioritizing the secondary set points to maintain an acceptable enclosure temperature, thus, evening the run time between each unit throughout the day.

CONDITION 3 DEPICTED AFTER 114 MINUTES

Area between green Lines above is the primary Dixell controller, with a set point of 92F.
Area between red lines above is the secondary Dixell controller, with a set point of 95F.
The black line with peaks and valleys shows the temperature inside the enclosure as it rises and falls with heat load.
The bottom section shows on/off state of the 2 air conditioners as temperatures vary along a 3+ hour window.
A rising slope in the temperature line means set point was reached and the air conditioners were turned off.
A falling slope means that the turn-on point was reached, and one or both air conditioners are cooling back to the set point. At every peak, one or both air conditioners will turn on. At every valley, one or both will turn off.
Whether it is one or both turning on or off depends on the temperatures inside the cabinet.

UNIT IDENTIFICATION

Both air conditioning units will be packaged individually and consolidated onto a single pallet. Depending on what redundant option you selected, you'll receive either one or two PLR sub-assemblies**.** The PLR(s) will be mounted to a din rail and shipped in a separate package including cables with the necessary wires to connect to the PLR sub-assemblies. **(not shown in photo)**

Note: All connections on the PLR are prewired from our factory. The PLR's will also be pre-programmed. Connections from the PLR wiring harness to the air conditioning unit will be factory wired for a plug and play installation.

1. Verify that you received 2 air conditioning units.

2. Verify that you received one PLR sub-assembly on a din rail with power, inputs, and outputs, as well as the wire harnesses attached to air conditioning units. (E5 and E6)
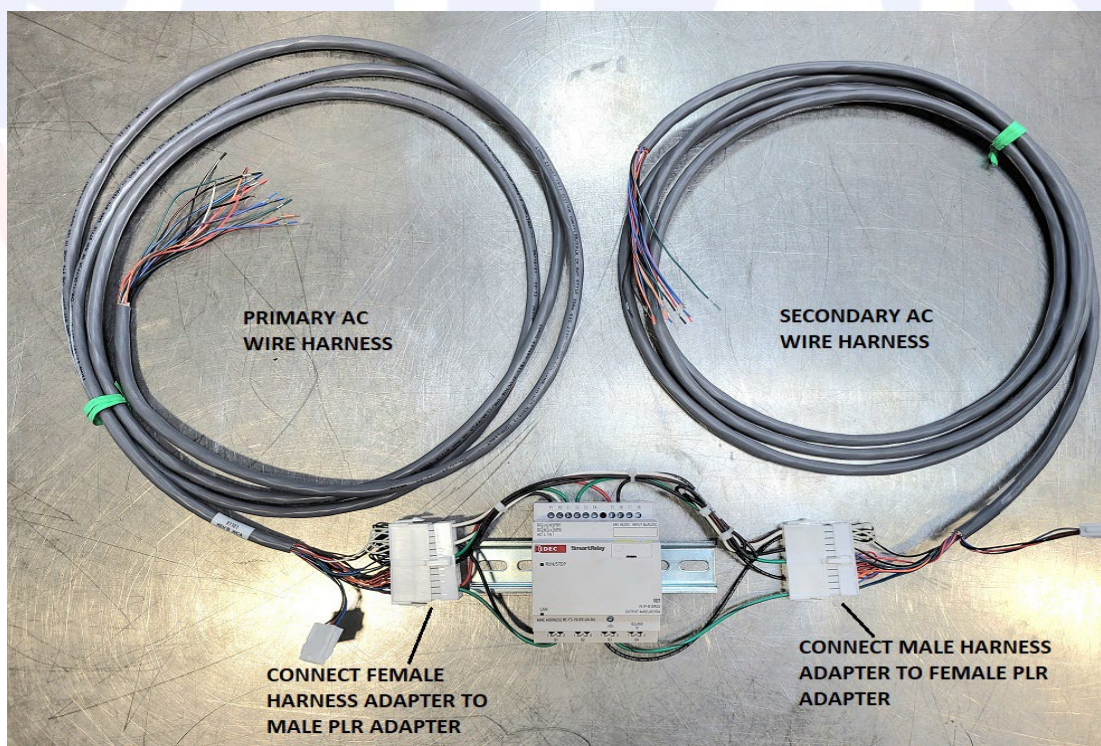
E5 Primary and E6 Secondary Palletized

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com

P a g e 6 | 13

CONNECTING E5/E6 AC UNITS TO THE PLR

1. Locate gray wire harness on Primary AC.

2. Connect female adapter on harness of Primary AC to male adapter on left side of the PLR.

3. Locate gray wire harness on Secondary AC.

4. Connect male adapter on harness of Secondary AC to female adapter on right side of PLR.

E5/E6 Basic Pair

PRIMARY AC WIRE HARNESS

SECONDARY AC WIRE HARNESS

CONNECT FEMALE HARNESS ADAPTER TO MALE PLR ADAPTER

CONNECT MALE HARNESS ADAPTER TO FEMALE PLR ADAPTER

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com

P a g e 7 | 13

E5/E6 PLR WIRING DIAGRAM WITH DIXELL CONTROLLER
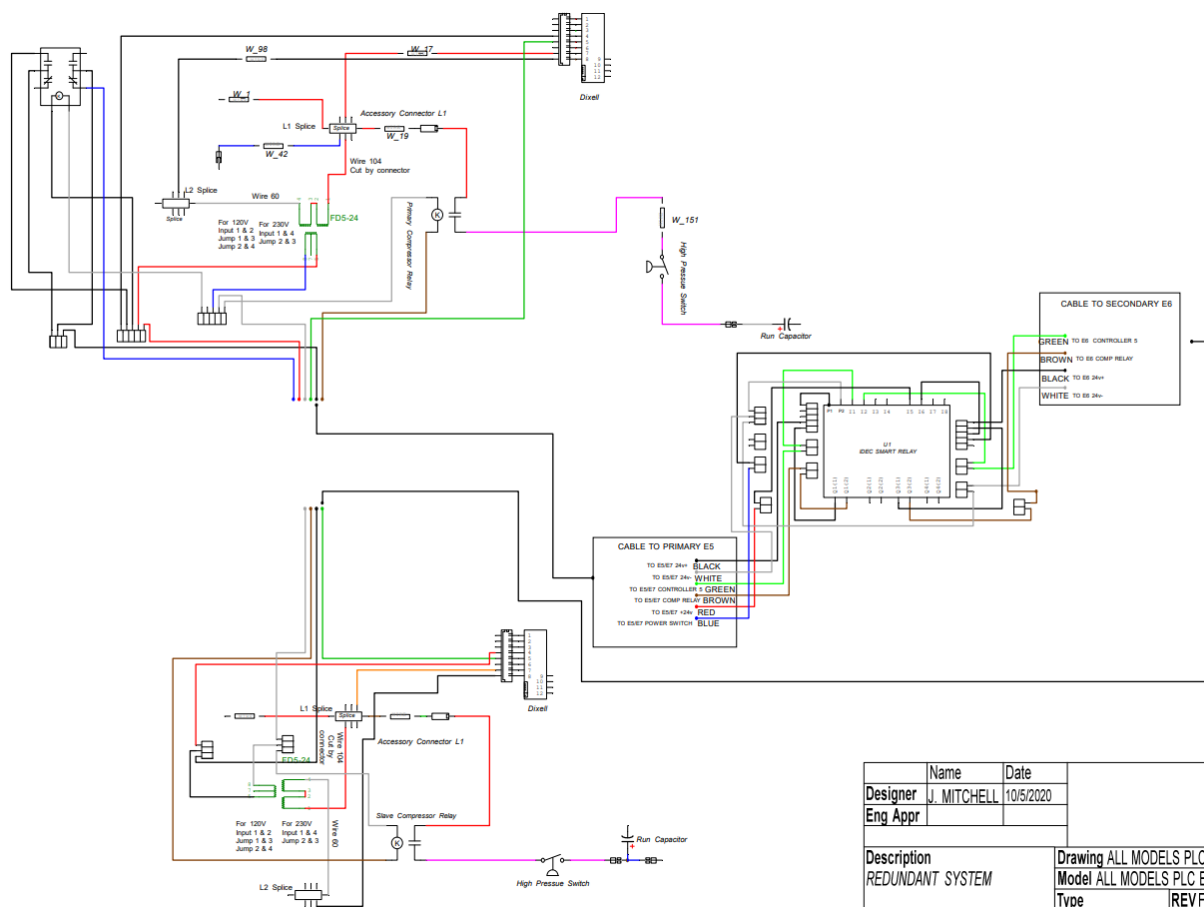
Deviation disclosure:

The Brown wire on the Primary and Secondary harness may deviate to a yellow wire from time to time due to availability.

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com

P a g e 8 | 13

REDUNDANT FAILSAFE SYSTEM WITH HMI DIAGNOSTICS

Compatible with Thermal Edge Redundant System options:

(E5, E6, E7, E8 - X1, X2, X3, X4, X5)

The HMI provides remote access via a web-based portal which displays how the system should be operating based on what the PLR is calling for. End-users may configure five (5) settings through this portal including the cycle time of both air conditioners, the auxiliary compressor status and enable time.

When combined with the E8 Secondary Unit Backup with PLR, end users get a failsafe system with full system visibility for both the primary and secondary system.

NOTE: The HMI log-in and diagnostics on the following pages only apply if your redundant unit(s) were purchased with the X options listed below.

X OPTIONS

X1	HMI ONLY
X2	Evaporator Fan + Compressor Sensors (For Redundant system only)
X3	Evaporator Fan + Compressor Sensors + HMI (For Redundant system only)
X4	Diagnostic Sensors for a single unit system
X5	Sensors with HMI for single unit system

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com

P a g e 9 | 13

Default IP address of a single PLR: 192.168.2.254
Subnet IP address: 255.255.255.0
Default Gateway address: 192.168.2.1
Backup PLR address (If you have one): 192.168.2.253

If remoting from outside network: Set up Port-forward on your router to port 8080

Login Screen example below:

STEPS:

1. Check "to customize site."
2. Leave the default name as is.
3. Enter password: Ch1ller (Ensure capital "C" and number 1 in place of "i")
4. Log in

If there are problems finding it on your network, the Mac address is on the PLR above the output terminals, and can be scanned using a free scanner called Advanced IP Scanner. The scanner can scan the network for all connected devices and will show all IP addresses associated with the Devices Mac address.

For a different IP address requirement, you can change the IP address by downloading the 30 trial software (WindLGC) from IDEC's website.

Website for free trail: https://us.idec.com/idec-us/en/USD/Software-WindLGC

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com

P a g e 10 | 13

This page was intentionally left blank.

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com

P a g e 11 | 13

DIAGNOSTICS
(X1)

AIR CONDITIONER #1 TIMERS

Q2 - Evaporator Fan #1
Q1 - Compressor #1
60 Minutes — Cycle Time Unit 1
00.20 m — Time Remaining Until Switch to Unit 2
02.32 m — 3 Min Comp 1 Safety Delay

AIR CONDITIONER #1 ALARMS

I5 - #1 Controller Power
#1 Compressor Failure Alarm
#1 Evaporator Fan Failure Alarm

I3 Door #1

I4 Door #2

I1 - Primary Controller Cooling Request

Auxiliary Compressor Enable Off (Red) to Override, On (Green) to Reset

Auxiliary Compressor Enable Time
20 Minutes
Time Until Auxiliary Compressor Starts
00.18 m

I2 - Secondary Controller Cooling Request

I7 - AUX PLC Status
System Operating on Backup PLC
Control Failure (PLC or Dixell)
Q5 - Dry Contact Alarm Output

All Compressor and Fan Alarms are disabled when open doors are detected and Open Door Power Off Delay timer has expired

60 Seconds — Open Door Power Off Delay
60 Seconds — Time Until Evap Fans and Compressors Stop

AIR CONDITIONER #2 TIMERS

Q4 - Evaporator Fan #2
Q3 - Compressor #2
60 Minutes — Cycle Time Unit 2
00.00 m — Time Remaining Until Switch to Unit 1
02.32 m — 3 Min Comp 2 Safety Delay

AIR CONDITIONER #2 ALARMS

I6 - #2 Controller Power
#2 Compressor Failure Alarm
#2 Evaporator Fan Failure Alarm

I8 - Optional Alarm Input

1800 Hurd Drive ● Irving, Texas 75038 ● (972) 580-0200 ● (888) 580-0202 ● Fax (972) 580-0277
URL: www.thermaledge.com ● Email: thermaledgeinfo@thermaledge.com

P a g e 12 | 13