TR200 Troubleshooting

Course Objectives

Student will learn to

- Identify the necessary tools and test equipment
- Exercise proper safety precautions when troubleshooting
- Make a physical inspection and identify blown components
- Perform a proper static check to identify a bad component
- Identify common programming errors and resolve them
- Test for bad circuit boards using described procedures
- Isolate problems to either the VFD or the application
- Check the drive for a bad current sensor
- Understand various alarm codes and what causes them

Reference Material

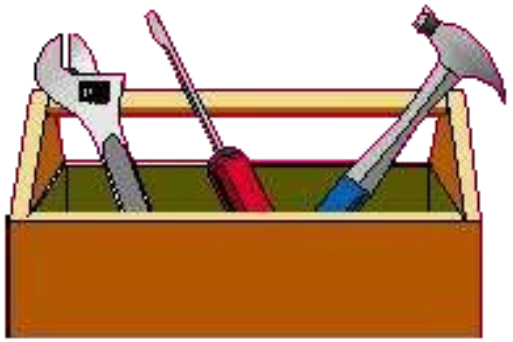
- Instruction Manual
- Service Manual
- Customer Connection Diagram

DANGER

- Touching the electrical parts of the VLT may be fatal.
- The largest models can require a significant amount of time to discharge it's internal circuitry to a safe level after being disconnected from the incoming AC line power.
- Check instruction manual for further warnings.

Required Tools

- Screwdrivers, Standard & Phillips
- Torx drivers T10 to T50
- Metric socket set, 7 – 17 mm
- long extension (must clear 20”)
- Torque wrench, 4 – 170 in./lbs.
- Magnet
- Nut starter



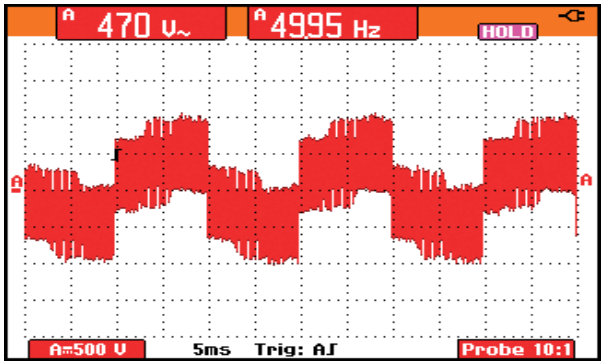
Required Equipment

- PWM compatible voltmeter

- Clamp-on ammeter

PWM Compatible Meter

Many Digital Meters will give erroneous readings due to PWM waveform.



The output voltage of a VFD can be measured accurately with an analog meter, or a digital meter designed for PWM compatibility. 1000 VDC scale is recommended

Possibly Useful Tools

- 1000 Volt Megger
- Cell phone
- Laptop computer with TRANE DRIVE UTILITY *Software*
- Oscilloscope

What Is Troubleshooting?

- Troubleshooting is nothing more than a logical approach to determining.....

Why the SYSTEM is not working?

The Logical Approach

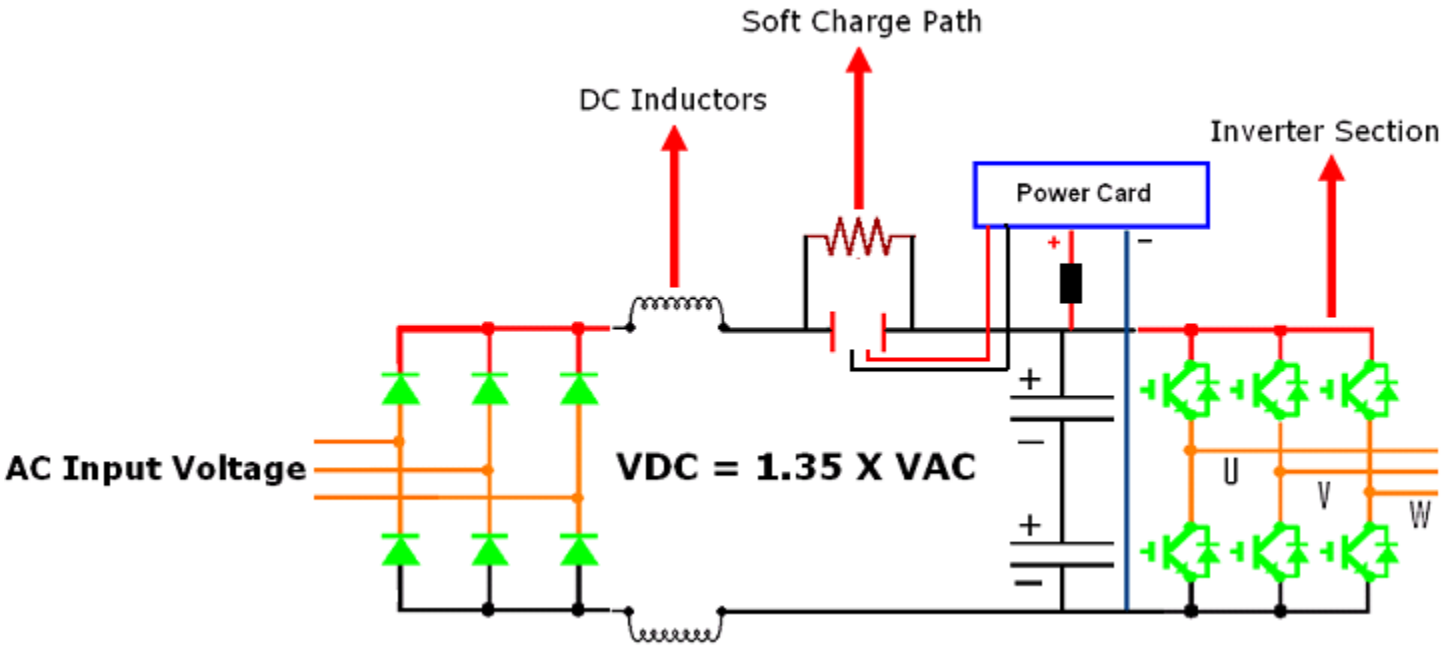
- Assess the situation
- Perform physical inspection
- Narrow down to one section
- Zero in on malfunction

Physical Inspection

- Is the Display Lit?
- Warning or Alarm Message Displayed?
- Programmed Correctly?
- Are there carbon deposits inside?

Physical Inspection

Troubleshooting No Display



Physical Inspection

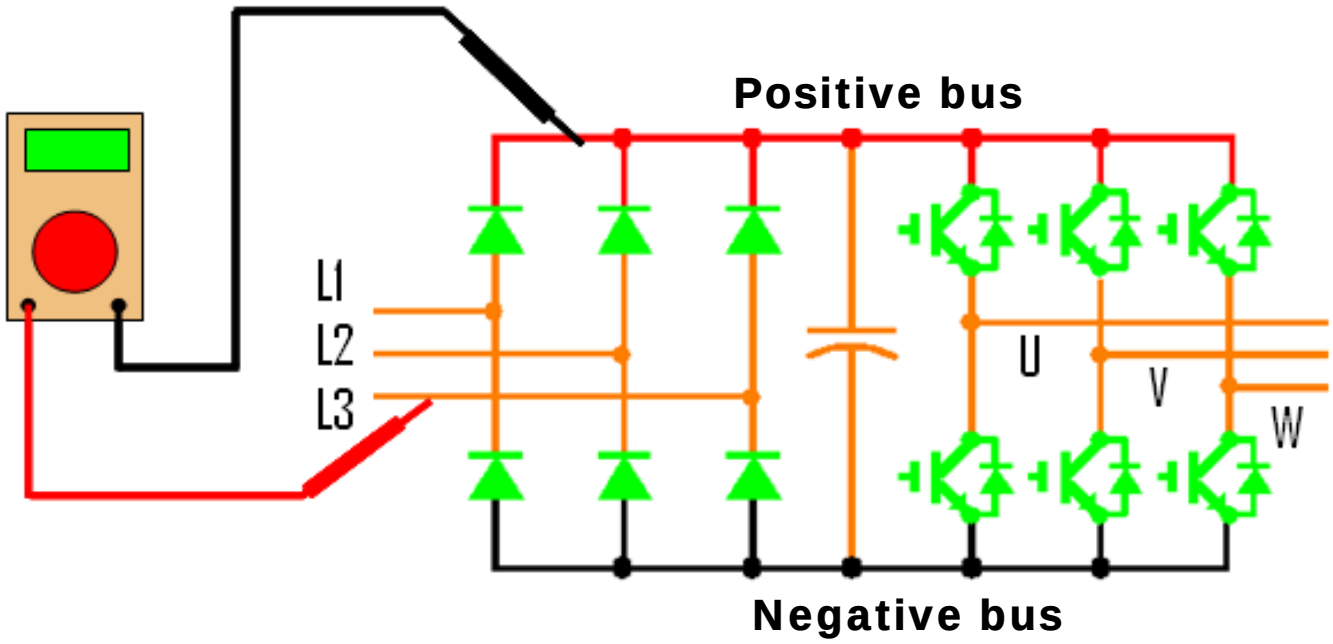
- Unit Installed Correctly?
- Are the connections tight?
- Environmental Conditions OK?

Physical Inspection

- Carbon Deposits Inside Drive?
- Burnt or Damaged Components?
- Blown Fuses?
- NOTE: Do not apply power to test the drive until a Static Test has been performed!!!

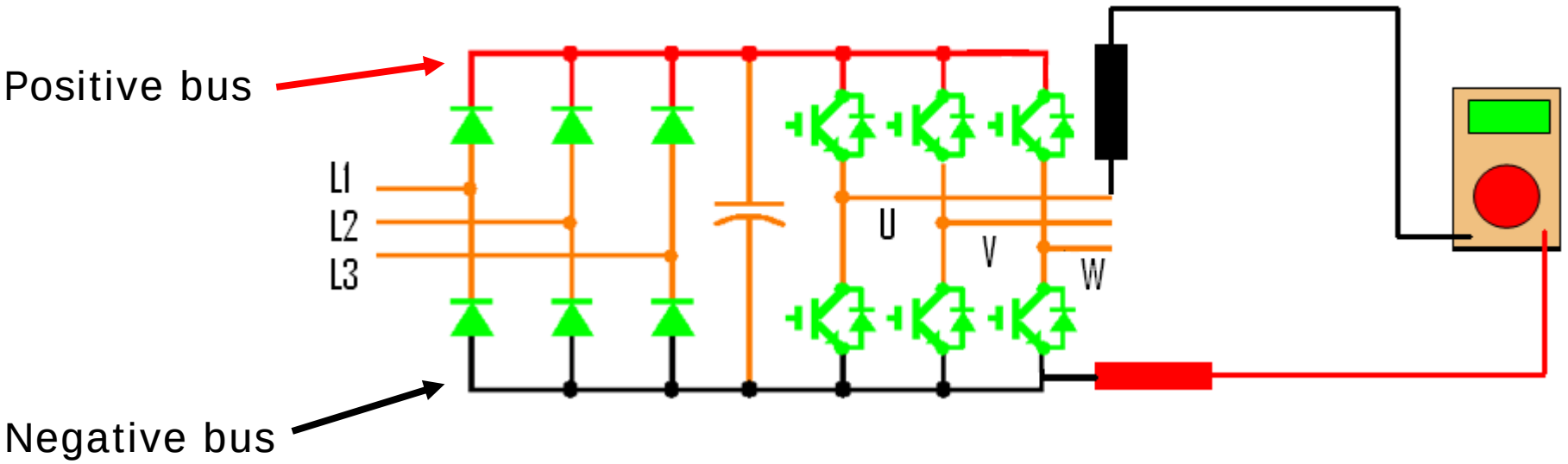
Static Test

- Now change the ohm meter leads and put the negative lead on the + bus
- The positive meter lead is now placed on L1, L2, L3 and then U, V, W
- The meter readings should be with in the range of 0.3 to 0.7 Volts



Static Test

- Place the + meter lead on the – bus
- Place the – meter lead on L1, L2, L3 and then U, V, W
- The meter readings should be with in the range of 0.3 to 0.7 Volts



Ohmmeter Gate Test

Warning! This test is only to be performed when the drive is powered off and fully discharged!

With the Ohmmeter set to the resistance scale, measure between the 2 gate leads for both IGBT's in each module

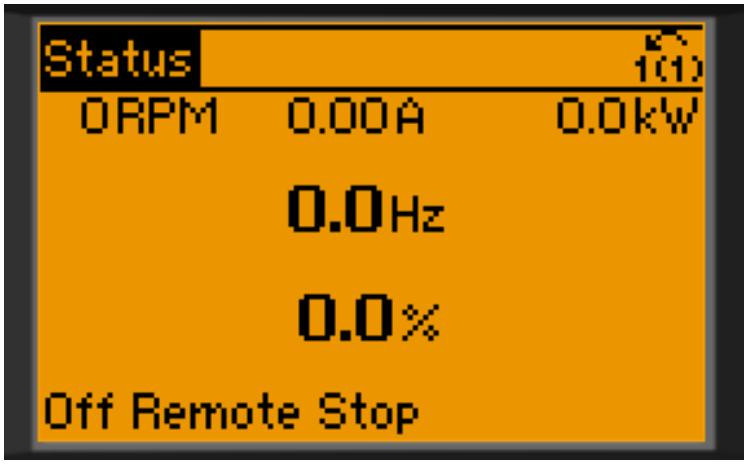
Readings will range from approximately 2k to 8k, look for consistency between readings

Drive Fault Indicators

- Drive fault displays and warnings
- Resetting alarms
- Sample alarms
- Alarm history

Drive fault displays and warnings

- What is the LCP display telling you?
  - Alarms
  - Warnings
  - Status



- If you contact the factory, be sure to note the *exact* wording of the display

Resetting Alarms

- **TRIP**
  (Red LED Flashing) → Press the RESET key to restart

- **TRIPLOCK**
  (Red & Yellow LED's On) → Disconnect power to restart the drive

Warning / Alarm Messages

- **ALARM 9 INVERTER TIME**
  - Ensure drive is sized and programmed correctly
  - Check for bad bearings
- **ALARM 10 MOTOR TIME**
  - Check motor parameters
  - Check Parameter 1-90
  - Check mechanical load
  - This is caused by motor overload conditions.
- **WARNING 59/12 CURRENT LIMIT**

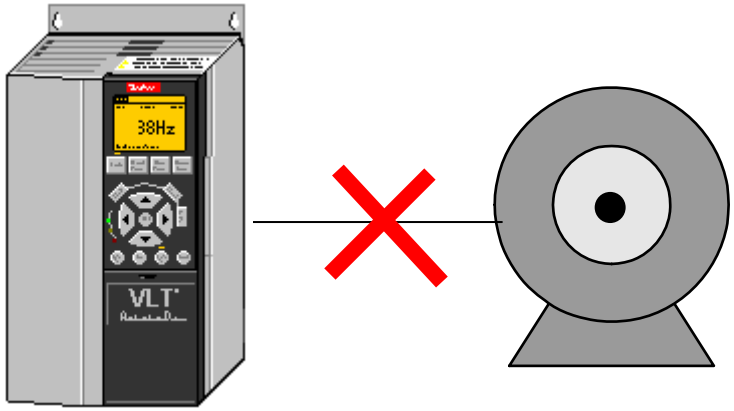
  Torque Limit
  - Check motor parameters
  - Check mechanical load
  - Check Parameter 4-16 - 18

Warning / Alarm Messages

- **ALARM 13**
  OVER CURRENT
  - Drive has exceeded 200% current surge
  - Check application for problems
- **ALARM 14**
  EARTH FAULT
  - There is a short to ground in the motor or the motor wiring
- **ALARM 16**
  CURR. SHORT CIRCUIT
  - There is a line-to-line short circuit in the motor or the motor wiring

Checking Current Sensors

- Disconnect Motor & Run Drive
- Observe Current In Display
- Current Should Be Zero
- >.2 Amp Indicates Defective Current Sensor
- <.2 Amp, Check Motor and Wiring



Warning / Alarm Messages

- **ALARM 29, 65, 66**
  DRIVE OVER TEMP → Is something (like an instruction manual) blocking the air flow?

- **ALARM 30, 31, & 32**
  MISSING MOTOR PHASE U, V, W → Check wiring between the drive and motor. This alarm doesn't show up when the drive is starting

Warning / Alarm Messages

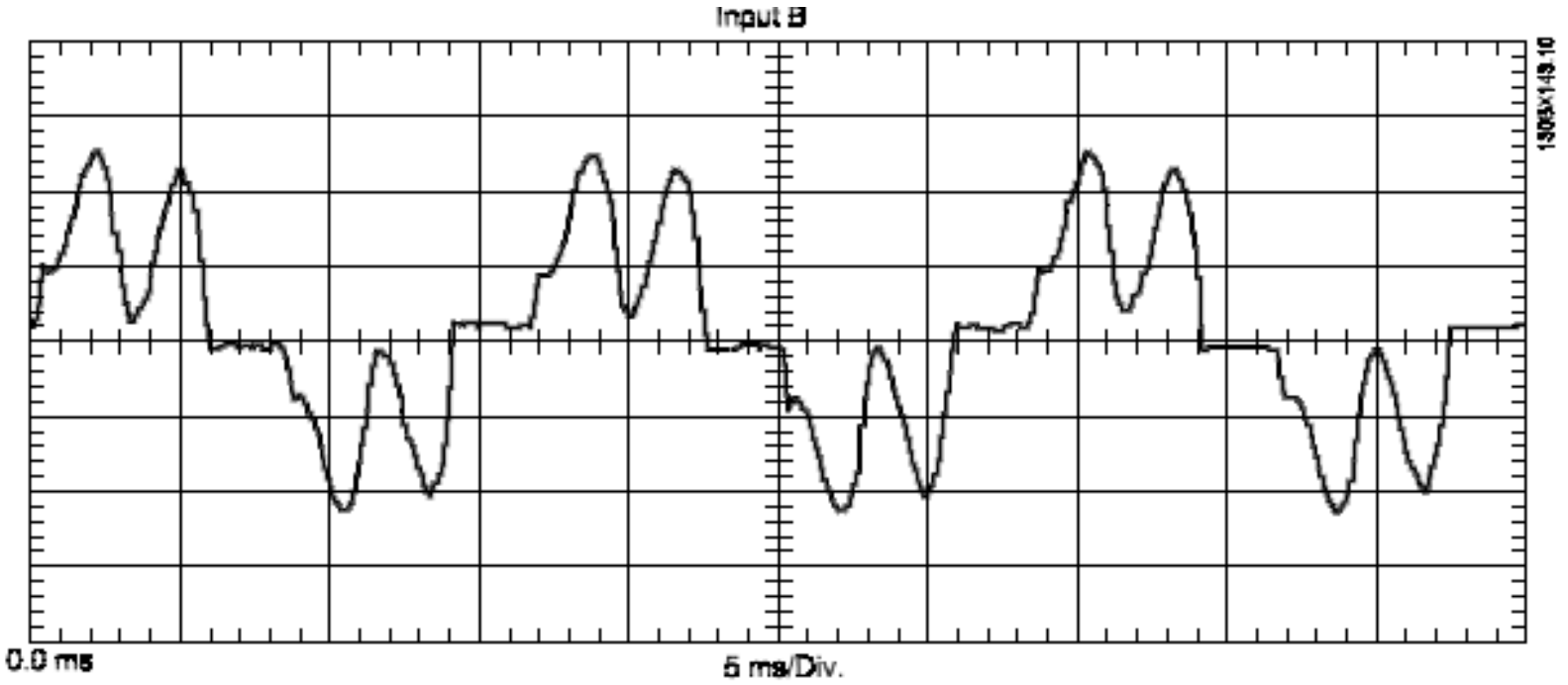
- **ALARM 4**
  MAINS PHASE LOSS

Check for balanced input voltage phase to phase at full speed

Check for balanced input current in each phase

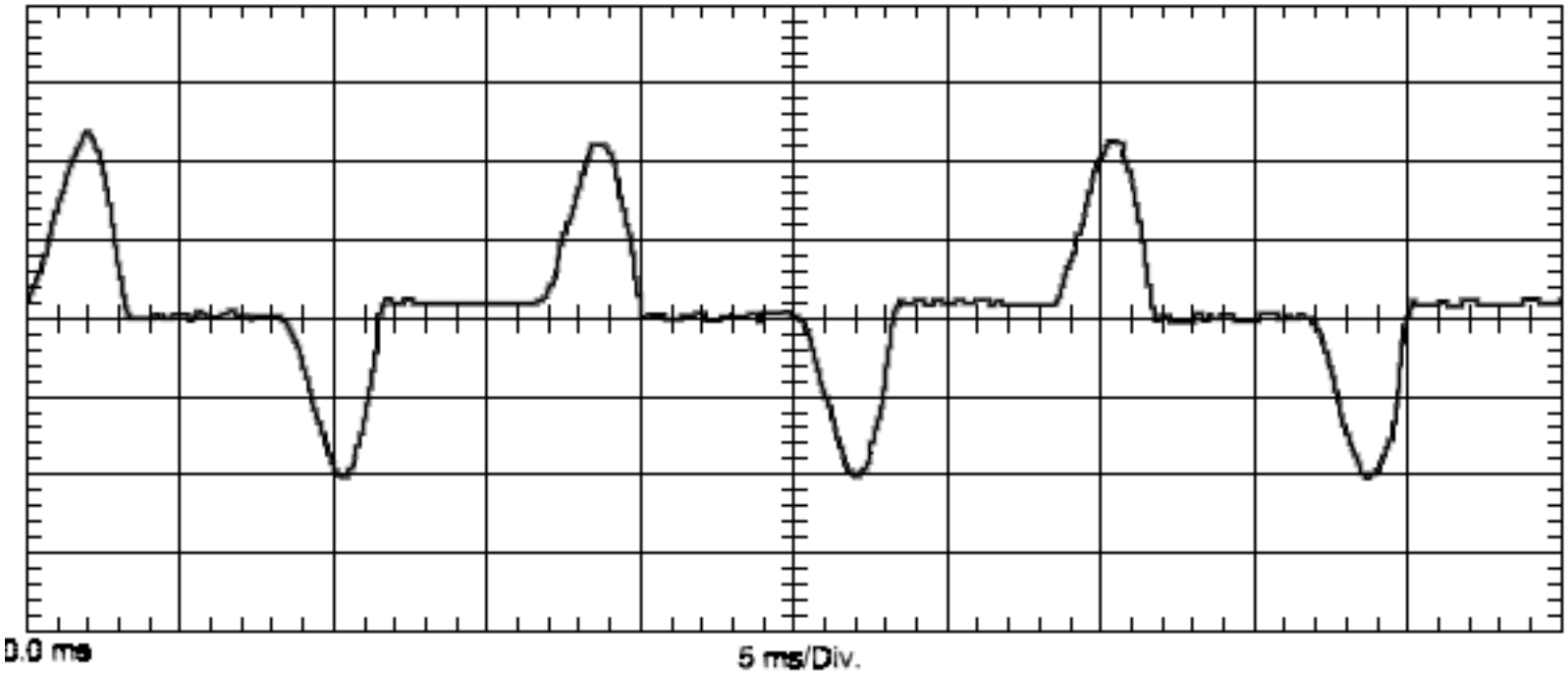
Check for an open phase in the rectifier, powercard gate circuitry or actual SCR gate resistance

Input Current Waveforms



Correct Input Current waveform

Input Current Waveforms



Incorrect input current waveform !

SCR Rectifier Gate Test

Warning! This test is only to be performed when the drive is powered off and fully discharged!

With the Ohmmeter set to the resistance scale, measure between the 2 gate leads of the SCR modules

Readings will range from approximately 10 to 20 ohms, look for consistency between readings

Warning / Alarm Messages

- **Alarm 7 DC Link Overvoltage**

DC Link Voltage is too high

- Regenerative Load
- High input voltage
- Rapid Ramp Down Time

- **Alarm 8 DC Link Undervoltage**

DC Link Voltage is too low

- Power outage
- Failure in the pre-charge circuit
- SCR's are not firing

Checking Bus Capacitors

- Look for swelling
- Look for fluid leakage
- Look for arcing
- Look for loose connections
- Check for abnormal discharge time

Warning / Alarm Messages

- **Warning 1**

  10 V LOW

  10 Volt power supply is being over loaded. Reduce the load (min res 590 ohms)

- **Alarm 15**

  HARDWARE MISMATCH

  Non-compatible Option Installed

Warning / Alarm Messages

- **ALARM 2**

  Live Zero Error → An input 4-20 mA or 2-10 V control signal is missing

- **ALARM 17**
- **Std Bus Timeout**

  → The connection to the serial communication port has been lost

Warning / Alarm Messages

- **ALARM 37**

  Gate Drive Fault

There is a problem with the IGBT gate or the gate drive card. With the DC bus disabled, remove the IGBT gate wires one at a time, start the drive and check for the fault to disappear.

The resistance of the IGBT gates can be measured at the connector. Readings vary from 2.5K to 7.5K. You are looking for consistency between them.

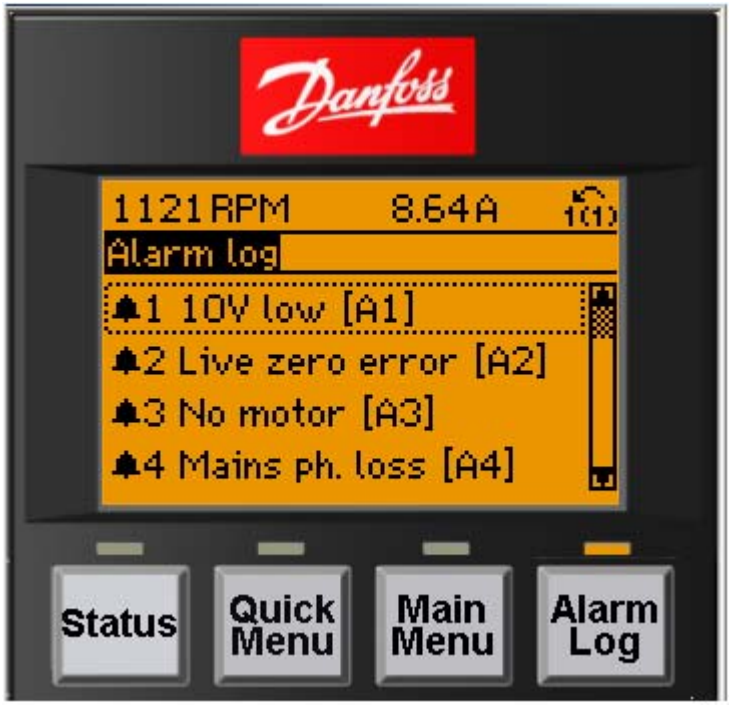
Warning / Alarm Messages

- **ALARM 50 - 58**
  AMA FAILURE → AMA procedure could not be carried out

- **ALARM 80**
  DRIVE INITIALIZED → All parameters in the drive have been reset to their default values.

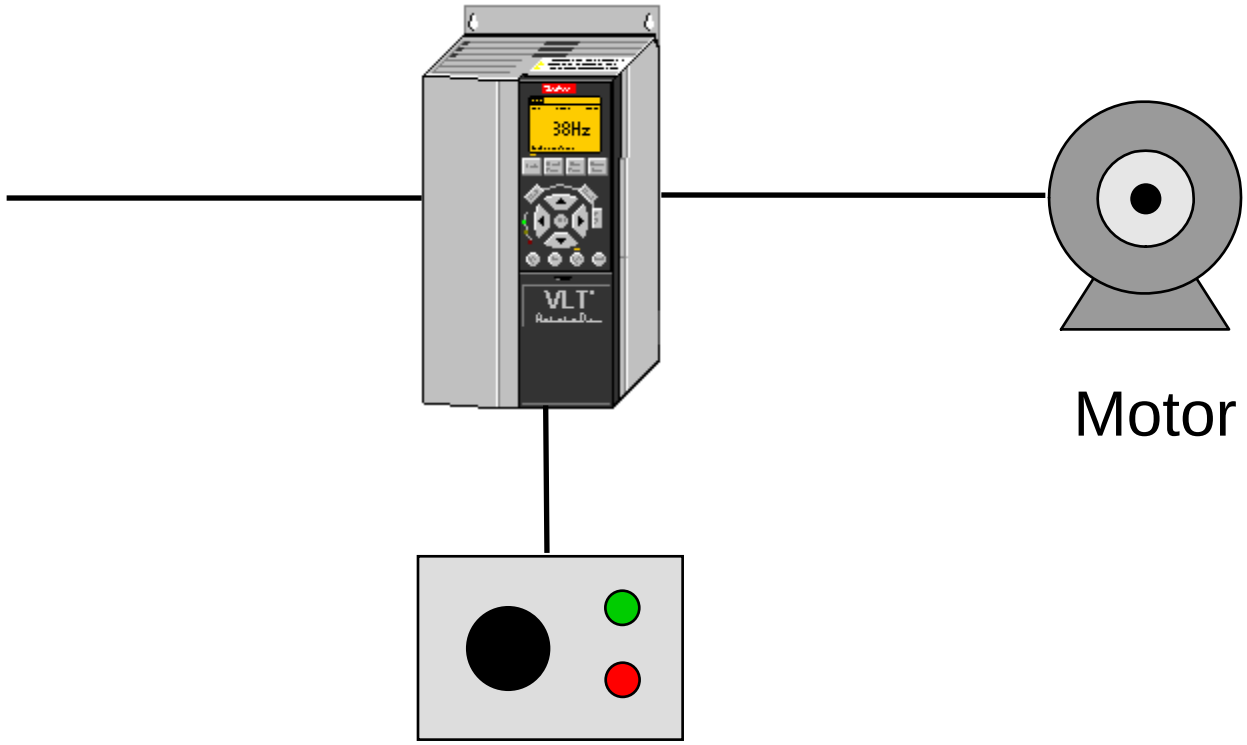
Alarm Log

- Last 10 alarms displayed
- Status info for each alarm
- Graphic displays



DIVIDE AND CONQUER

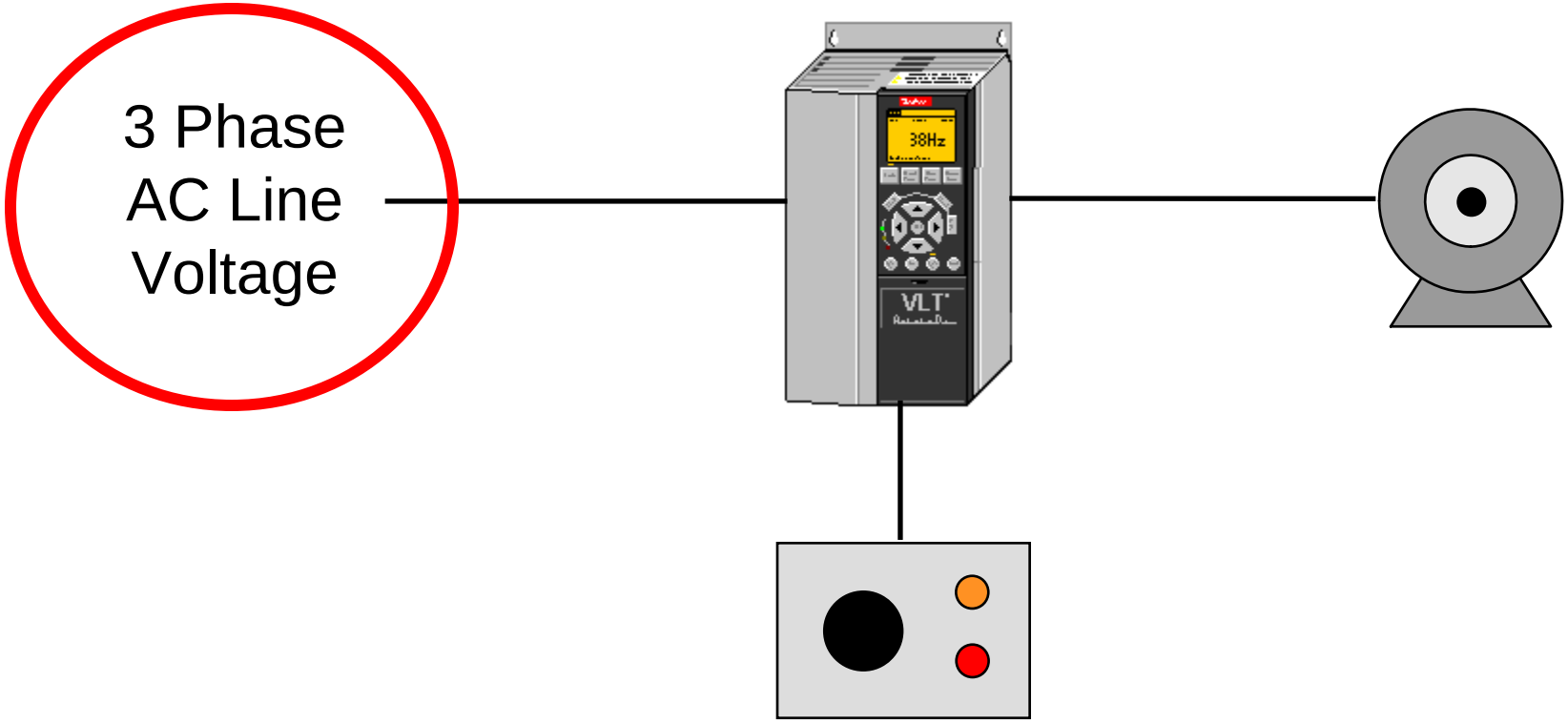
3 Phase
AC Line
Voltage



Motor

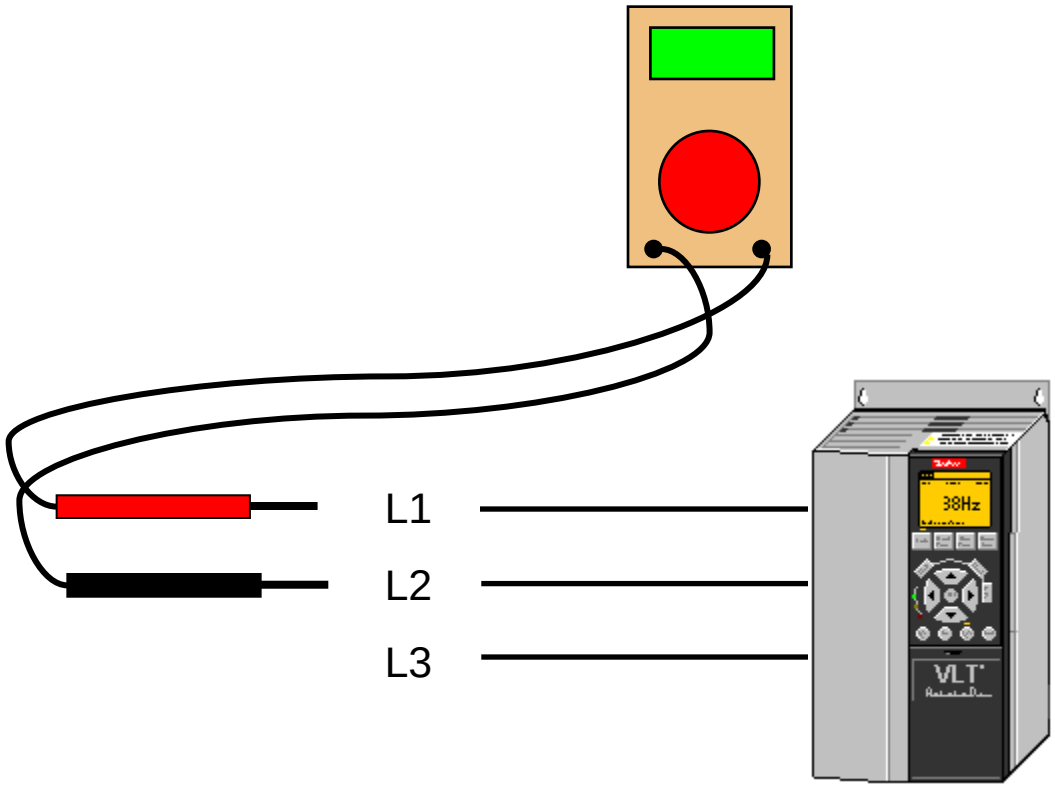
Control Logic

Input Power

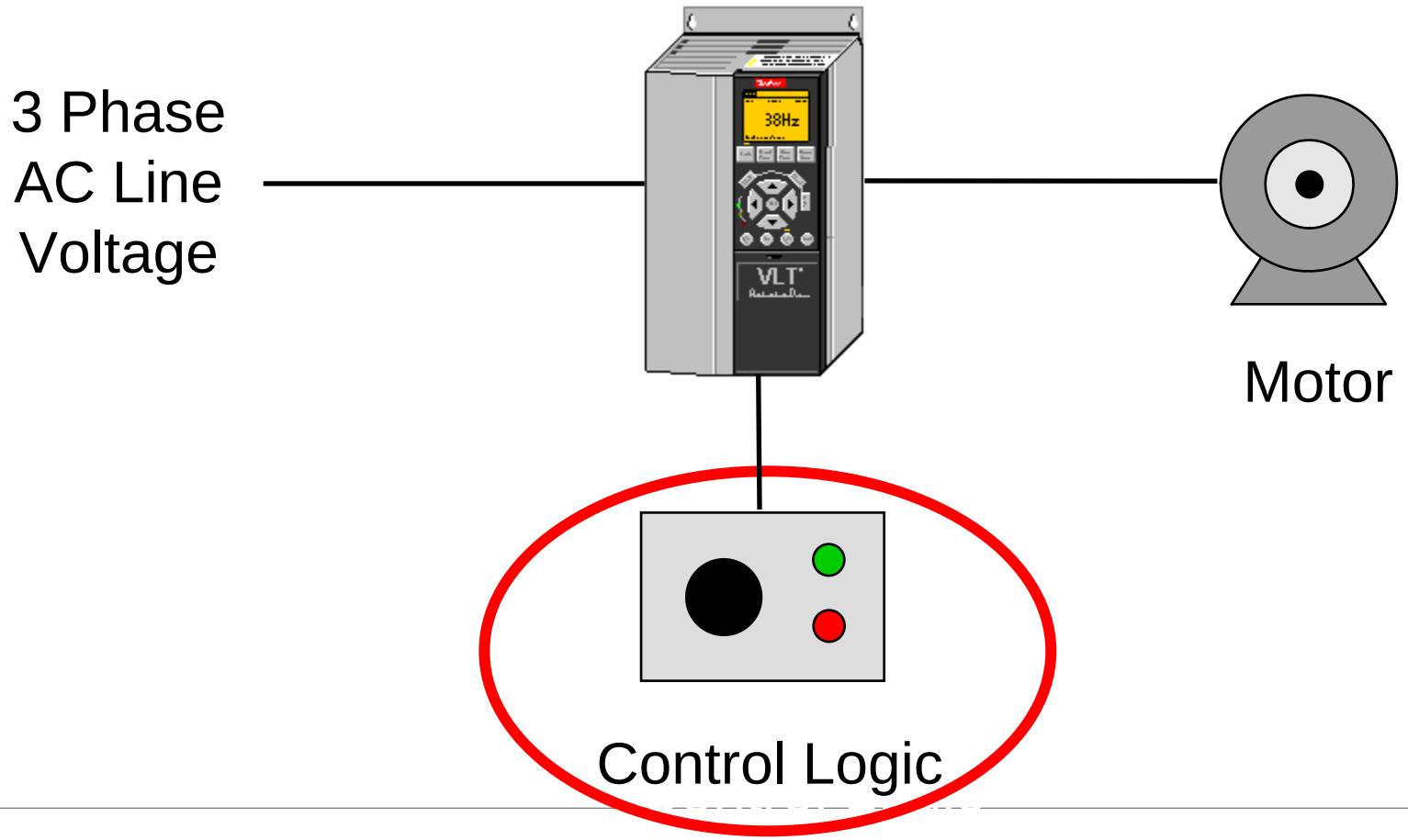


Checking Line Voltage

- Measure Phase to Phase AC Line Voltage
  - L1 - L2
  - L1 - L3
  - L2 - L3



Control Logic



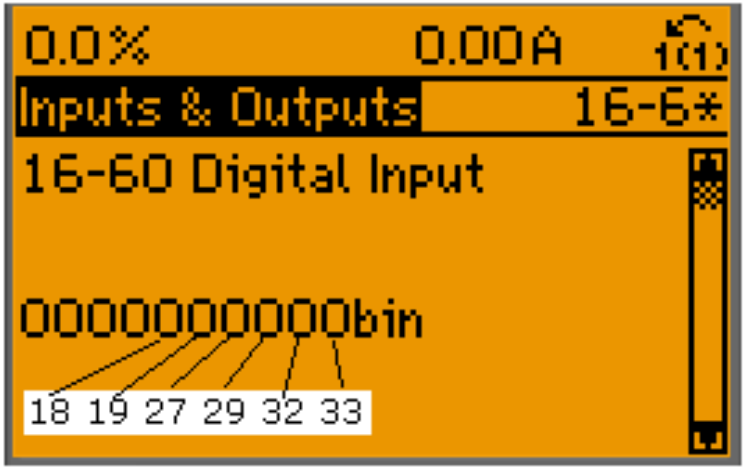
Digital Inputs

- Press up or down arrows or Set Parameter 0-23 to Display Digital Inputs

- Binary # Corresponds to Digital Inputs

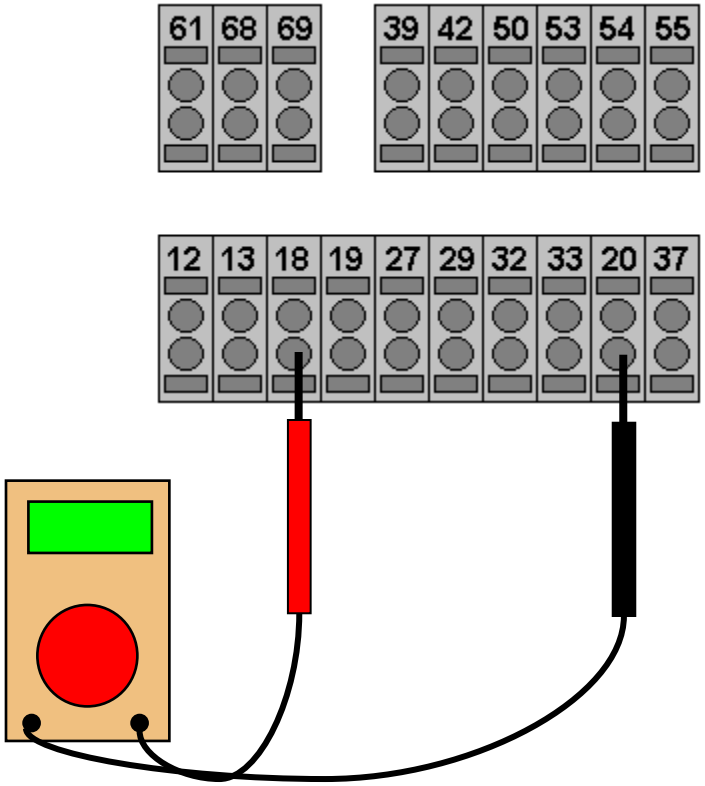
  MSB = Term. 18

  LSB = Term. 33



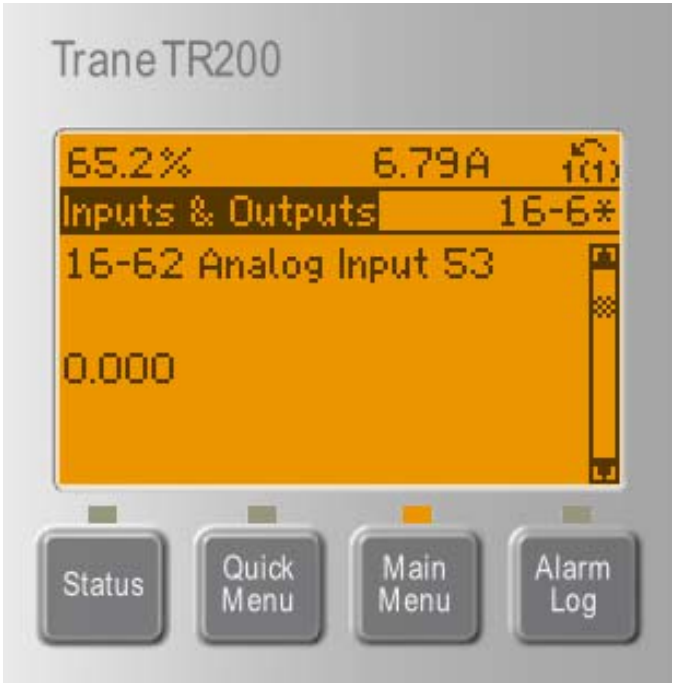
Digital Inputs

- If Input State is not Displayed Correctly, Measure Voltage at Terminal.
- Reference Meter on Terminal 20.
- Digital Inputs Must be 10-28VDC to be High (Logic 1)



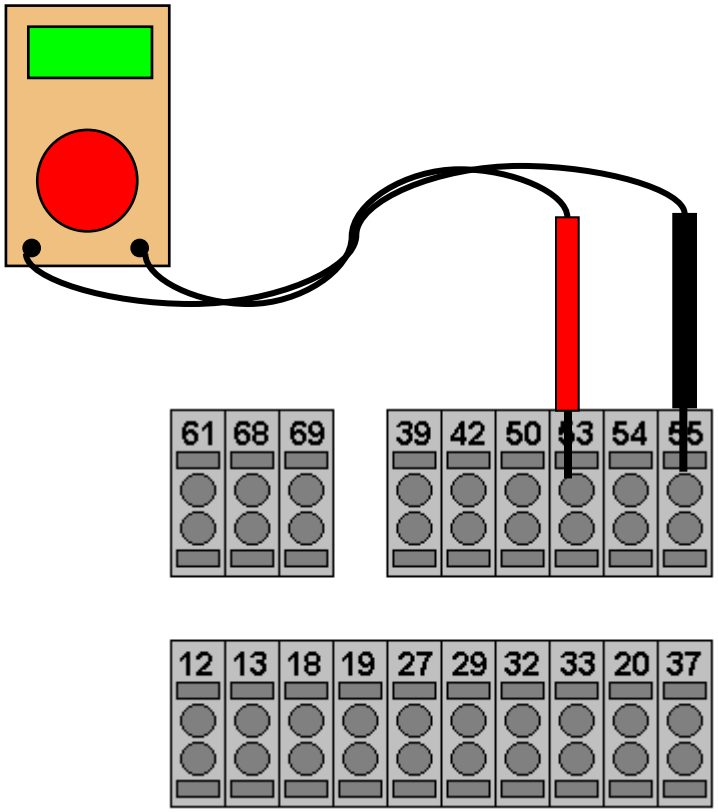
Analog Inputs

- The Same Procedure can be Used to Check Analog Inputs

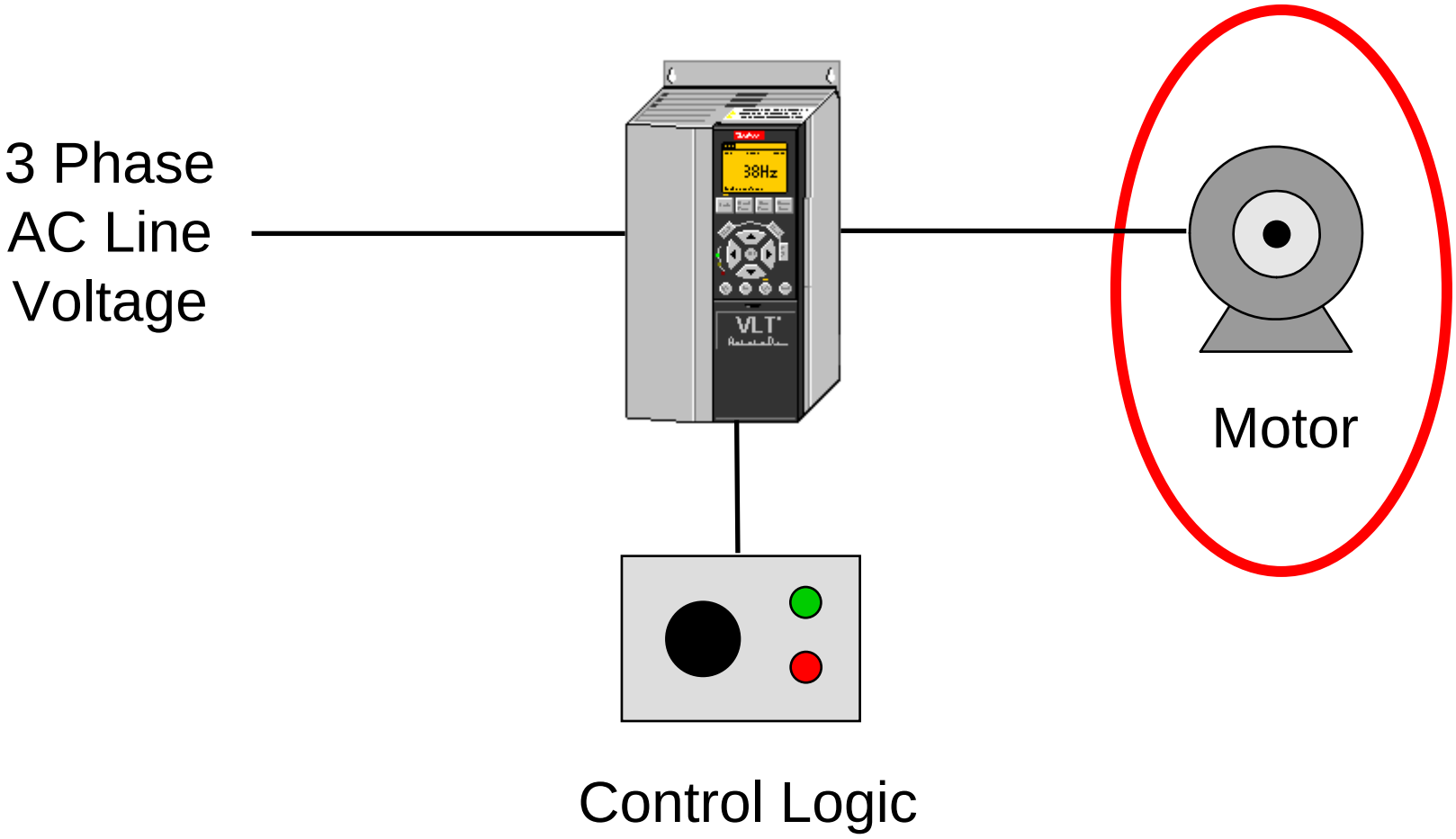


Analog Inputs

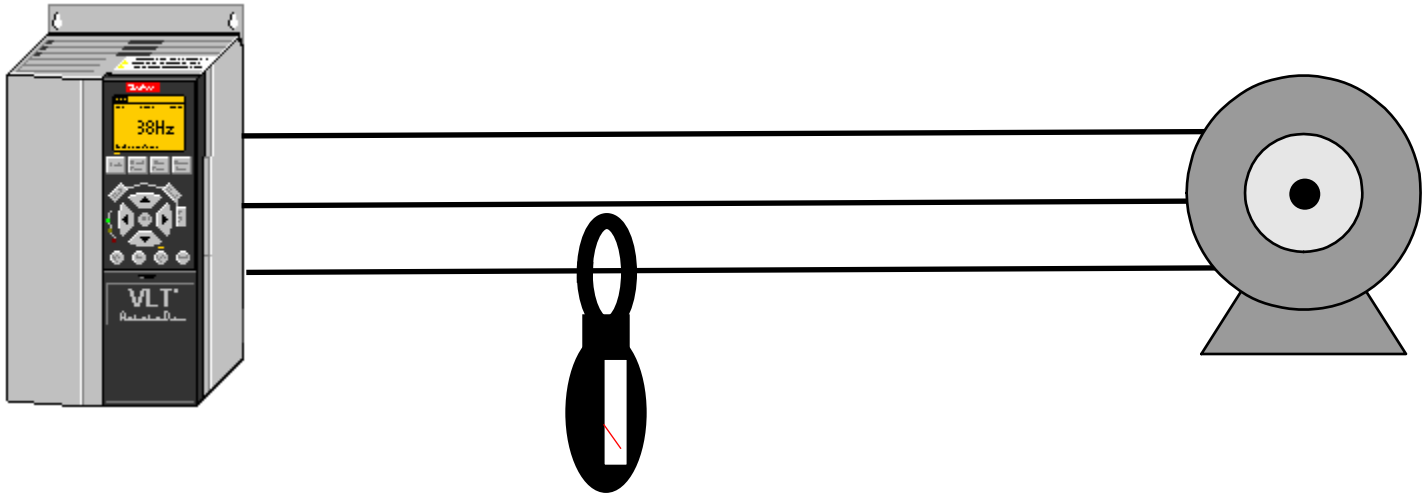
- Reference Meter (-) to Term. 55
- positive Lead to Term. 53 or 54
- For Voltage 0-10VDC
- For Current Put Meter In Series
- Observe Polarity



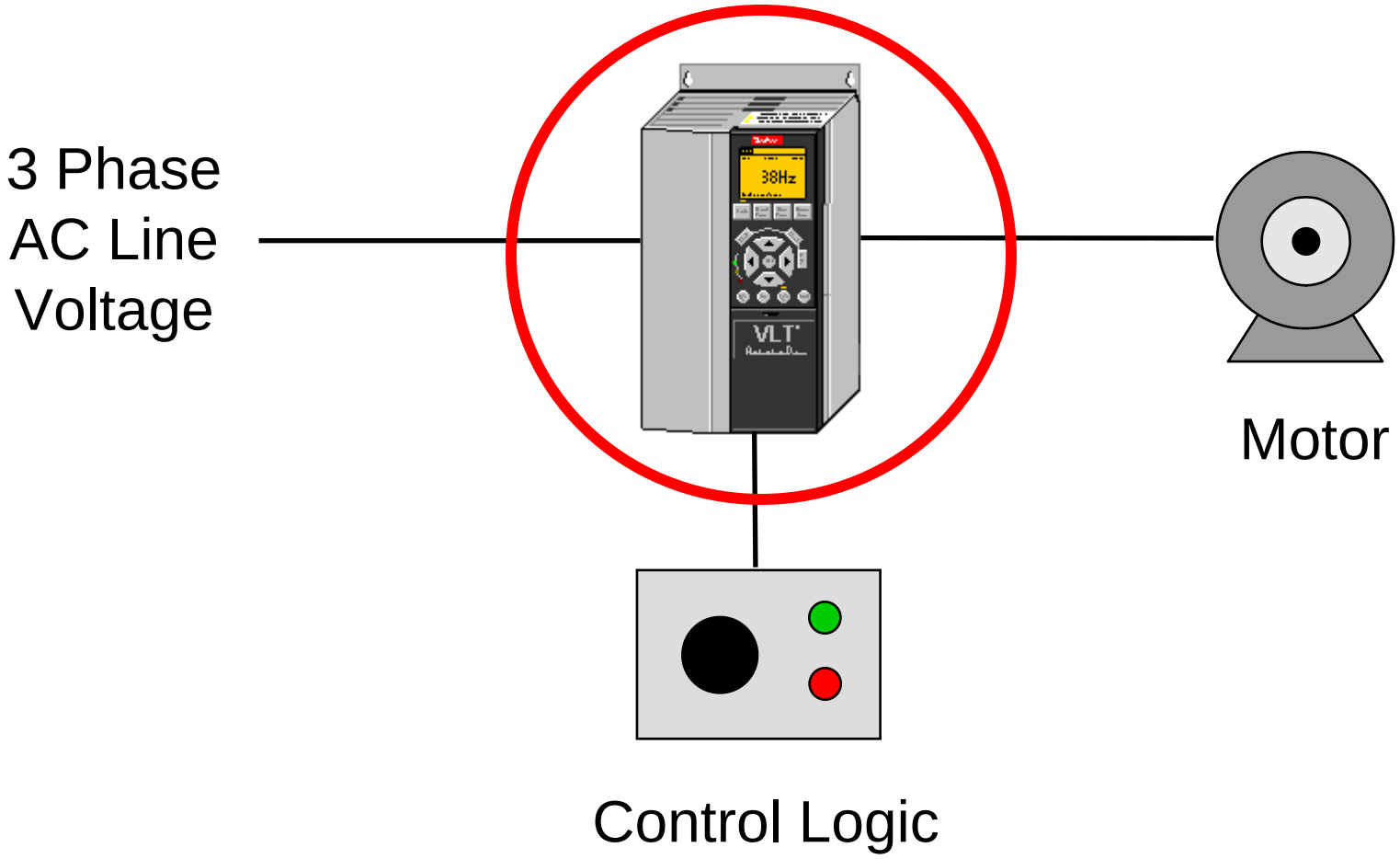
Output Circuit



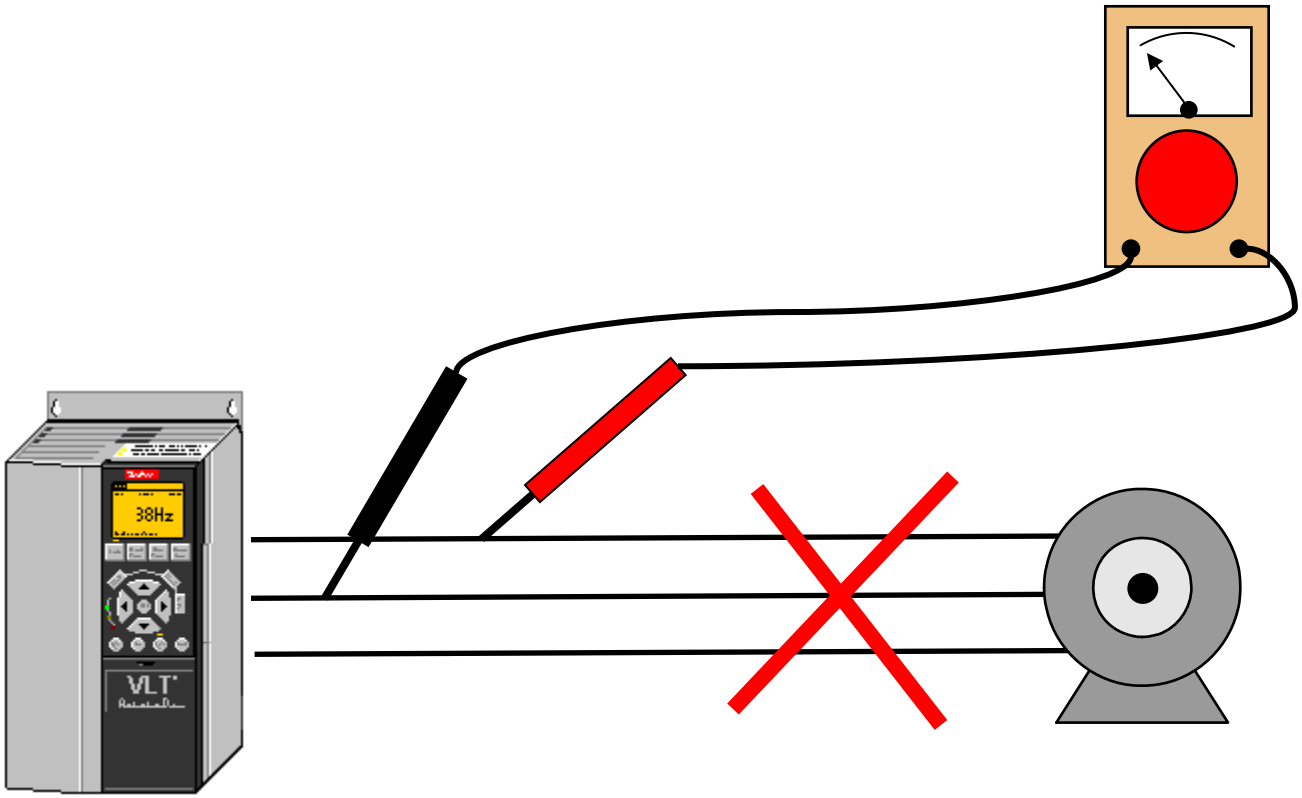
Measuring Output Current



Frequency Drive



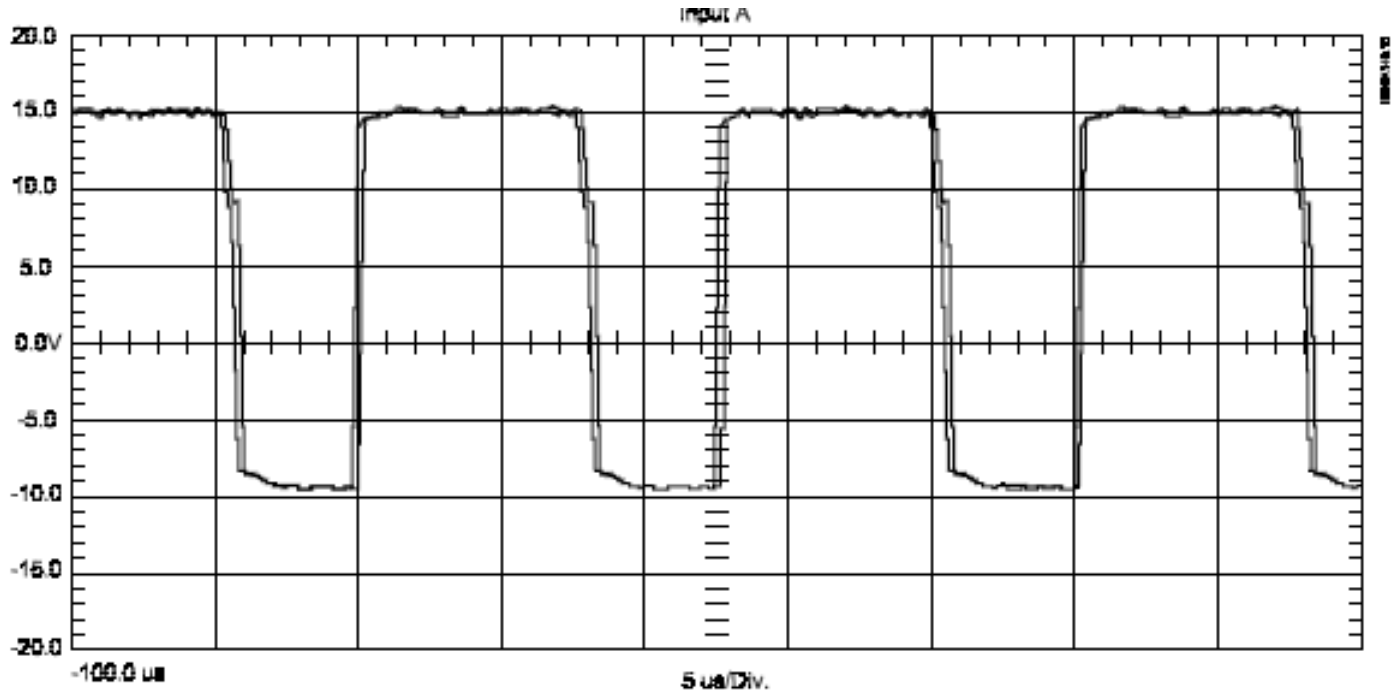
Measuring Output Voltage

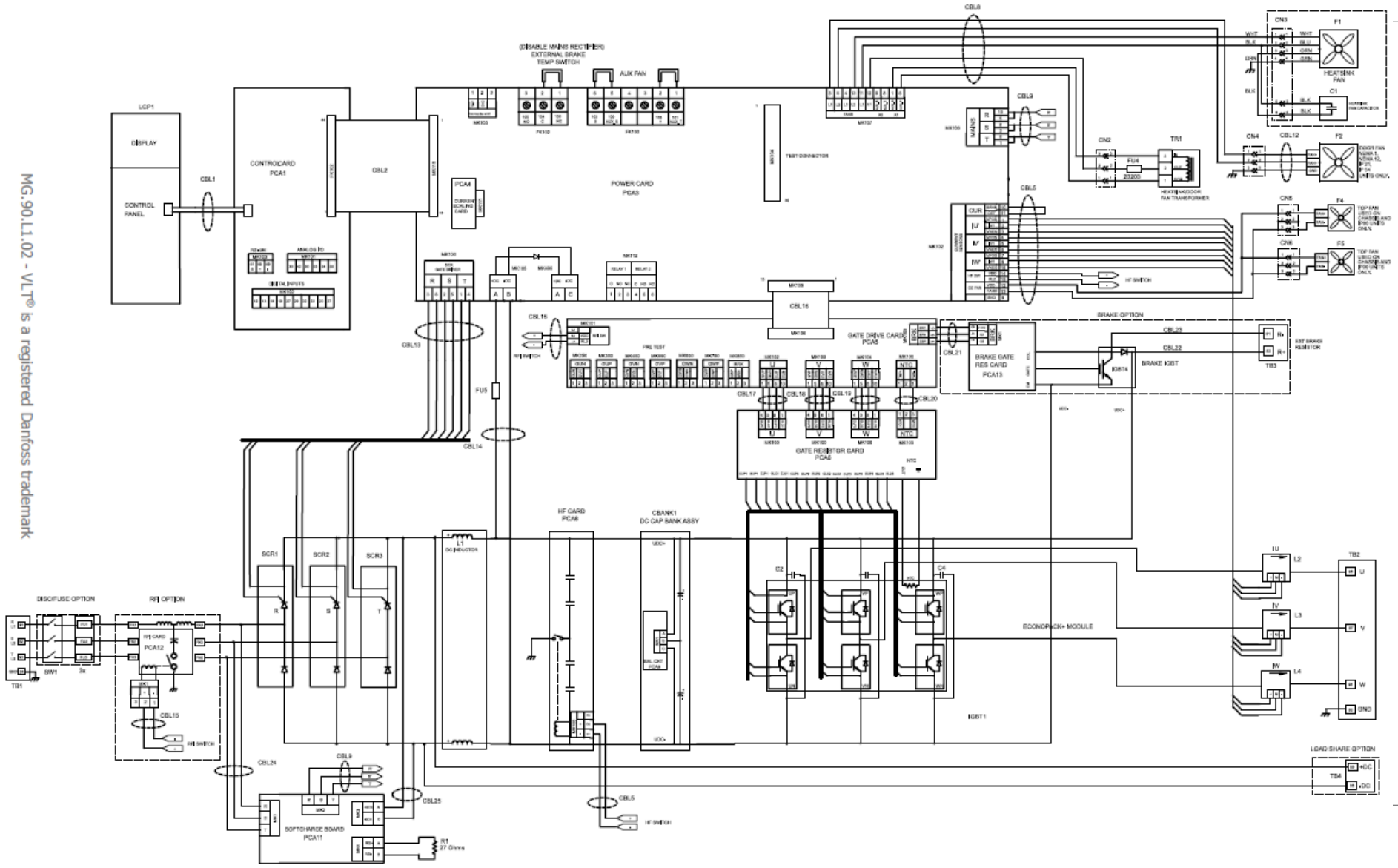


Drive or Motor?

- Voltage is Balanced But Current is not
  - Drive is Good
  - Problem in Motor or Wiring
- Voltage is Unbalanced
  - Drive is Bad
  - Not all IGBT's Switching Correctly.
  - Check Gate Signals & IGBT Gates

IGBT Gate Signals





Inspect For	Description
Auxiliary equipment	Look for auxiliary equipment, switches, disconnects, or input fuses/circuit breakers that may reside on input power side of drive or output side to motor. Examine operation and condition of these items as possible causes for operational faults. Check function and installation of pressure sensors or encoders (etc.) used for feedback to drive.
Cable routing	Avoid routing motor wiring, AC line wiring, and signal wiring in parallel. If parallel routing is unavoidable, try to maintain a separation of 6 - 8 inches (150 – 200 mm) between the cables or separate them with a grounded conductive partition. Avoid routing cables through free air.
Control wiring	Check for broken or damaged wires and connections. Check the voltage source of the signals. Though not always necessary depending on the installation conditions, the use of shielded cable or a twisted pair is recommended. Ensure the shield is terminated correctly. Refer to the section on grounding shielded cables in Section 2.
Drive cooling	Check operational status of all cooling fans. Check door filters on NEMA 12 (IP54) units. Check for blockage or constrained air passages. Verify bottom gland plate is installed.
Drive display	Warnings, alarms, drive status, fault history and many other important items are available through the display on the local control panel of drive.
Drive interior	Drive interior must be free of dirt, metal chips, moisture, and corrosion. Check for burnt or damaged power components or carbon deposits that were the result of a catastrophic component failure. Check for cracks or breaks in the housings of power semiconductors, or pieces of broken component housings loose inside the unit.
EMC considerations	Check for proper installation with regard to electromagnetic capability. Refer to the drive instruction manual and Section 5 of this manual for further details.
Environmental conditions	Under specific conditions these units can be operated within a maximum ambient of 50°C (122°F). Humidity levels must be less than 95% noncondensing. Check for harmful airborne contaminates such as sulfur based compounds.
Grounding	The drive requires a dedicated ground wire from its chassis to the building ground. It is also suggested that the motor be grounded to the drive chassis as well. The use of conduit or mounting of the drive to a metal surface is not considered a suitable ground. Check for good ground connections that are tight and free of oxidation.
Input power wiring	Check for loose connections. Check for proper fusing. Check for blown fuses.
Motor	Check nameplate ratings of motor. Ensure that motor ratings coincide with drives. Check that drive's motor parameters (1-20 – 1-25) are set according to motor ratings.
Output to motor wiring	Check for loose connections. Check for switching components in output circuit. Check for faulty contacts in switch gear.
Programming	Check that drive parameter settings are correct according to motor, application, and I/O configuration.
Proper clearance	These drives require top and bottom clearance adequate to ensure proper air flow for cooling in accordance with the drive size. Drives with exposed heat sinks out the back of the drive must be mounted on a flat solid surface.
Vibration	Though somewhat subjective look for an unusual amount of vibration that the drive may be subjected to. The drive should be mounted solidly or the use of shock mounts employed.

Before Calling the Factory, Be Able to:

Describe the drive

- Serial number
- MATERIAL # 178B0300 (PLUS)
- SERIAL # 805016H336 (*all* of it!)
- Model number (FC302)
- SOFTWARE VERSION (Parameter 15-43)
- Does the drive have bypass?

Describe The Problem

- Describe the problem
- *Exactly* what does the LCP show?
- What does (or doesn't) happen?
- When does the problem occur?
- What time of day?
- What is the drive doing at the time?
- What else is happening at the same time?
- What have you tried?
- Describe the job site

Service Center Repair

- Authorized Danfoss service centres can repair the drive
- The problem might be non-warranty
- Get a purchase order

This concludes this training module

If you have any comments or questions, please contact:

- **TRANE Technical Support**