

# Civacon 85XX Rack Monitor System and Associated Equipment

## Installation and Wiring Instructions Manual

Manual Part Number: H52433PA



API = American Petroleum Institute  
IS = Intrinsically Safe

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## 1. Product Description

This manual describes the installation, operation, and troubleshooting of the Civacon 85XX Loading Rack Monitoring System. It is intended to help operators, maintenance persons, and equipment specifiers understand the operation and features of the 85XX system. It is recommended reading this manual before installation of any equipment.

The 85XX monitor is a loading rack monitoring system that usually has a junction box(s) with extension cables and plugs connected to it. The 85XX monitor detects and communicates an overflow condition to the loading rack control automation equipment. The 85XX monitor also communicates a non-permissive condition to the loading operator by way of the front panel display.

The display also provides diagnostic information with defective sensors.

An overall loading rack system contains a loading rack control monitor (85XX Rack Monitor), junction boxes (Model 7500 Series), an API Optic cordset and plug (Model 7100), an API Thermistor cordset and plug (Model 7300), and optional ground verification devices (Model 7600, 7620, or 7720, etc.). Plug Hangers are also available. Please consult the factory for the current availability of all optional products. Thermistor and Optic signal inputs allow compatibility with the two API standard signaling conventions commonly used in the industry. Either of these signals comes from the truck/trailer mounted onboard control monitor or sensors.

## 1.1 Products

All CIVACON Loading Rack Monitors are suitable for hazardous locations with intrinsically safe outputs, and housed in a NEMA 4 Explosion Proof Enclosure. The 8580 is UL (Class I, Division 1, Group D) and the 8500 is CENELEC (EEx d [ia] IIAT6) approved. All units have internal ground verification.

Product #	Description
UNITED STATES and CANADA:	
8580	OPTITHERM Rack Monitor w/ 6 Thermistor channels (90-250VAC)
8580C	OPTITHERM Rack Monitor w/ 8 Thermistor channels (90-250VAC)
EUROPEAN	
8500E	OPTITHERM Rack Monitor w/ 8 Thermistor channels(90-250VAC)
SUPPLIED ACCESSORIES:	
BCU-1	BYPASS CONTROL UNIT
10 Position Connector for Field Wiring at J2 – CIVACON# H52446M	
Control Drawing – Reference D52305-030	
Screwdriver H50286M	
OPTIONAL SYSTEM ACCESSORIES:	
7100E	OPTIC PLUG and Cord(Contact Civacon for options)
7300E	THERMISTOR Plug and Cord(Contact Civacon for options)
7500	Junction Box
7510	Junction Box w/ Breakaway Socket
1386	Civacon Rack Tester

## 2. System Operation

The purpose of the Civacon 85XX Rack Monitor liquid level sensing system is to detect a liquid point level signal from a sensor mounted in compartments of a tank truck, or storage tanks. The system provides an automatic signal to the rack automation equipment to shut-off the flow of liquid, and warn of an impending overflow condition of a tank truck or storage tank. It can detect up to 8 Thermistor Sensor inputs or 12 Optic Sensor inputs.

The 85XX Rack Monitor system uses self-checking principles to provide a continuous check on all system components. This is accomplished by the exchange of digital pulses between sensor and rack monitor. These digital pulses must pass through all active components in the sensor, sensor wiring, and back to the control monitor to test all the components in the circuit. If at any time the circuit detects a failure in any of the components, the system reverts to a NON-PERMISSIVE condition. The unit must then be repaired before it can return to an operational condition. Sensors and probes cannot be "jumpered" out of the circuit and still work.

The 85XX Rack Monitor system provides an "AUTO-SWITCH" capability between API Optic signal format and API Thermistor signal format. The monitor statically remains in the Optic mode, providing Optic signals to terminals 4, 5, 6 and 8 on the monitor, which correspond to pins 4, 5, 6 and 8 on an Optic plug. The monitor also monitors channel 1 for a Thermistor signal. If one is detected, it switches the Optic signal tracks going to terminals 4, 5, 6 and 8 off, and the input terminals over to Thermistor channels 4, 5, 6 and 8.

The monitor will work with any API 5 wire Optic sensor. The monitor only uses 4 of the 5 wires, because the fifth wire is used for onboard monitor diagnostics

ONLY. Up to eight standard load Optic sensors may be connected to the monitor.

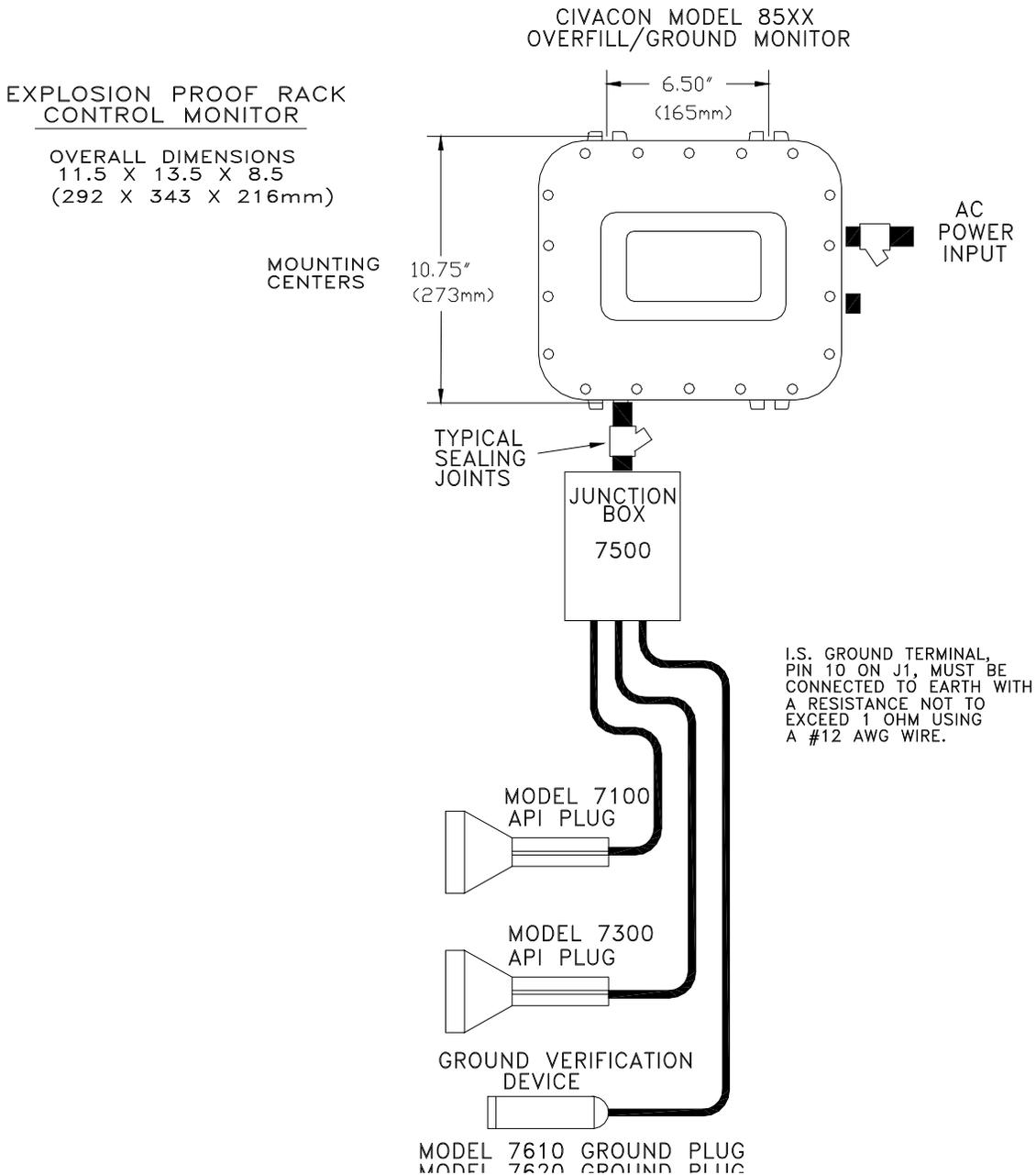
The monitor will work with any API 2 wire Thermistor probe. The monitor is optimally set up for use with GREEN Thermistor, 200 ohm, type probes. It will also work with SILVER Thermistor, 2,000 ohm, type probes, but the time to warm-up will take longer. The monitor will also work with any electronic type 2 wire probe that conforms to the API Thermistor signal format. Civacon's electronic 2 wire sensor is called a QUICK-START® sensor. Please refer to the factory for current model numbers and availability. Depending on the amount of channels the monitor is equipped with, the monitor can handle either up to six (6) or up to eight (8) probes.

The monitor will work with any API Thermistor format terminator. Most terminators have multiple units within themselves. Civacon's model 1900E series terminator comes with five internal channels. It has 6 wires exiting, with a single white wire being the ground or common line. The monitor is also designed to work with any OnBoard Monitor's API Optic or API Thermistor signal format outputs. Of course the monitor can only be connected to one type of signal source at any one time. You cannot have both Optic and Thermistor plugs connected at the same time. This is an illegal condition, and the results are indeterminate.

Note: Please consult the factory for current model numbers and options to the above.

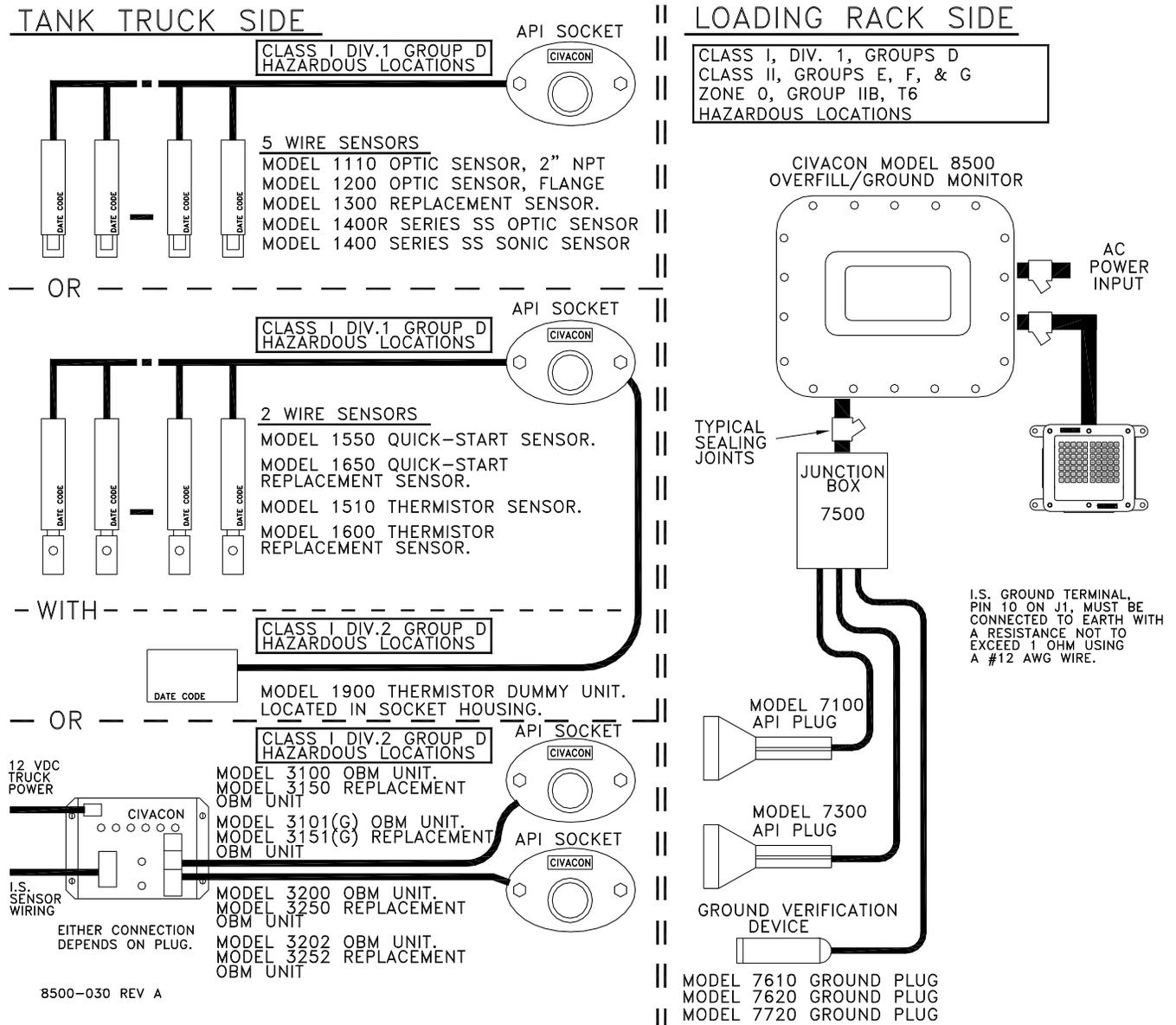
## 3. Mounting Diagram

Maximum diameter bolt holes for mounting the enclosure are 7/16" (11 mm) diameter.



**FIGURE 1 - MECHANICAL INSTALLATION**

## 4. System Control Diagram



**FIGURE 2 - SYSTEM CONTROL DIAGRAM**

### Notes:

- Control Equipment and Electrical Apparatus connected to the Rack Monitor should not use or generate more than 250 Volts.
- Installation should be in accordance with NEC ANSI/NFPA 70 and ANSI/ISA RP12.6. In Canada, the system must be installed in accordance with the Canadian Electrical Code, CEC Part I.
- Maximum ambient temperature is 60o C (144o F).
- Explosion-proof seals must be mounted within 18 inches of the enclosure.

## 5. Wiring Instructions - Power

All wiring entering the rack monitor enclosure must enter through the NPT conduit openings provided by the factory. Use weather tight conduit fittings and thread sealant on pipe threads to keep out external moisture. Ensure that the proper sealing fittings are installed, and potted (sealed) appropriately.

### CAUTION:

The control monitor's wiring and terminal strips on one side are intrinsically safe, and are separated from the AC power wiring by barriers. This separation of wires must be maintained. All sensor wires must enter the bottom (intrinsically safe side) of the monitor enclosure, and not mix with the AC power wiring or any other wiring at the top. AC power and control circuit wiring must enter through the conduit openings in the top of the enclosure. Wires should be cut to length with no excessive wire coiled inside the enclosure.

The power supply circuit should contain a disconnect switch and an appropriate fuse or circuit breaker with a minimum current rating of 1 Amp. for proper monitor operation. We strongly suggest the use of a high quality stranded and tinned copper wire with a minimum thickness of 18 gauge for all electrical connections. It is recommended that the power be switched off when servicing the electrical system. See Section 6 for proper monitor fuse replacement values.

### SAFETY FIRST!!

POWER MUST BE OFF WHEN INSTALLING OR REMOVING POWER LEADS TO THE MONITOR. THE WIRES FOR THE POWER FROM THE POWER PANEL MUST BE KEPT SEPARATE FROM THE PLUG (SENSOR) WIRING! THEY CANNOT BE RUN TOGETHER IN THE SAME CONDUIT!

50 mm (approx. 2 inches) of separation must be maintained between this wiring.

This is important to maintain safe current levels in the Intrinsically Safe wiring.

Do not apply power to the monitor without reading this manual and thoroughly checking all connections. If your unit is an 120VAC unit, it will operate satisfactorily within a range of voltage from 105VAC to 125VAC. If your unit is a 240VAC unit, it will operate satisfactorily within a range of voltage from 208VAC to 250VAC. If the power wires pass through a EEx d [ia] IIA area or a Class I, Division 1, Group D area, the conduit and wire type must be suitable for this use.

### ATTENTION:

Be sure to check the local electrical and fire codes for proper installation. Many localities require an inspection to be performed before circuits are energized.

Three terminals are provided on the power input terminal strip on the monitor. These are L1 (LINE), L2 (NEUTRAL), and GROUND. The proper power source must be wired to these terminals, including a GREEN ground wire. A ground lug terminal is provided on the enclosure of the monitor. The IS safety ground should be connected to this terminal lug point. In all cases, the appropriate NEC or CEC code should be followed.

## RELAY CONTACTS:

All Relay contacts on the Power-Relay Board do not have voltage present as supplied. The customer may connect voltage to the Common contacts to switch voltage to auxiliary pump control equipment. Each Common contact of the relays has a 5A/240V fuse in series with this contact. Civacon part number for this fuse is Civacon H52449M.

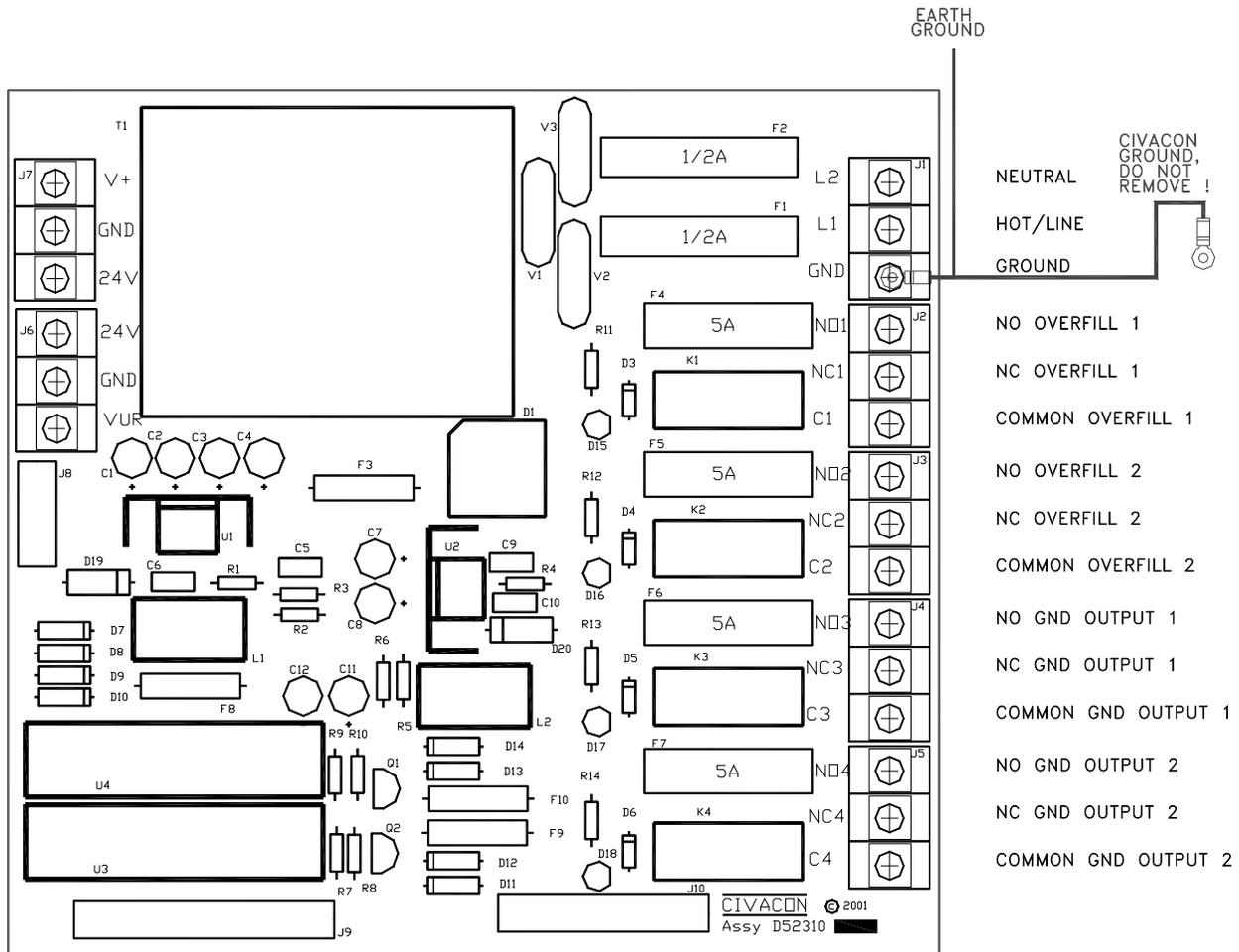
### **ONLY REPLACE WITH EXACT STYLE AND RATING!**

There are two (2) sets of relays for each active and valid Overfill and Ground Verification PERMIT conditions.

RELAY DESCRIPTION	RELAY DESIGNATOR	ASSOCIATED FUSE	CONTACTS	RELAY INDICATOR LED
Overfill Relay #1	K1	F4	C1/NC1/NO1	D15
Overfill Relay #2	K2	F5	C2/NC2/NO2	D16
Ground Verification Relay #1	K3	F6	C3/NC3/NO3	D17
Ground Verification Relay #2	K4	F7	C4/NC4/NO4	D18

## 5.1 Power Wiring

The monitor must be wired according to Figure 3.



**FIGURE 3 - POWER WIRING**

### Additional Notes:

- Installation should be in accordance with NEC ANSI/NFPA 70 and ANSI/ISA RP12.6 . In Canada, the system must be installed in accordance with the Canadian Electrical Code, CEC Part I.

## 6. Wiring Instructions – Intrinsic Safety (IS) Signals

We strongly suggest the use of a high quality stranded and tinned copper wire with a minimum thickness of 18 gauge for all electrical connections to the intrinsically safe area connections. For wire lengths greater than 1000 feet (300 m.), please consult the factory.

### WARNING:

During installation of the IS wiring, the installer must ensure that the plastic shield that encloses the Ground/Overfill Board remains attached during operation. These recommendations must be followed to limit the inductance and capacitance of the IS field wiring. Failure to do so will impair the intrinsic safety and approvals of the system.

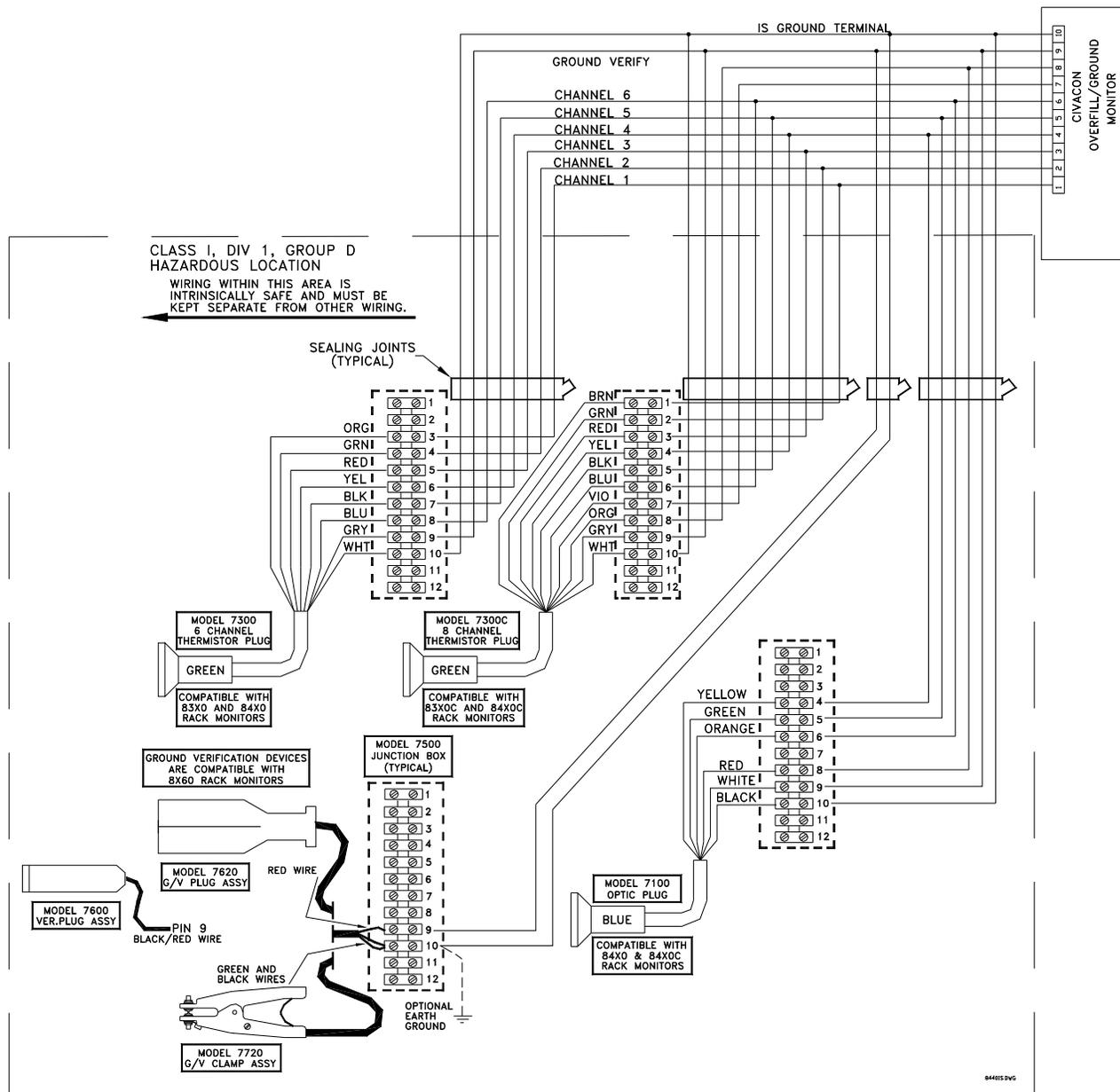
### CAUTION:

Hazardous conditions exist in fixed tank or large open rack installations. For lightning protection, above ground wiring runs must be in metal conduit, which must be weather-proof and have grounding rods to earth at each end. Underground wiring runs can be in non-metal liquid-tight conduit, however, such runs must terminate in a metal weather-proof junction box upon surface transition. It is suggested that underground wiring runs be run in metal conduit. This junction box must have a ground rod to earth. Lightning suppression equipment can be added at each sensor and control monitor. If additional protection is desirable, consult the factory.

Additional installation information can be obtained from Civacon for the other products used in the **IS** wiring portion of this installation. This information is usually shipped with the other products when they are purchased. If you misplace or lose this information, use the following information for obtaining replacements.

Use CIVACON Instruction Sheet or Manual H50457PA for additional information on installing Model 7500 series Junction Boxes.

Use CIVACON Instruction Sheet or Manual H50204PA for additional information on installing Model 7100E or 7300E series Rack Connector Plugs.

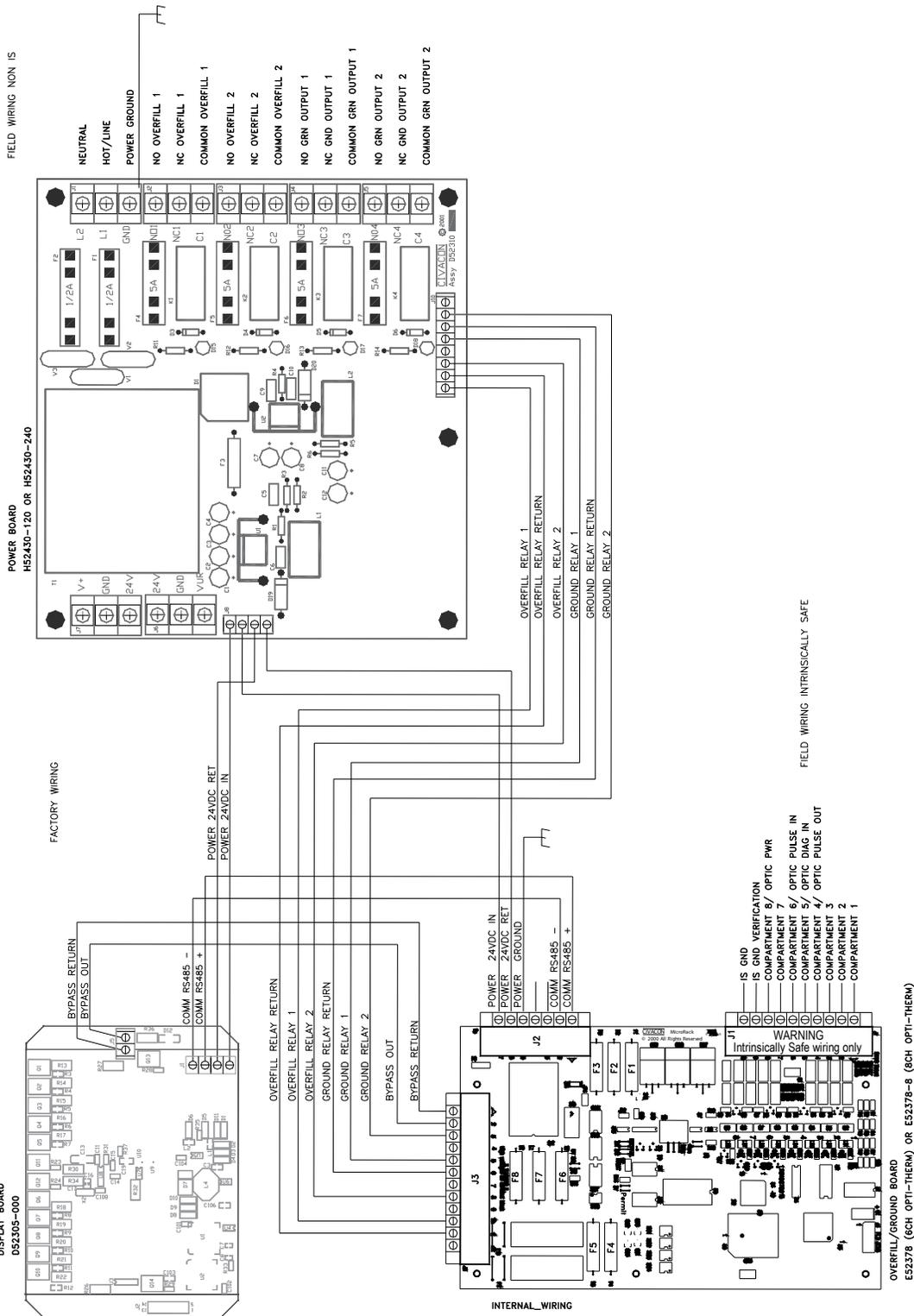


**FIGURE 4 - I.S. WIRING**

**Note:** Use optional earth ground when the monitor's earth ground is questionable in G/V plug or clamp source applications.

The 85XX system provides an "auto-switch" capability between API Optic signal format and API Thermistor signal format. Inputs are connected to the Overfill/Ground board's terminals 4(SIG OUT), 5(DIAGNOSTIC), 6(SIG RETURN), 8(OPTIC POWER), and 10 (GND)for the Optic mode, which correspond to pins 4, 5, 6, 8, and 10 on an Optic plug. When a valid Thermistor or Thermistor dummy signal is detected, the monitor goes into Thermistor mode. In this mode, the monitor uses terminals 1, 2, 3, 4, 5, 6, (7 & 8 are for 8 channel only), and 10(GND) for the Thermistor sensors. The Ground Verification signal input is on pin 9 of the board and API plug.

## 7. Internal Wiring



**FIGURE 5 - Internal WIRING**

This figure is provided for reference only!

## 8. Operation and Description of Indicators

The 85XX rack monitor can automatically detect presence of either Optic or Thermistor signal from the tanker source. NOTE: THE 85XX MUST FIRST HAVE A VALID GROUND VERIFICATION (GV) SIGNAL BEFORE THE OVERFILL DETECTION CIRCUITRY WILL PROVIDE A PERMIT CONDITION. The GV inputs are at pins 9 and 10 of J1 of the Overfill/Ground board. If GV is not used in the application, a jumper must be installed between pins 9 and 10 for the system so that the 85XX will detect Thermistor or Optic overfill signals.

### STARTUP:

When power is applied to the 85XX, the unit goes into an initialization routine searching for a valid Ground Verification signal. Once GV is detected, the GV relays, K3 and K4 are activated and the unit will begin looking for either Thermistor or Optic signal present at J1 of the Overfill/Ground board. If the proper signal is detected, the unit will then activate the Overfill Relays K1 and K2 and all LEDs on the GREEN light bank will be active.

### PERMIT INDICATION:

All LEDs on GREEN are ON and FLASHING (see Figure 10)

### GROUND VERIFICATION FAULT CONDITION:

RED "▼" is displayed.

### OVERFILL FAULT INDICATION:

The 85XX will indicate which tank compartment is experiencing a fault or wetted condition. The RED LED bank will indicate by number which compartment needs attention.

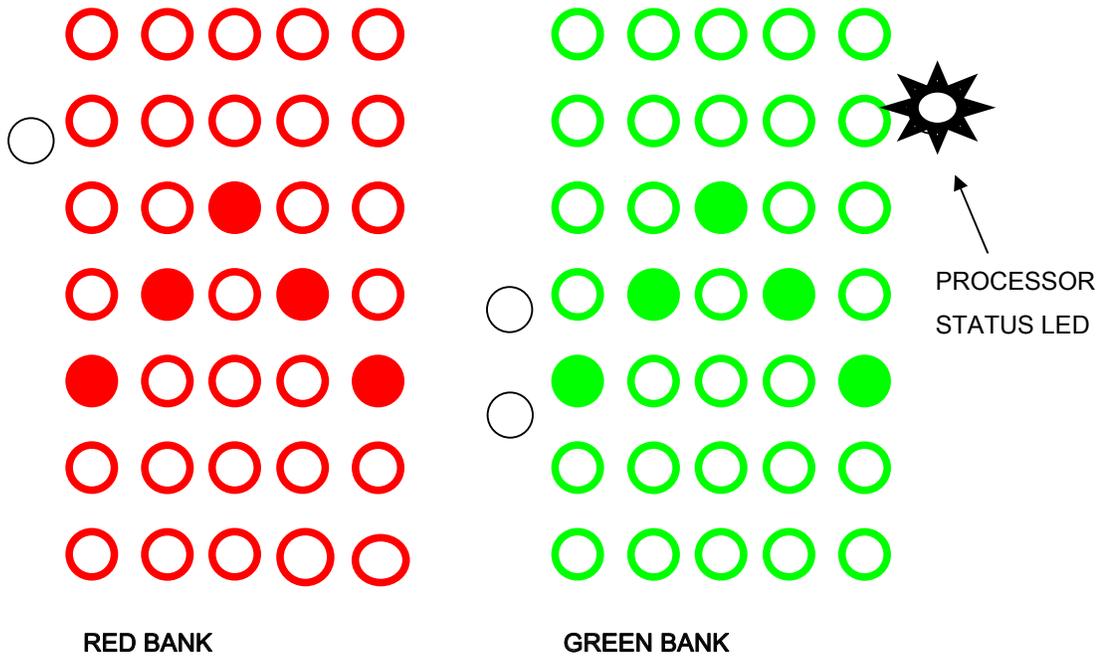
THERMISTOR Fault – will display all compartments that are wet or faulted if there are multiple

OPTIC Fault – will display only one channel determined by the impedance of the sensor probe's green diagnostic wire.

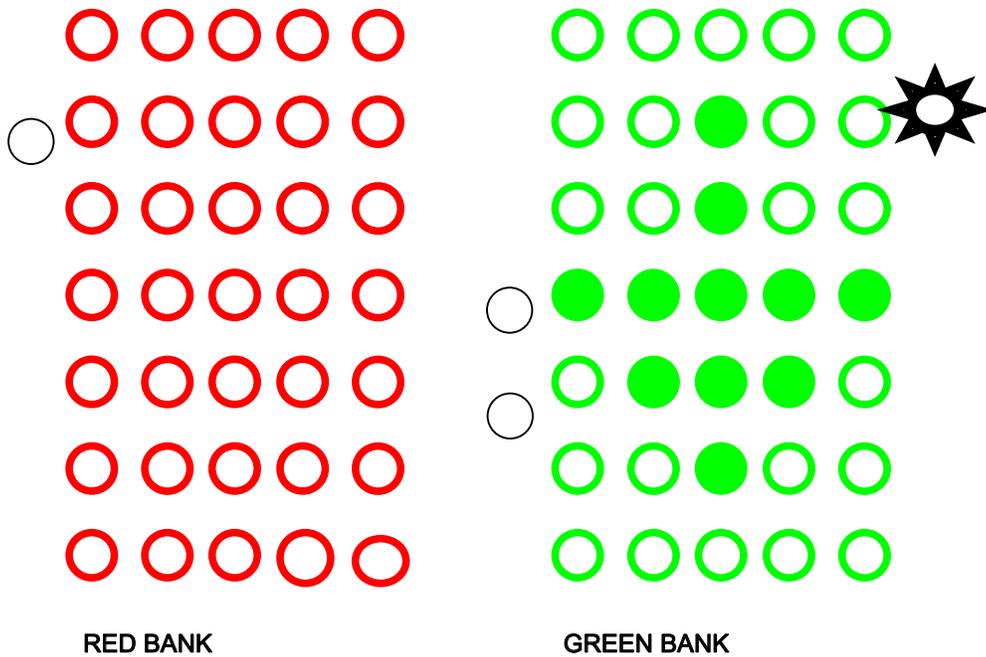
### BYPASS INDICATION:

When the unit has been bypassed using the BYPASS CONTROL UNIT (BCU-1), both the RED and GREEN LED banks will be ON and FLASHING (see Figure 12).

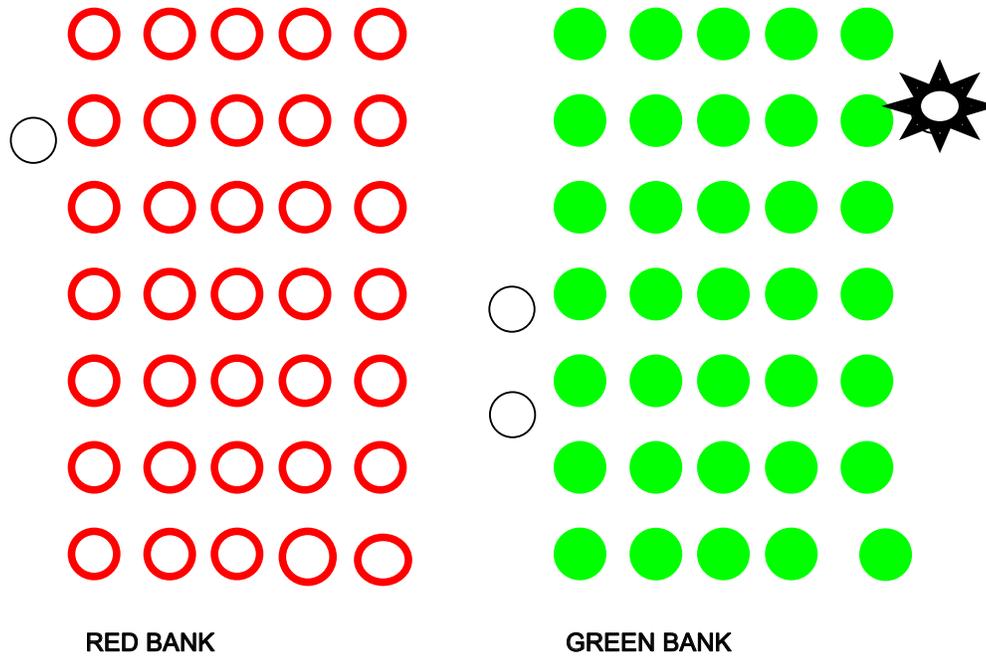
**8.1 Display Information**



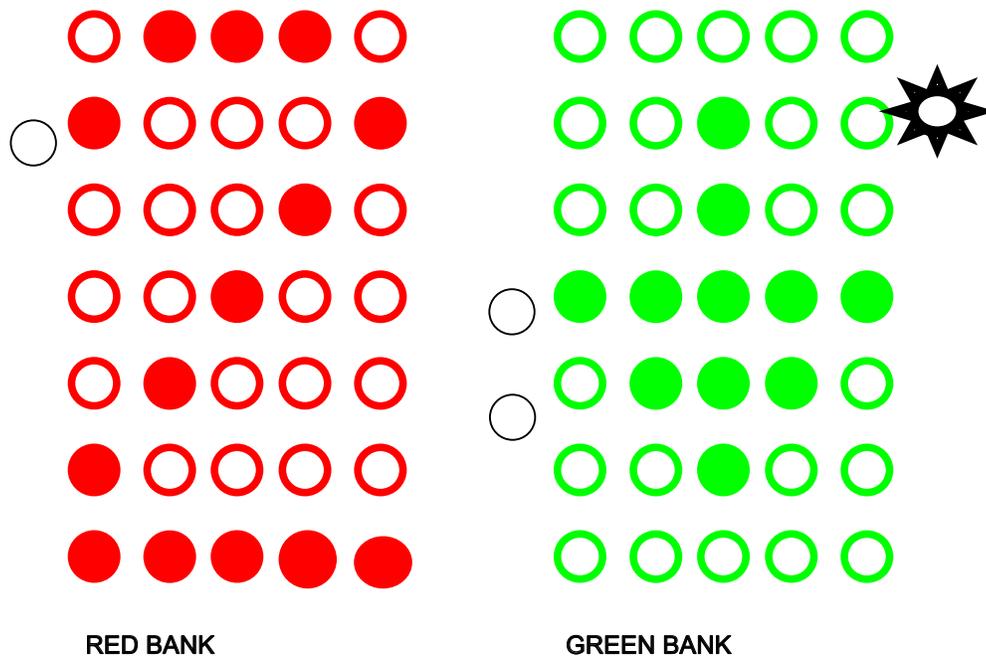
**FIGURE 6 - SYSTEM INITIALIZING**



**FIGURE 7 - GROUND IS VERIFIED (SEARCHING FOR OVERFILL)**

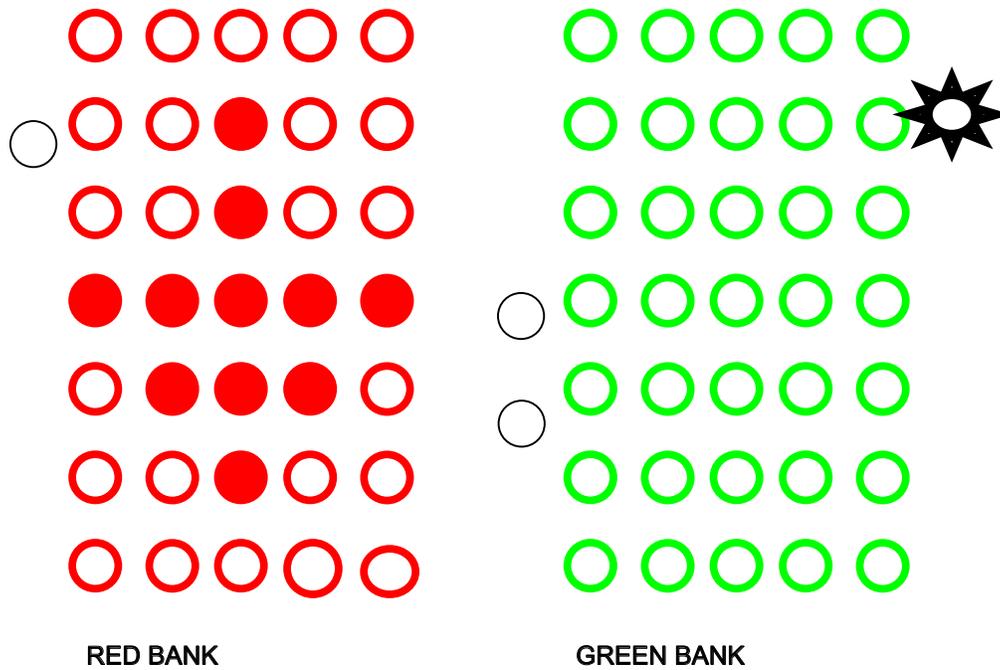


**FIGURE 8 - PERMIT AND DETECTED (OVERFILL AND GROUND)  
ALL GREEN SOLID ON**

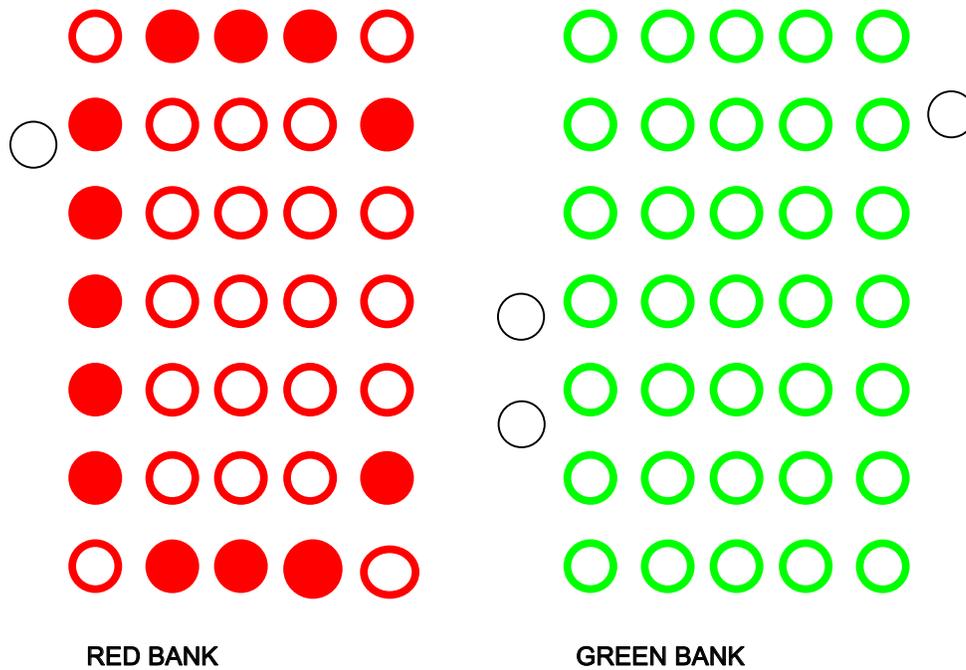


**FIGUR 9 - SENSOR FAULT INDICATION - GROUNDING PRESENT**

("2" = Problem with Compartment #2 - Good Ground )



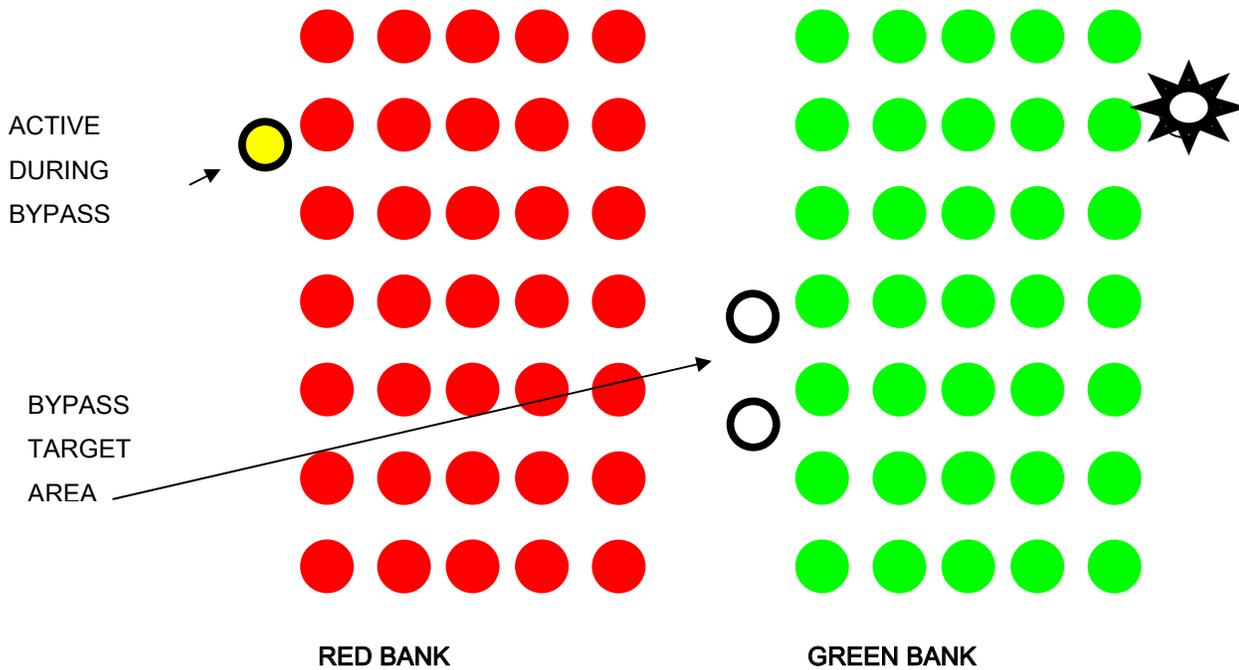
**FIGURE 10 - GROUND FAULT**  
**85XX DOES NOT SEE CORRECT GROUNDING CONNECTION**



**FIGURE 11 - COMMUNICATION FAULT - INTERNAL TO 85XX**  
**NO COMMUNICATION COMING FROM PROCESSOR BOARD**

## 8.2 Bypass Operation

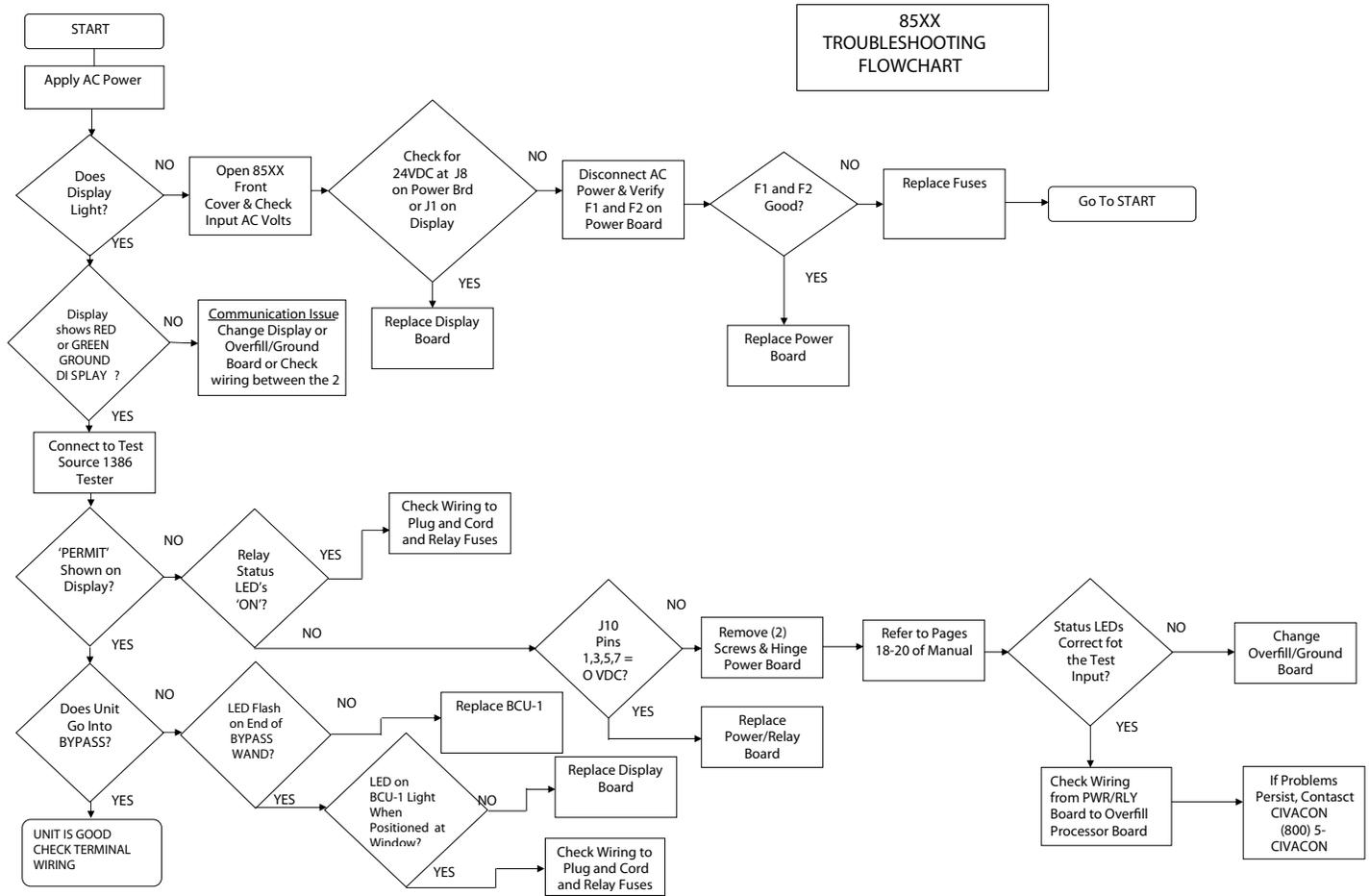
The terminal supervisory personnel have, at their discretion, the ability to bypass the 85XX so that the Ground and Overfill relays will become active. To achieve Bypass, the operator should position the Bypass Control Unit (BCU-1) by holding the unit 2" (inches) or closer to the front of the display board and pointing directly at 2 LEDs in the center of the display.



**BYPASS CONDITION**  
**FIGURE 12 - ALL RED and GREEN FLASHING**

When BYPASS mode is achieved, both the RED and GREEN LED banks will be ON and flashing and the LED in the top, left corner of the display will be ON. The BYPASS mode will continue until this BCU-1 is directed at the window again. (Note: the Blue LED must be flashing before the system will detect the BCU-1 input.) A Power RESET of the 85XX will force the system into a NON-BYPASS condition.

## Troubleshooting Flowchart



## 9. Checkout Procedure

1. Before applying AC line power to the 85XX Series Rack Monitor, perform a visual inspection of the power and control wiring according to **Figure 3**.
2. Apply the proper AC line power to the 85XX Series Rack Monitor. Ensure the rack monitor plug(s) is not connected to anything. **Figure 6**, “System Initializing” followed by Software Version Number. Example: Green LED showing “1” followed by “.” followed by “2,” stands for Software Version 1.2

Check the rack automation equipment for a **NO** “PERMISSIVE” signal (Figure 10).

NOTE: Do not activate the Bypass mode at this time.

3. Connect the Rack Monitor’s plug to an appropriate test sensor source.

Use a known working tank truck with appropriate sensors installed that can connect through the plug and socket to the Rack Monitor for a permit signal source. A Civacon Model 1386 RackTester Unit may be used if it is available.

Apply proper Ground Verify signal. GREEN “▼” should display. (Figure 7)

Apply proper Overfill signal. The GREEN Permit LED’s should all be ON. (Figure 8)

4. Disconnect the test source. Display should have RED “▼”. (Figure 10)
5. With Ground Verify Signal connected (pin 9 and 10 of J1) Activate the BYPASS mode using the BCU-1. See **Figure 12** for proper display.
6. Deactivate the BYPASS mode. The RED “▼”. should remain display
7. If the 85XX does not meet the above tests, refer to the troubleshooting section.

### CAUTION:

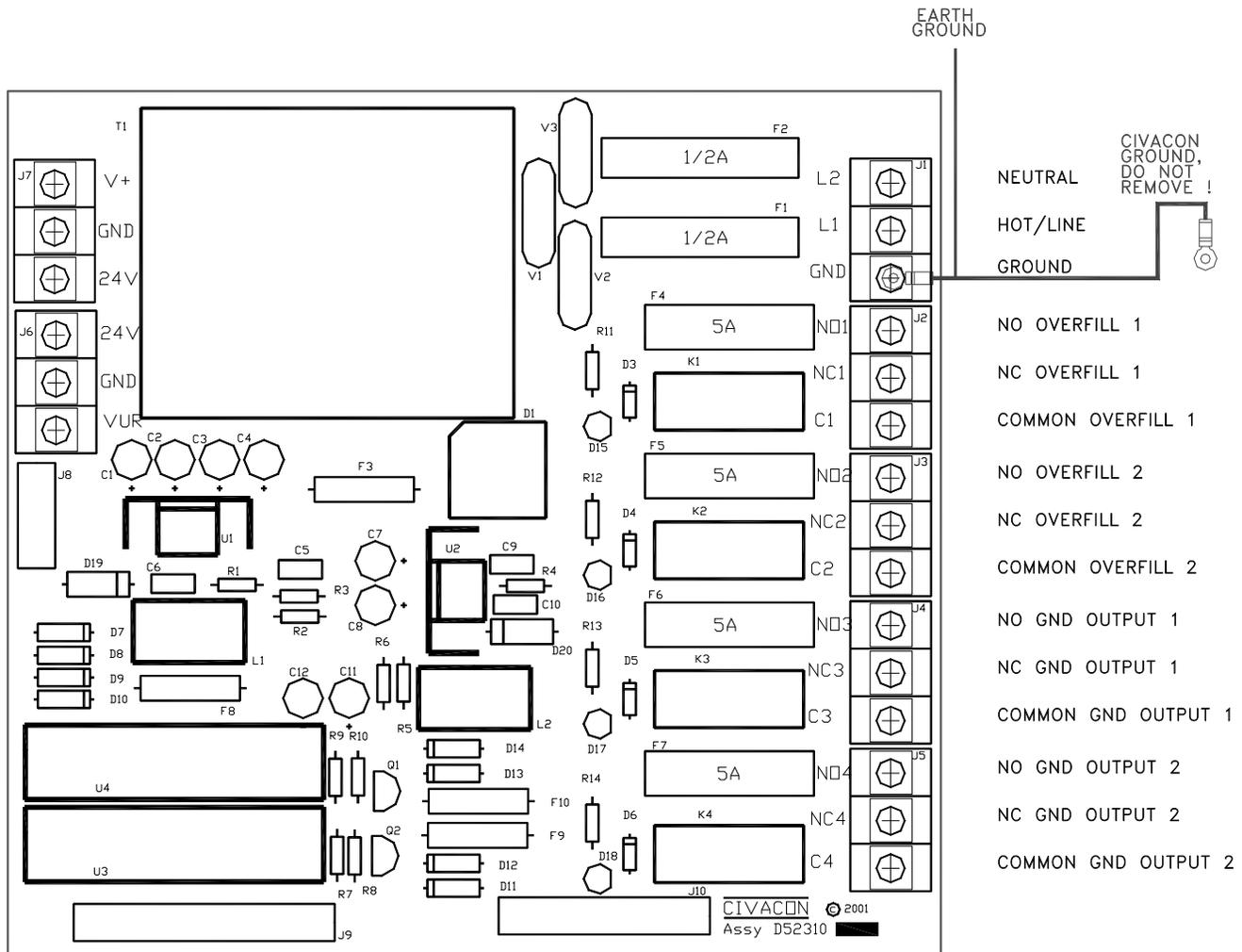
Hazardous conditions exist on the printed circuit board. Only a qualified technician should be probing around on the circuitry contained within. Please consult the factory with any questions.

## 10. Troubleshooting

Refer to the attached Troubleshooting Chart.

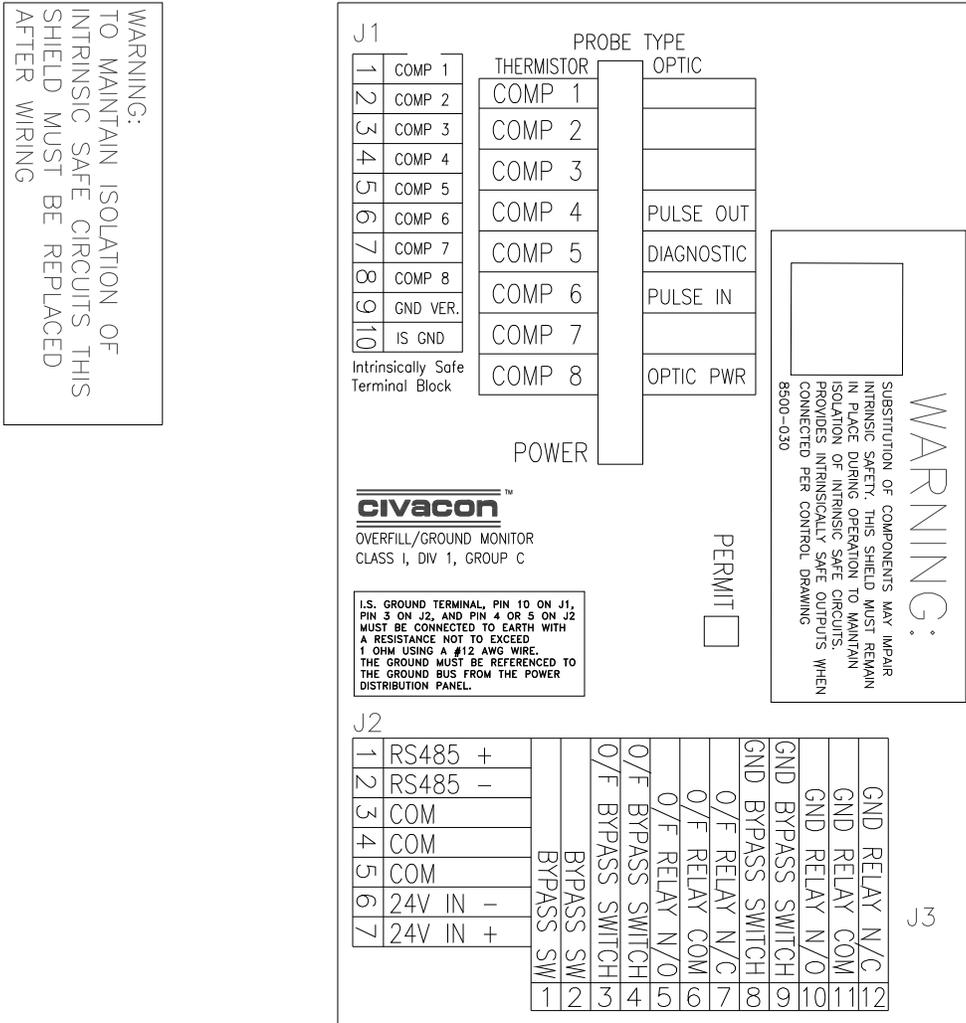
Troubleshooting will require the use of a voltmeter and the ability to look at status LEDs inside the 85XX.

## 10.1 Power/Relay Board Status LEDs



### Overfill/Ground Board Status LEDs

To view the status LEDs for the Overfill/Ground Monitor Board, remove the four(4) screws of the Power/Relay board indicated by the ⇒ marking on the circuit board. This will allow access to view the status LEDs on the Overfill/Ground board.



**FIGURE 14 – OVERFILL/GROUND BOARD**

An LED is visible for each of the input channels on the top of the Overfill/Ground board. This LED indicates the state of the corresponding Thermistor channel. Each LED will be flashing to indicate a signal from the respective compartment, or in the case of the Optic sensors, the entire loop. A steady on for the Thermistor indicates a constant non-pulsing signal.

**Note:** Flashing does not indicate that the sensor is indicating permissive, as the signal may be out of specification. The indications for these LEDs are shown in the table below.

Thermistor Mode (Channels 1 – 8)	
Green	Constant power or open circuit
Red	Constant low signal or ground
Flashing Red/ Green	Thermistor is present (signal may be valid to permit loading)

If in the Thermistor mode all the LEDs are flashing, and they are a valid Thermistor signal, then the monitor should give a permissive indication. Providing that the truck ground is connected and functioning as well, the indications in the table below will apply.

Optic Mode	
Channel 8 LED	Green
Channel 4 LED	Green
Channel 6 LED	Red
Channel 5 LED	Green

## 10.2 Replacement Parts

### FIELD REPLACEABLE COMPONENTS:

E52378	ASSY, OVERFILL/GROUND MONITOR BOARD
E52378-8	ASSY, OVERFILL/GROUND MONITOR BOARD (8 CH. THERM)
D52305-000	ASSY, PCB, 85XX RACK MONITOR DISPLAY BOARD
D52320-000	ASSY, POWER RELAY BOARD 90-250VAC
BCU-1	BYPASS CONTROL UNIT

### CAUTION:

The Power/Relay board chassis contains NO components that are field replaceable except the six (6) AC fuses. Any substitution of components may impair the intrinsic safety and approvals of the system.

**SAFETY FIRST!! POWER MUST BE OFF WHEN REMOVING AND REPLACING THE AC FUSES IN THE MONITOR. THE WIRES FOR THE POWER TERMINALS FROM THE POWER PANEL MUST BE KEPT TURNED OFF DURING ANY FUSE REPLACEMENT! This is important to maintain safe repair practices.**

The six (6) AC fuses that are field replaceable are F1, F2, F4, F5, F6, F7. The following list of specifications should be followed.

- F1 & F2 = 3AG Type, 250V, 1/2 (0.5) AMP AC Line Input Fuses Civacon# H52447M
- F4 – F7 = 3AG Type, 250v, 5 AMP Relay Fuses Civacon # H52449M

Please note that fuse F3 is **NOT** a field replaceable component.



## 11. Warranty

All parts and products are thoroughly inspected and tested from the time raw material is received at our plant, until the product is completed. We guarantee that all products are free from defects in materials and workmanship for a period of one year from the date of shipment. Any product that may prove defective within said one year period will, at our option, be promptly repaired, or replaced, or credit given for future orders.

This warranty shall not apply to any product which has been altered in any way, which has been repaired by any party other than an authorized service representative, or when such a failure is due to misuse or conditions of use. We shall have no liability for labor costs, freight costs, or any other cost or charges in excess of the amount of invoice for the products.

**THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND SPECIFICALLY THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

### **WARNING:**

OPW Engineered Systems' products should be used in compliance with applicable federal, state, and local laws and regulations. Product selection should be based on physical specifications and limitations, compatibility with the environment, and the material to be handled. OPW Engineered Systems makes no warranty of fitness for a particular use.

**IMPORTANT:** OPW products should be used in compliance with applicable federal, state, provincial, and local laws and regulations. Product selection should be based on physical specifications and limitations and compatibility with the environment and materials to be handled. OPW MAKES NO WARRANTY OF FITNESS FOR A PARTICULAR USE. All illustrations and specifications in this literature are based on the latest product information available at the time of publication. OPW reserves the right to make changes at any time in prices, materials, specifications and models and to discontinue models without notice or obligation.