



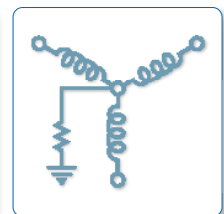
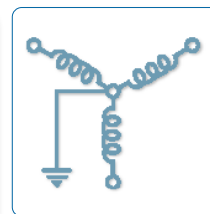
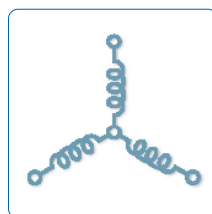
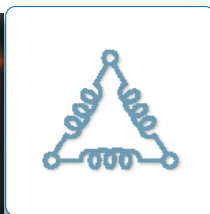
Unparalleled Protection



i-AVT Plus

A two-in-one voltage safety solution

Installation & Operation Manual



ABOUT I-GARD

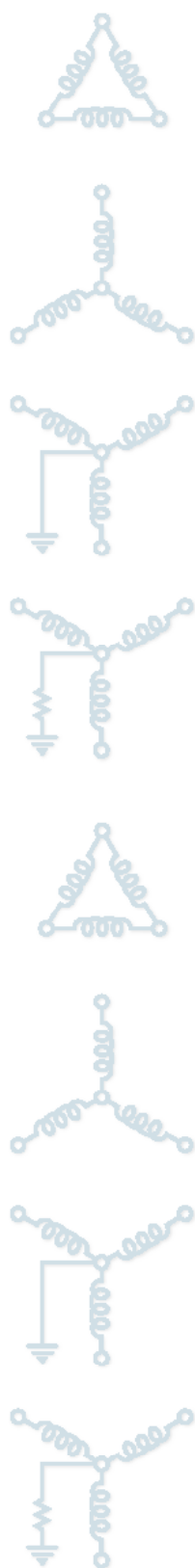
I-Gard's commitment to electrical safety provides both industrial and commercial customers with the products needed to protect their electrical equipment and the people that operate them.

As the only electrical-safety focused company whose product portfolio includes neutral grounding resistors, high-resistance grounding systems and optical arc mitigation, we take pride in our technologies that reduce the frequency and impact of electrical hazards, such as arc flash and ground faults.

For those customers who have purchased from us over the last 30 years, you know us for the quality and robustness of our products, our focus on customer service and technical leadership. We build on this foundation by investing in developing new products in electrical safety education by actively participating in the IEEE community programs on technical and electrical safety standard, and working with local universities at discovering new technologies. We remain unrelenting in our goal of improving electrical safety in the workplace.

Our commitment to excellence is validated by long-standing relationships with industry leaders in fields as diverse as petroleum and gas, hospitals, automotive, data centers, food processing, aerospace, water and waste water plants, and telecommunications. We provide our customers with the product and application support required to ensure that their electrical distribution system is safe and reliable.

TABLE OF CONTENTS



1. GENERAL INFORMATION	2
1.1 INTRODUCTION	2
1.2 SAFETY NOTES	2
2. PRODUCT DESCRIPTION	3
2.1 COMPONENTS	3
2.2 TECHNICAL SPECIFICATION	3
2.3 CONFORMITY OF STANDARDS	4
3. INSTALLATION INSTRUCTIONS	5
3.1 MOUNTING I-AVT PLUS	5
3.1.1 DISPLAY UNIT INSTALLATION	6
3.1.2 CONTROL UNIT INSTALLATION	6
3.1.3 VTI PHASE WIRE CONNECTIONS	6
3.1.4 I-AVT-R SENSOR LEAD CONNECTIONS.	6
3.1.5 KNOWN VOLTAGE SOURCE CONNECTION	6
3.1.6 SYSTEM ENERGIZATION	6
3.2 CONNECTIONS	7
4. OPERATION INSTRUCTIONS VTI	8
4.1 VISUAL CHECK AND LED INDICATIONS	8
4.2 VOLTAGE MEASUREMENT AND TROUBLESHOOTING	8
5. OPERATION INSTRUCTIONS I-AVT-R	9
5.1 INITIAL SET-UP	9
5.2 VOLTAGE PRESENCE INDICATORS	9
5.3 PERFORMING AN ABSENCE OF VOLTAGE TEST	9
5.4 VISUAL CHECK AND LED INDICATIONS	10
5.5 TEST SEQUENCE	10

1. GENERAL INFORMATION

This manual is intended for installation and maintenance of the i-AVT Plus. Carefully read and make sure that you understand all instructions before you mount, connect, and configure the i-AVT Plus.

The manual is available on:

<https://i-gard.com>

1.1 INTRODUCTION

The i-AVT Plus combines the functionality of a Voltage Test Portal (VTi), which indicates the presence of hazardous voltage and serves as a reliable tool for measuring voltage and troubleshooting electrical issues on energized systems. Using high-impedance test points, the VTi enables voltage measurements through the panel door without the need to open it. Additionally, the i-AVT Plus includes an approved Absence of Voltage Tester (i-AVT-R) for safely verifying that systems are de-energized and free from hazardous voltage before maintenance or repairs.

For enhanced safety, **NFPA 70E Annex O.2.4 (13)** recommends installing high-impedance protected test points, enabling voltage measurement through the door to reduce risks associated with arc flash and electric shock.

Additionally, **CSA Z462 (Clause 4.2.5)** and **NFPA 70E (Section 120.6)** emphasize using adequately rated, permanently mounted absence of voltage testers to confirm the absence of voltage at the work location.

1.2 SAFETY NOTES

In this user manual, these symbols are used:



WARNING

General warning symbol indicates the presence of a hazard which could result in personal injury and damage to equipment or property.



WARNING

Warning symbol indicated the presence of hazardous voltage which could result in personal injury.



WARNING

Approved personnel are allowed to install and make the electrical connection of the Softstarter in accordance with existing laws and regulations.



INFORMATION

Information sign tells the reader important facts and conditions.

2. PRODUCT DESCRIPTION

2.1 COMPONENTS

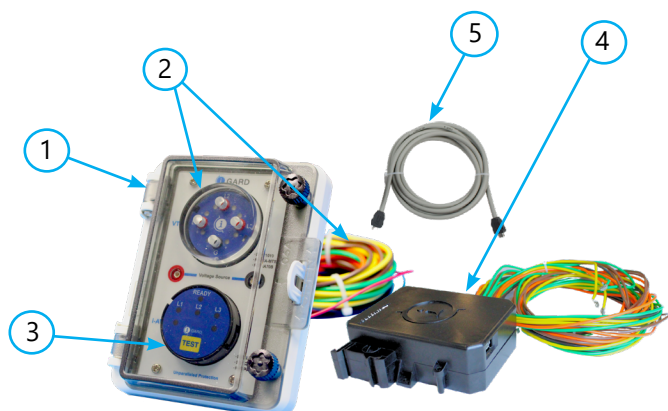


Figure 2.1: i-AVT Plus Components

1. i-AVT Plus Display Unit
2. VTi with Lead Connections (4 wires) 8 Ft. length.
3. i-AVT-R Display Unit
4. Control Unit with lead connections (8 wires) 8 Ft length.
5. IX Cable.

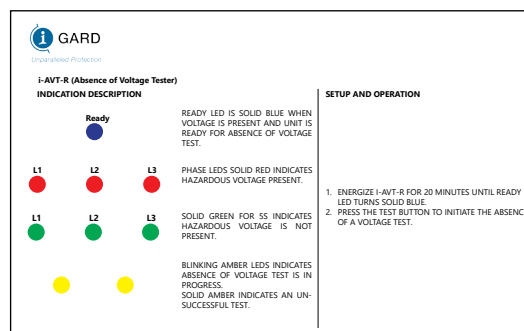


Figure 2.2: i-AVT-R Label

2.2 TECHNICAL SPECIFICATION

	VTi	I-AVT-R
Operational AC Voltage Range	Voltage indicator: 80-1000 VAC, 50/60 Hz Test point: 0-1000 VAC VDC	80-600 VAC, 50/60 Hz
Operational Temperature Range	-20°C to +55°C	
Storage Temperature Range	-40°C to +85°C	
Wire Specifications	4 wire, 18 AWG, 8 Ft., PVC Insulated	4 Pair of wires, 18 AWG, 8 Ft., PVC Insulated
Indication LEDs	(8) Flashing indicator LEDs	(6) Flashing indicator LEDs
Internal Resistance	130 k Ω (Internal impedance protection affects voltage reading $\pm 3.6\%$)	-
Voltage category rating	CAT III @1000V AC, CAT IV @600V AC	-
Absence of Voltage Threshold	-	3 V AC/DC
Safety Integrity Levels	-	SIL3
Enclosures IP Rating	IP67	
Known Voltage Source test point	3.3 V DC	
Altitude of working	2000m	
Country of Origin	Canada	

2.3 CONFORMITY OF STANDARDS

UL 508	(Applicable to Voltage Indicator). Industrial Control Equipment
CSA C22.2 No. 14-13	(Applicable to Voltage Indicator). Industrial Control Equipment CAT IV 600V
UL 61010	(Applicable to Voltage Indicator). Safety Requirements for electrical equipment for measurement, control and laboratory use - Part 1: General Requirements.
UL 61010-2-030	(Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for equipment having testing or measuring circuits)
EN 50581:2012	(Applicable to Voltage Test Station). Technical documentation for the assessment of electric and electronic products with respect to the Restriction of Hazardous Substances
UL 1436	Standard For Outlet Circuit Testers And Similar Indicating Devices
CSA C22.2#160	Voltage and Polarity Testers
IEC 61326-3-1	Electrical Equipment For Measurement, Control And Laboratory Use - EMC Requirements - Part 3-1: Immunity Requirements For Safety-Related Systems And For Equipment Intended To Perform Safety-Related Functions (Functional Safety) - General Industrial Applications
FCC 47CFR 15: 2013 Subpart B Class A	Radio Frequency Devices. Subpart B Unintentional Radiators
CISPR 16	Specification For Radio Disturbance And Immunity Measuring Apparatus And Methods. Radiated Emission Test. AC Mains Conducted Emissions Test
IEC 61000-4-2	Test Standard for Electrostatic Discharge (ESD) Immunity
IEC 61000-4-3	Electromagnetic Compatibility (EMC) - Part 4-3 : Testing and Measurement Techniques - Radiated, Radio-Frequency, Electromagnetic Field Immunity Test
IEC 61000-4-4	Electromagnetic Compatibility (EMC) - Part 4-4: Testing and Measurement Techniques - Electrical Fast Transient/Burst Immunity Test
IEC 61000-4-5	Electromagnetic Compatibility (EMC)- Part 4-5: Testing and Measurement Techniques - Surge Immunity Test
IEC 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and Measurement Techniques - Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields
IEC 61000-4-11	Electromagnetic compatibility (EMC) - Part 4-11: Testing and Measurement Technique - Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests for Equipment with input current up to 16 A per phase
UL 746C	Standard For Polymeric Materials - Use In Electrical Equipment Evaluations
IEC 61508-01 SIL 3	Standard for Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems – Part 1: General Requirements Safety Integrity Level 3- SIL 3

3. INSTALLATION INSTRUCTIONS

This chapter provides instructions on the mounting and electrical connections that must be completed before the i-AVT Plus can be used.



WARNING

Mounting and electrical connection of the units must be made by authorized personnel and in accordance with existing laws and regulations



WARNING

Make sure that supply voltage is switched off before mounting and connecting the i-AVT Plus



WARNING

Always follow safety and lockout/tagout procedures when working on or near electrical systems and equipment.



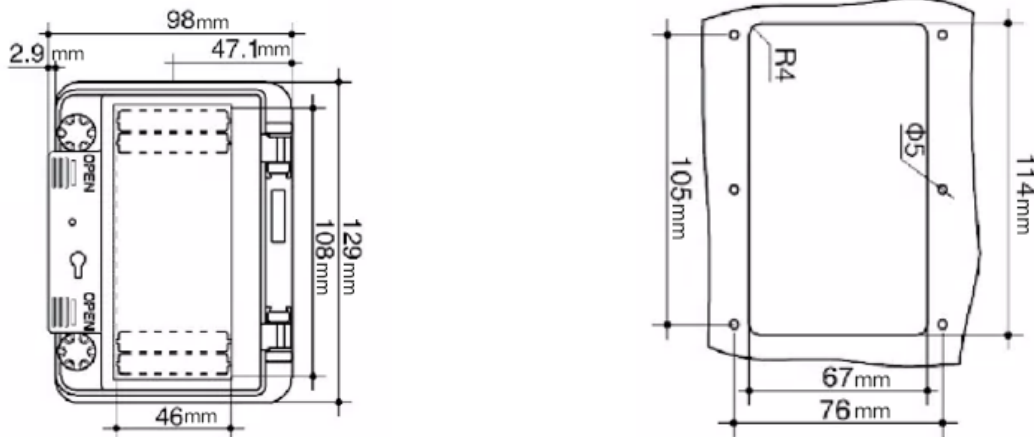
WARNING

If this product is used in a manner not herein prescribed, the protection provided may be impaired.

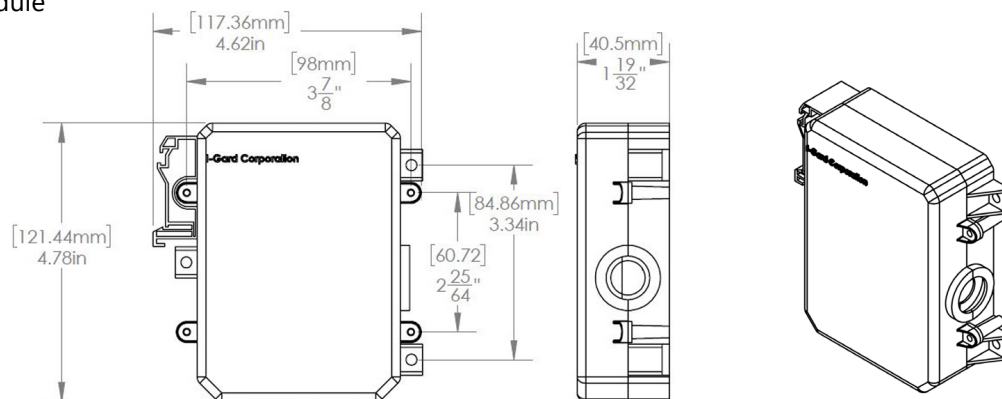
3.1 MOUNTING i-AVT Plus

Dimensions

Display Module



Control Module



3.1.1 DISPLAY UNIT INSTALLATION

1. Identify and cut a hole for the Display Unit on the exterior of an enclosure cover, following the specified dimensions as shown in fig 3.1.1
2. Fix the Display Unit through the cutout, ensuring the washer is placed between the Display Unit and the enclosure cover.
3. Secure the Display Unit to the panel using the six screws provided.

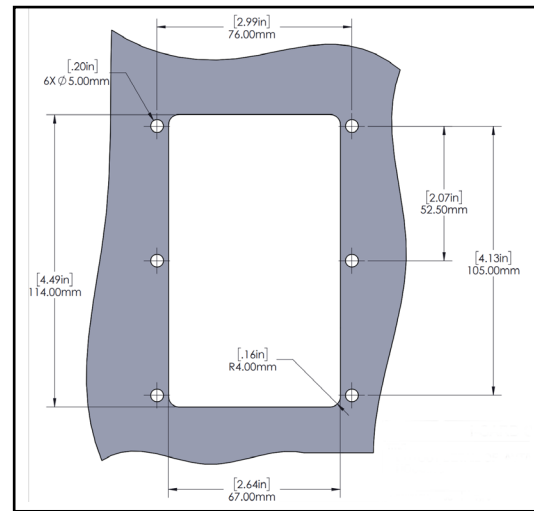
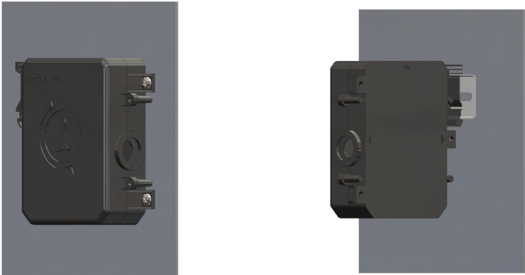
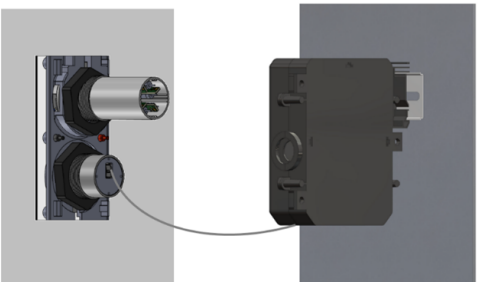


Figure 3.1.1: i-AVT Plus cutout dimensions.

3.1.2 CONTROL UNIT INSTALLATION

	
1. Mount the Control Unit inside the panel using either a DIN rail or screw mounting as shown in the picture.	2. Connect the Control Unit to the I-AVT-R using the IX cable supplied as shown in the picture.

3.1.3 VTI PHASE WIRE CONNECTIONS (Refer the connection drawings)

Terminate the provided wires to the corresponding phases.

- **Brown (L1)** to Phase L1,
- **Orange (L2)** to Phase L2
- **Yellow (L3)** to Phase L3
- **Green (G)** to Ground

3.1.4 I-AVT-R SENSOR LEAD CONNECTIONS. (Refer the connection drawings)

- **Phase Leads:**
Connect two sensor leads for each phase (Brown for L1, Orange for L2, and Yellow for L3) to the bus being monitored. Terminate each pair of sensor leads at different locations on the respective phase for redundancy.
- **Ground Leads:**
Terminate the two Green ground sensor leads to separate locations on the panel ground for secure and redundant grounding.

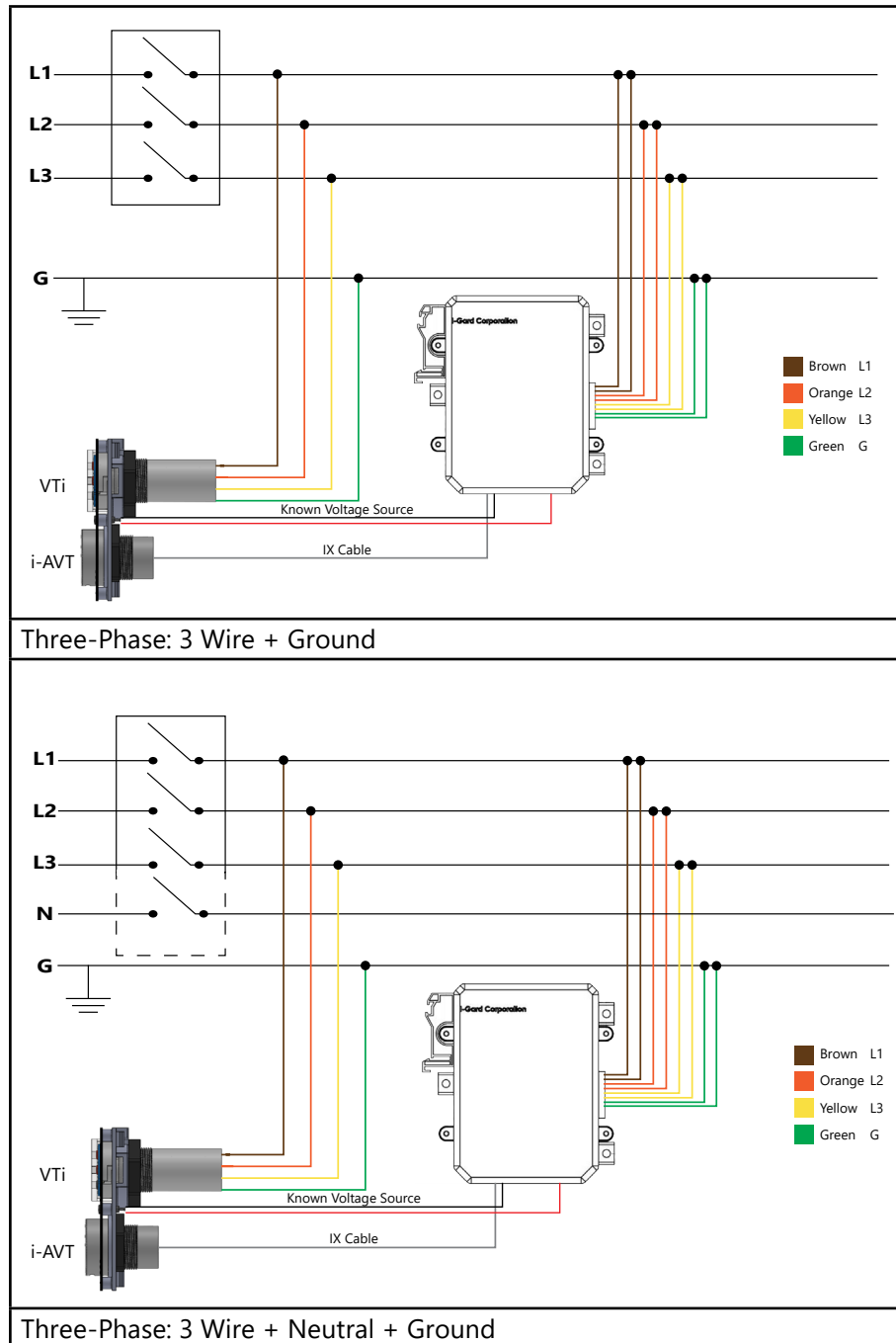
3.1.5 KNOWN VOLTAGE SOURCE CONNECTION (Refer the connection drawings)

- Connect the two wires from the known voltage source of the I-AVT Plus to the control module.

3.1.6 SYSTEM ENERGIZATION

- Energize the bus to power the device. The phase LEDs on the VTi and I-AVT-R will light red. After a few minutes, the Ready LED on the I-AVT-R will flash blue and turn solid once fully charged. Depending on the supply voltage, charging can take 5 minutes to 20 minutes.

3.2 CONNECTIONS



4. OPERATION INSTRUCTIONS VTi

4.1 VISUAL CHECK AND LED INDICATIONS

Perform a visual inspection. The four dual LEDs will illuminate in the following ways to indicate different conditions:

AC VOLTAGES				
Condition	L1	L2	L3	G
Normal 3 Phase Connection	 Flashing Red	 Flashing Red	 Flashing Red	 Off
Phase to Ground Leakage	 Flashing Red	 Flashing Red	 Flashing Red	 Flashing Red
Phase Loss (Example: L2 Fails)	 Flashing Red	 Off	 Flashing Red	 Flashing Red
Phase Unbalance	 Flashing Red	 Flashing Red	 Flashing Red	 Flashing Red

Table 4.1: AC Voltages

4.2 VOLTAGE MEASUREMENT AND TROUBLESHOOTING

The VTi works with a digital multimeter to measure voltage, making it a valuable tool for troubleshooting electrical motors. It provides key electrical information to diagnose power supply issues and identify faults affecting motor performance. With VTi, user can address common motor problems like: Overheated motors, Burnt-out motors, Failure to start, Motor Stopped.



INFORMATION

Use digital voltmeter with 1000V AC or 1000V DC rated input minimum, 10M Ω input impedance and CAT III & IV. A pair of insulated test probes with .080" DIA. points.

Measuring Voltage Using a Multimeter

- I. Before and after testing, verify the multimeter's accuracy using a known AC or DC voltage source.
- II. Turn the multimeter dial to the VAC (AC Voltage) or VDC depending on the system voltage.
- III. Insert the multimeter probes into any two of the four terminal ports: L1, L2, L3, G and Measure the voltage between the selected points.



5. OPERATION INSTRUCTIONS I-AVT-R

5.1 INITIAL SET-UP

The i-AVT-R Control Unit draws its operating power directly from the bus. When the bus is offline, the unit uses supercapacitor technology to continue powering its electronics.

1. **Power ON:** When the device is powered on, three RED lights will illuminate (see Fig. 5.1.a).
2. **Charging:** After a few minutes, the Ready LED will start flashing BLUE, indicating that the device is charging. Depending on the supply voltage, charging can take 5 minutes to 20 minutes.
3. **Fully Charged:** Once the supercapacitor is fully charged, the BLUE LED will turn SOLID (see Fig. 5.1.b).



Figure 5.1.a: Power ON

Figure 5.1.b: Fully charged

INFORMATION



The I-AVT-R Display Module also includes a USB-C charging port for charging its capacitor. Use a USB/C to C/C cable to connect the module to a power bank for charging (see Fig. 5.1.c).

5.2 VOLTAGE PRESENCE INDICATORS

When voltage is detected in one or more phases, the appropriate Voltage Presence Indicators will illuminate as shown in Figure 5.1.b.



WARNING

RED LEDs off does not confirm voltage absence. Always press the TEST button to verify the absence of voltage.



Figure 5.1.c: i-AVT-R C Type charging port connected

5.3 PERFORMING AN ABSENCE OF VOLTAGE TEST



WARNING

Ensure the Ready LED is solid BLUE before de-energizing the bus.

1. **Power OFF:** De-energize the bus and verify that the Phase LEDs are off, indicating no voltage is present (see Figure 5.3.a).
2. **Initiate the Test:** Press the TEST button to begin the absence of voltage test.
3. **Test in Progress:** Flashing Amber LEDs will indicate that the test is in progress (see Figure 5.3.b).
4. **Test Results:** The test result will appear within 10 seconds (refer below).



Figure 5.3.a: Power OFF

Figure 5.3.b: Flashing AMBER LEDs

Safe Condition: If voltage is less than 3V AC/DC, three GREEN LEDs illuminate for 5 seconds, indicating it is safe to open the panel door.



Unsafe Condition: If the test fails, AMBER LEDs remain lit, signaling a potentially unsafe condition. In this case Verify the installation and Wait 10 seconds before retesting.



5.4 VISUAL CHECK AND LED INDICATIONS

i-AVT-R			
Ready LED is SOLID BLUE when Voltage is Present and unit is ready for Absence of Voltage Test.	 Ready		
Phases LEDs SOLID RED indicates hazardous Voltage Present.	L1 	L2 	L3 
SOLID GREEN for 5S indicates hazardous Voltage is not Present.	L1 	L2 	L3 
Blinking AMBER LEDs indicates Absence of Voltage TEST is in progress.	 		
SOLID AMBER LEDs indicates an unsuccessful Test.	 		

Table 5.4: LEDs Indications

5.5 TEST SEQUENCE

The i-AVT is equipped with sensor leads to continuously monitor the voltage on the bus system. It includes two leads for each phase, two for ground, and two for neutral.

The process begins with a built-in supervisory circuit that checks the continuity of all sensor connections to ensure they are secure and correctly installed.

Once the connections are verified, the system tests for the absence of both AC and DC voltage, including phase-to-ground and phase-to-phase measurements.

To ensure reliability, this test is repeated. The full test sequence is visually represented in Figure 5.5.

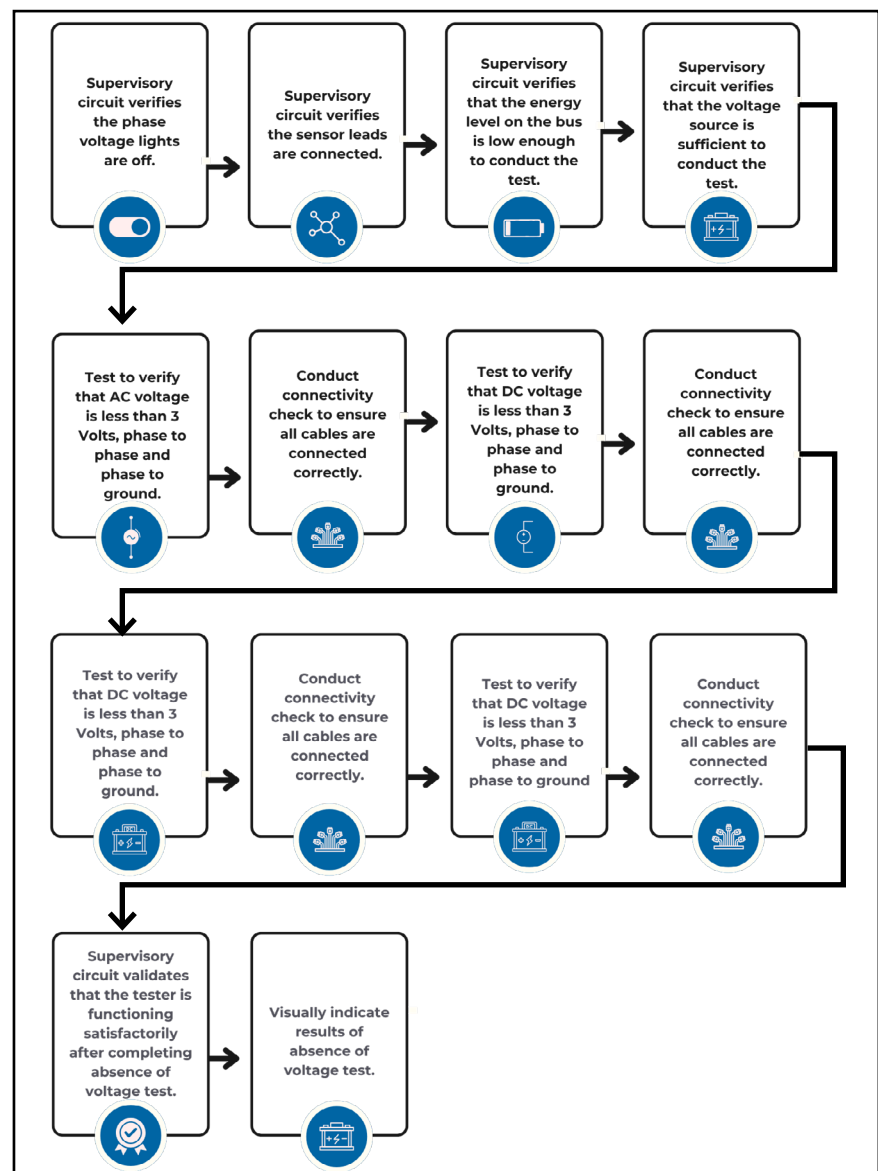


Figure 5.5: Flowchart for determining Absence of Voltage

NOTES

Lined area for notes.



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