instruction

bulletin

REACTIVAR™ AccuSine®
Power Correction System (PCS)
50,100 and 300A models

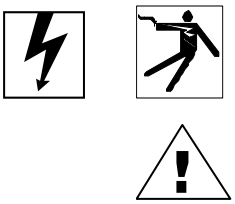
Rev. N - Jan 2008

Federal Pioneer
Merlin Gerin
Modicon
Square D
Telemecanique

Schneider Electric

NOTICE

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** dWeath or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

Note: Provides additional information to clarify or simplify a procedure

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. This document is not intended as an instruction manual for untrained persons. No responsibility is assumed by Square D for any consequences arising out of the use of this manual.

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1. PRE-INSTALLATION

Inspect the PCS (AccuSine Power Correction System) for any damage as soon as it is received. Transfer of the equipment to a carrier at any of the Square D Plants or other shipping point constitutes delivery to the purchaser. Title and all risk of loss or damage in transit shall pass to the purchaser at that time, regardless of freight payment.

1.1 Taking Delivery

- Check that all packages and/or crates have been delivered and that the equipment has not been damaged in transit.
- Forward any claims to the carrier immediately (most carriers impose a 24-hour time limit for the reporting of loss or damage).
- In the event of damage or missing items, quote the Bill of Lading number when making your claim to the carrier.
- Goods, whether sent freight pre-paid or not, are shipped at the consignee's risk.
- Damaged or missing items are the responsibility of the carrier and must be reported.
- Check that the information shown on the equipment nameplates corresponds with the order specifications.
- The packaging material should be replaced for protection until installation has begun.

1.2 Storage

If this AccuSine PCS is not to be installed when unpacked, it should be stored indoors in a clean, dry place. The storage temperature must be between -40^{0}C (-40^{0}F) and 65^{0}C (149^{0}F) with a maximum humidity of 95%, non-condensing. It is preferable to store the unit in its original shipping container to protect the unit from potential damage.

1.3 Seismic Certification

AccuSine PCS are seismically certified for site-specific seismic requirements of the model building codes and/or standards. Optional construction features may be required, depending on the location of the installation and the particular code and/or standard of interest. Seismic certifications of compliance and equipment labels can be provided upon request. See Appendix F for more detailed information.

2. SAFETY PRECAUTIONS

This chapter contains important safety precautions that must be followed before attempting to install, service, or maintain electrical equipment. Carefully read and follow the safety precautions outlined below.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

- Only qualified workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone and wear proper Personal Protective Equipment.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of back-feeding.
- Turn off all power supplying this equipment before working on or inside.
- Always use a properly rated voltage sensing device to confirm that all power is off. Lethal voltages exist for up to ten (10) minutes after power removal. Always use a volt meter to verify that the DC bus capacitors have discharged prior to service.
- Beware of potential hazards, wear personal protective equipment, and carefully inspect the work area for tools and objects that may have left inside the equipment.
- Replace all devices, doors and covers before turning on power to this equipment.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- An open circuit current transformer (CT) secondary may develop a lethal voltage. Short the CT terminals before and while working on CT circuits. Never open circuit the terminals of a CT connected to a live bus.
- The bus capacitors, C_s, store a large amount of energy. DC-voltage will be maintained for up to 10 minutes after power removal. Physical contact prior to full discharge can be lethal. Always use a volt-meter to verify that the bus capacitors are discharged prior to contact.

Failure to follow these instructions will result in death or serious injury.

3. INSTALLATION

This section provides the information required to properly install AccuSine PCS and associated equipment for proper operation and performance. Frequently start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. Read and understand all instructions in this section prior to installation.

3.1 General

Note:

- AccuSine PCS may not perform properly if capacitors (for example power factor capacitors, EMI or RFI filters, TVSS with capacitor input) are connected to the AC-bus down-stream from the current transformers (CT's) of the AccuSine PCS. Consult Section 3.5 in this manual to properly deal with this situation. In addition to stand-alone connection, power factor capacitors may be enclosed in equipment. Refer to site one-line diagrams/equipment schematics to verify their absence. Consult Square D if in doubt.
- The following information is a guide for proper installation. Square D Company does not assume responsibility for compliance with any code, national, local or otherwise, or for the proper installation of this equipment. Personal injury and/or equipment damage may result if codes and instructions are ignored during installation

3.2 Location and Mounting

3.2.1 Enclosed Units

The AccuSine PCS unit must be mounted in a vertical position on a smooth, non-flammable surface using the mounting holes provided. Refer to Figures 3-1,3-2 and 3-3 for mounting dimensions and location of mounting holes. Lifting lugs are provided for hoisting. Mount in a clean, dry location with an ambient temperature between 0^0C (32^0F) and 40^0C (104^0F) and with a humidity not greater than 95%, non-condensing.

CAUTION

HAZARD OF EQUIPMENT FAILURE

- **NEMA 1 units require unrestricted exchange of environmental air to the inside of the enclosure for proper cooling. Insure that the environment meets at least Pollution Degree 2, i.e. does not contain conductive particles, significant amounts of dust, or corrosive or otherwise harmful gases. Malfunction and possible destruction of AccuSine PCS may occur.**
- **Select a mounting location with adequate strength to hold the weight of the unit. Select mounting bolts of appropriate size for the weight of the unit. Refer to Appendix A.**
- **Provide for adequate cooling clearance of at least 12 inches (300 mm) on top of the AccuSine PCS unit. Provide not less than 6 inches (150 mm) clearance on the left, right and bottom sides. However, no clearance is needed for the bottom side of an AccuSine PCS unit rated at 300 Amp.**
- **AccuSine PCS generates significant heat during operation. Consult the product specifications in Appendix A for the Watt losses for each AccuSine PCS model. Insure that the room where AccuSine PCS is mounted has adequate ventilation. Maintain the ambient temperature between 0^0C (32^0F) and 40^0C (104^0F).**

Failure to follow these instructions can result in equipment damage.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

Be sure to disconnect power prior to removal of the AccuSine PCS cover. Lethal voltages exist for up to 10 minutes after power removal. Always use a volt-meter to verify that the DC bus-capacitors have discharged prior to service.

Failure to follow this instruction can result in death or serious injury

3.2.2 Chassis Units

Chassis-type AccuSine PCS units must be installed in a NEMA-rated enclosure such as a motor-control center. Three warning labels to be attached on the front and sides of these enclosures are sent along with shipment of all chassis units from the manufacturing plant. These warning labels pertain to personnel safety and operational safety issues.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

In chassis-mount units, components carrying lethal voltages are unprotected from accidental physical contact. Operating these units outside an adequate enclosure is in violation of applicable electrical codes.

Failure to follow this instruction can result in death or serious injury

For optimal cooling the chassis must be mounted in a vertical position using the mounting holes provided. See Figures 3-4, 3-5 and 3-6 for mounting dimensions and position of mounting holes.
Chassis-mount units may be mounted directly side-by-side.

CAUTION

HAZARD OF EQUIPMENT DAMAGE

AccuSine PCS dissipates significant amounts of heat. Consult the product specifications in Appendix A for the Watt losses for each AccuSine PCS model. It is the responsibility of the integrator to supply an adequate amount of cooling air to the unit and to duct away the hot exhaust air. The cooling air intake temperature must not exceed 40ºC (104ºF) under any operating condition. The installation of the chassis-mount units must facilitate an airflow of 300 cfm (50 Amp unit), 500 cfm (100 Amp unit), and 1250 cfm (300 Amp unit), respectively.

Failure to follow this instruction can result in property damage

The remote Digital Interface Module (DIM) including its connecting cable are optional for chassis-type AccuSine PCS units and must be ordered and installed separately if a DIM is required. Refer to Appendix A, Specifications, for model numbers.

The DIM should not be installed in close vicinity to a heat-source, power-wiring, or high-power switching elements. The cable-assembly connecting the DIM to J3 and J4 of the Control PCB must not be routed in parallel with or attached to power-wiring.

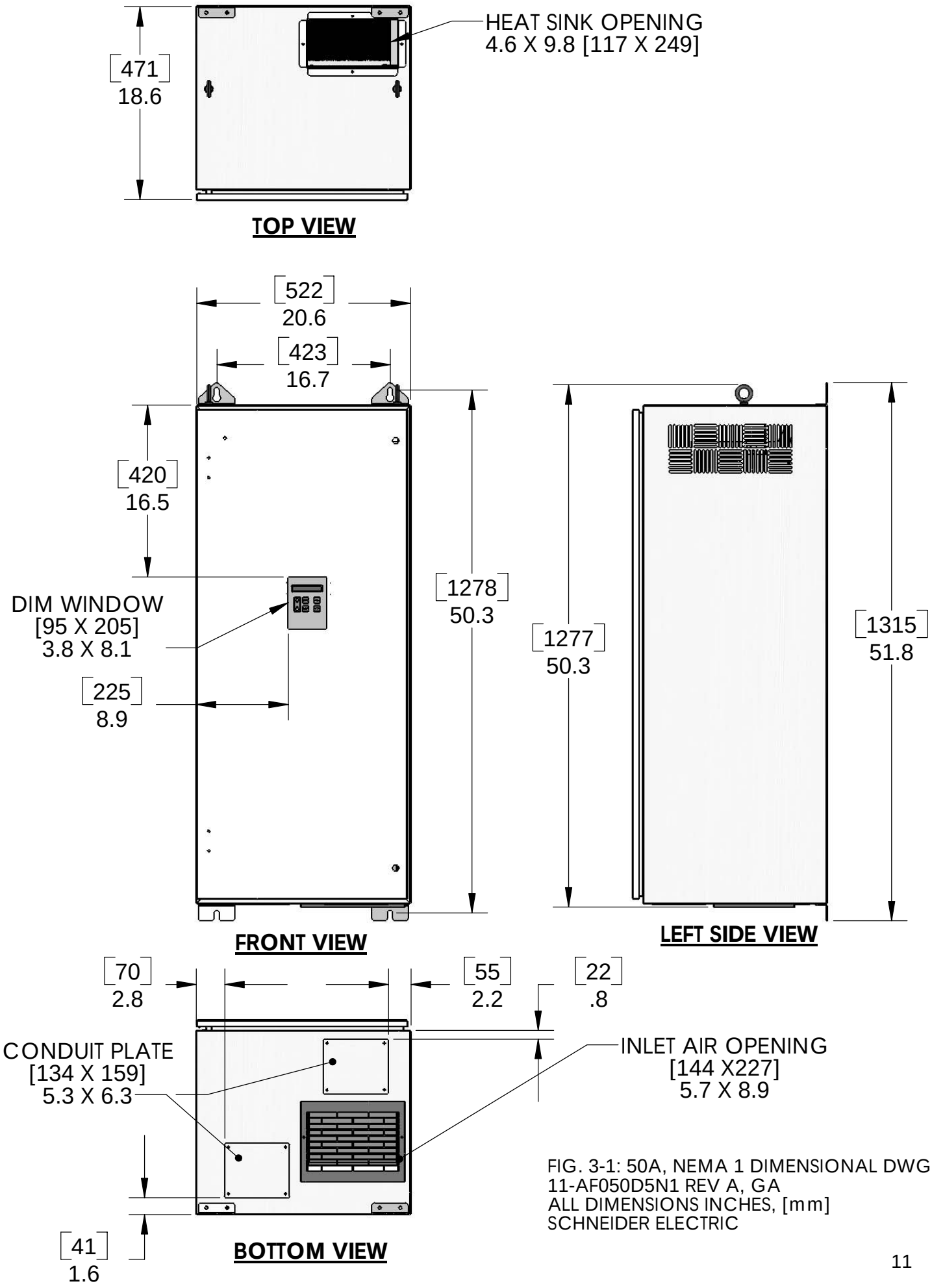


FIG. 3-1: 50A, NEMA 1 DIMENSIONAL DWG
11-AF050D5N1 REV A, GA
ALL DIMENSIONS INCHES, [mm]
SCHNEIDER ELECTRIC

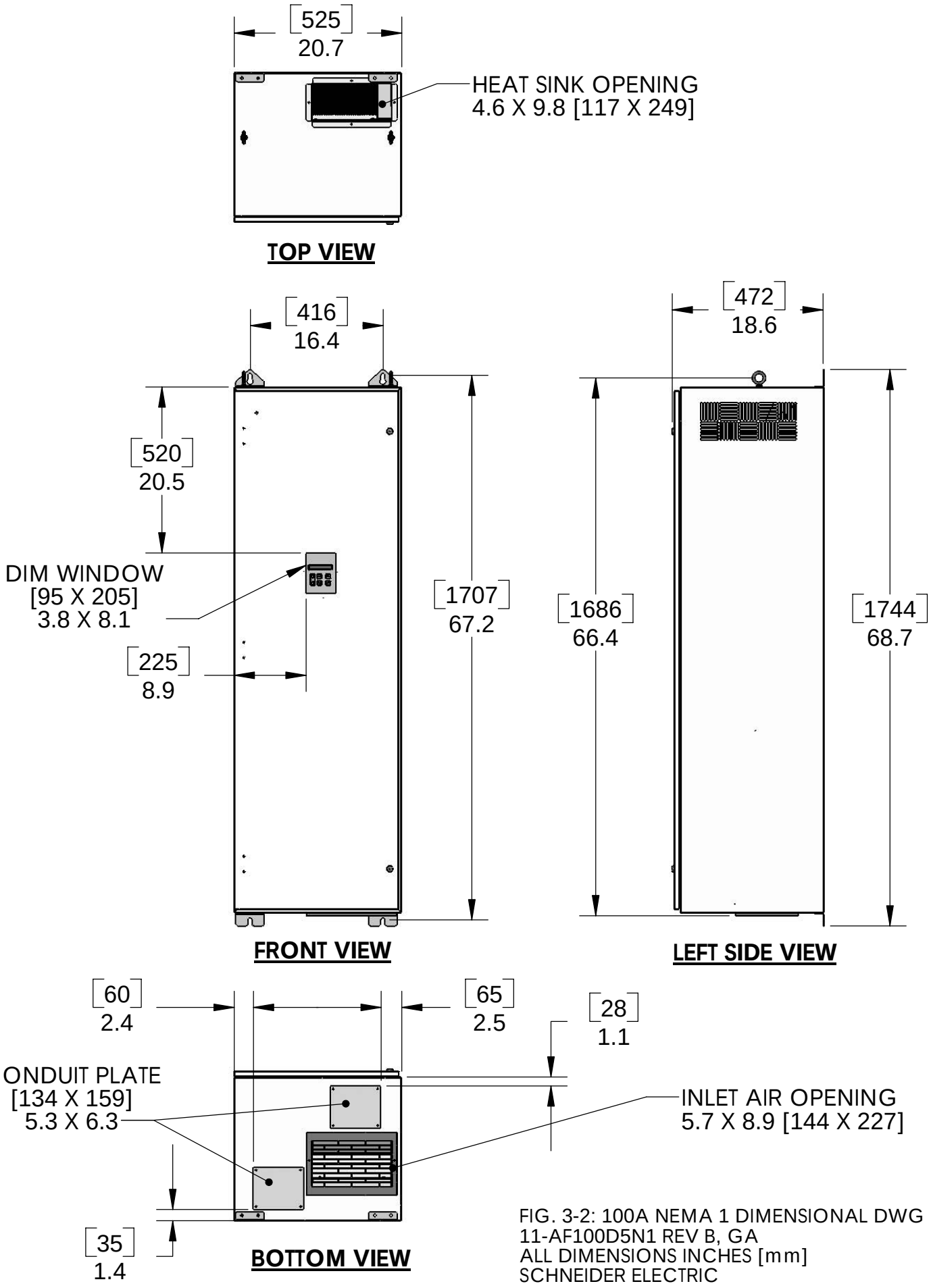


FIG. 3-2: 100A NEMA 1 DIMENSIONAL DWG
11-AF100D5N1 REV B, GA
ALL DIMENSIONS INCHES [mm]
SCHNEIDER ELECTRIC

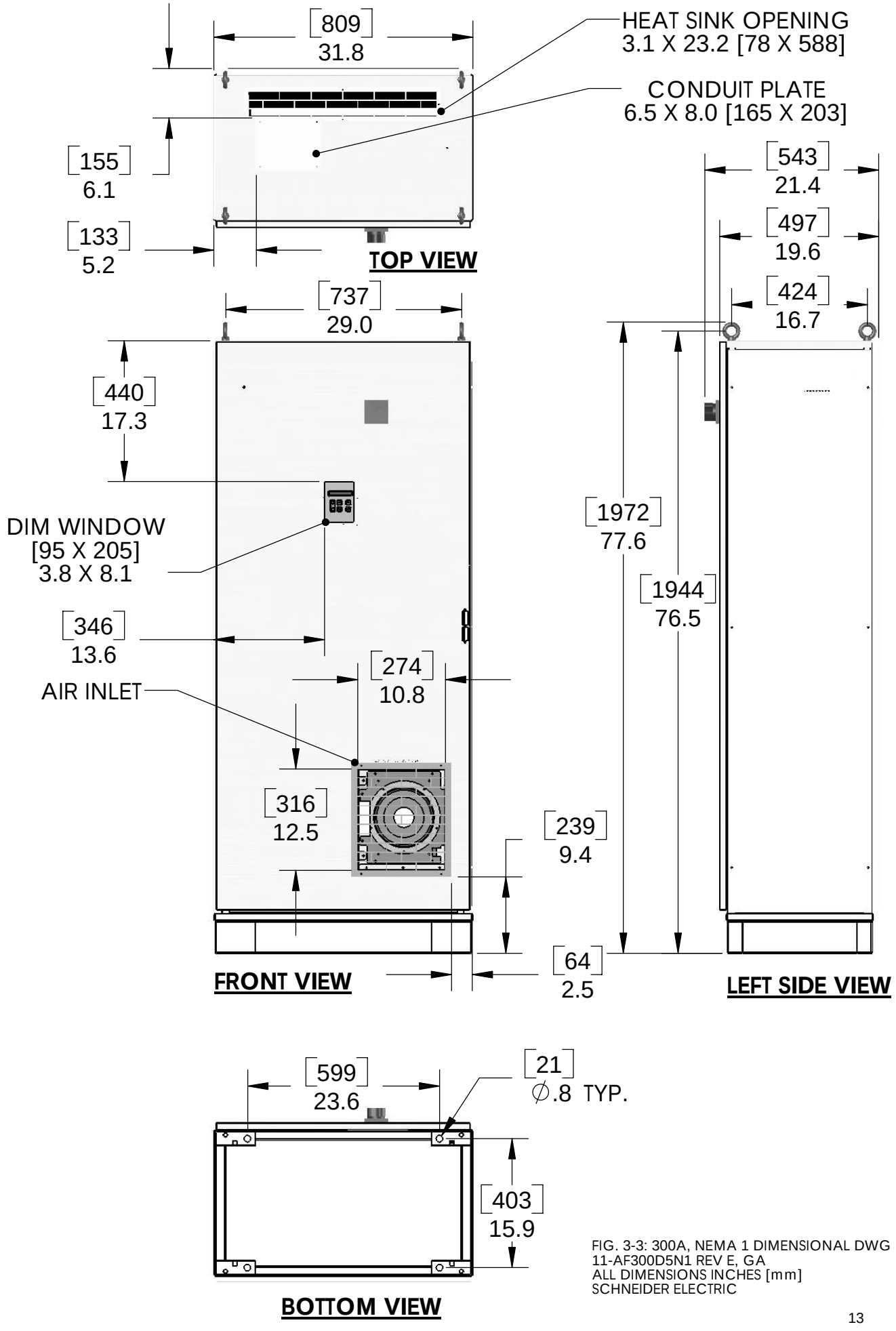


FIG. 3-3: 300A, NEMA 1 DIMENSIONAL DWG
11-AF300D5N1 REV E, GA
ALL DIMENSIONS INCHES [mm]
SCHNEIDER ELECTRIC

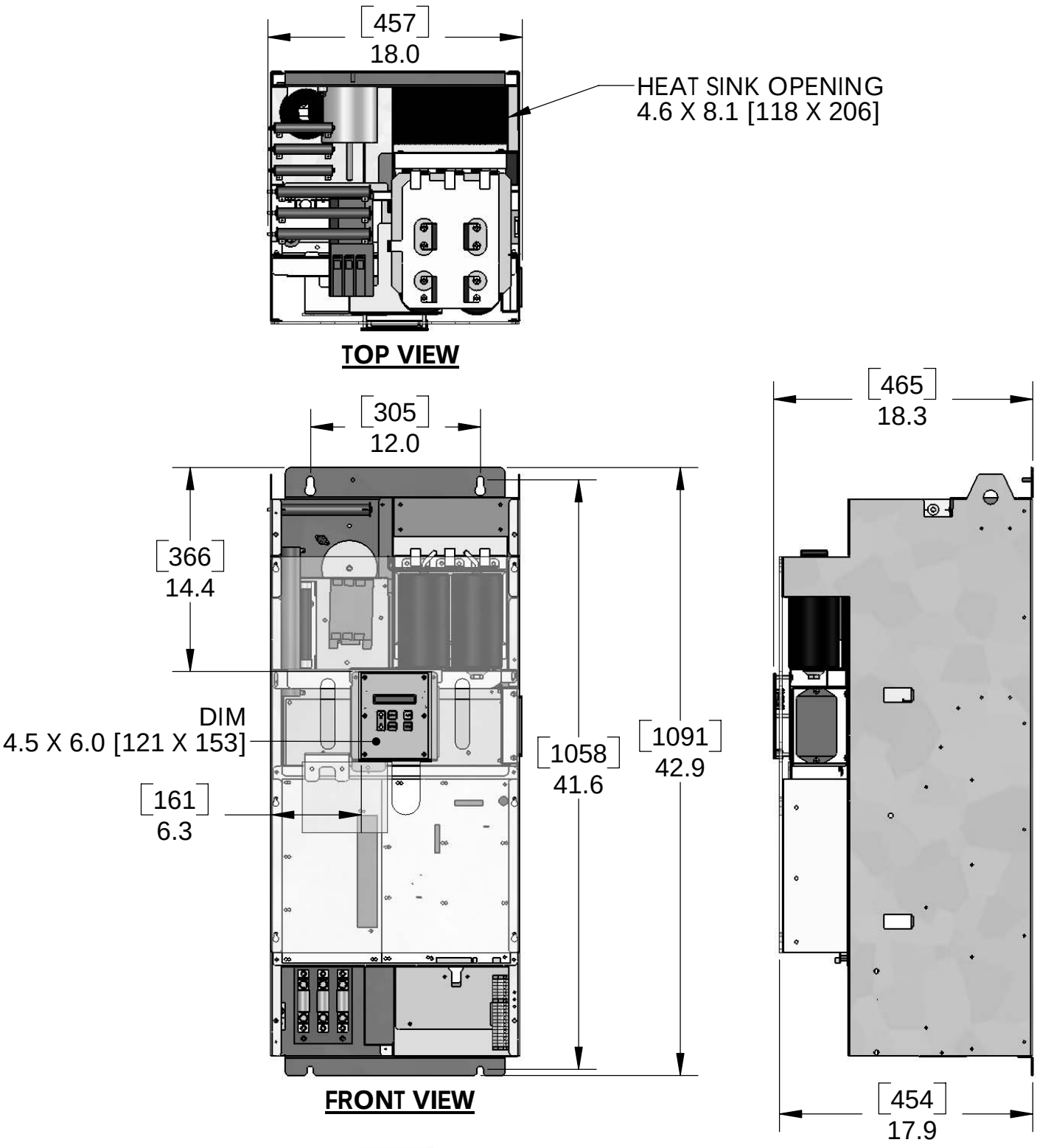


FIG. 3-4: 50A CHASSIS DIMENSIONAL DWG
11-AF050D5CHD REV A, GA
ALL DIMENSIONS INCHES [mm]
SCHNEIDER ELECTRIC

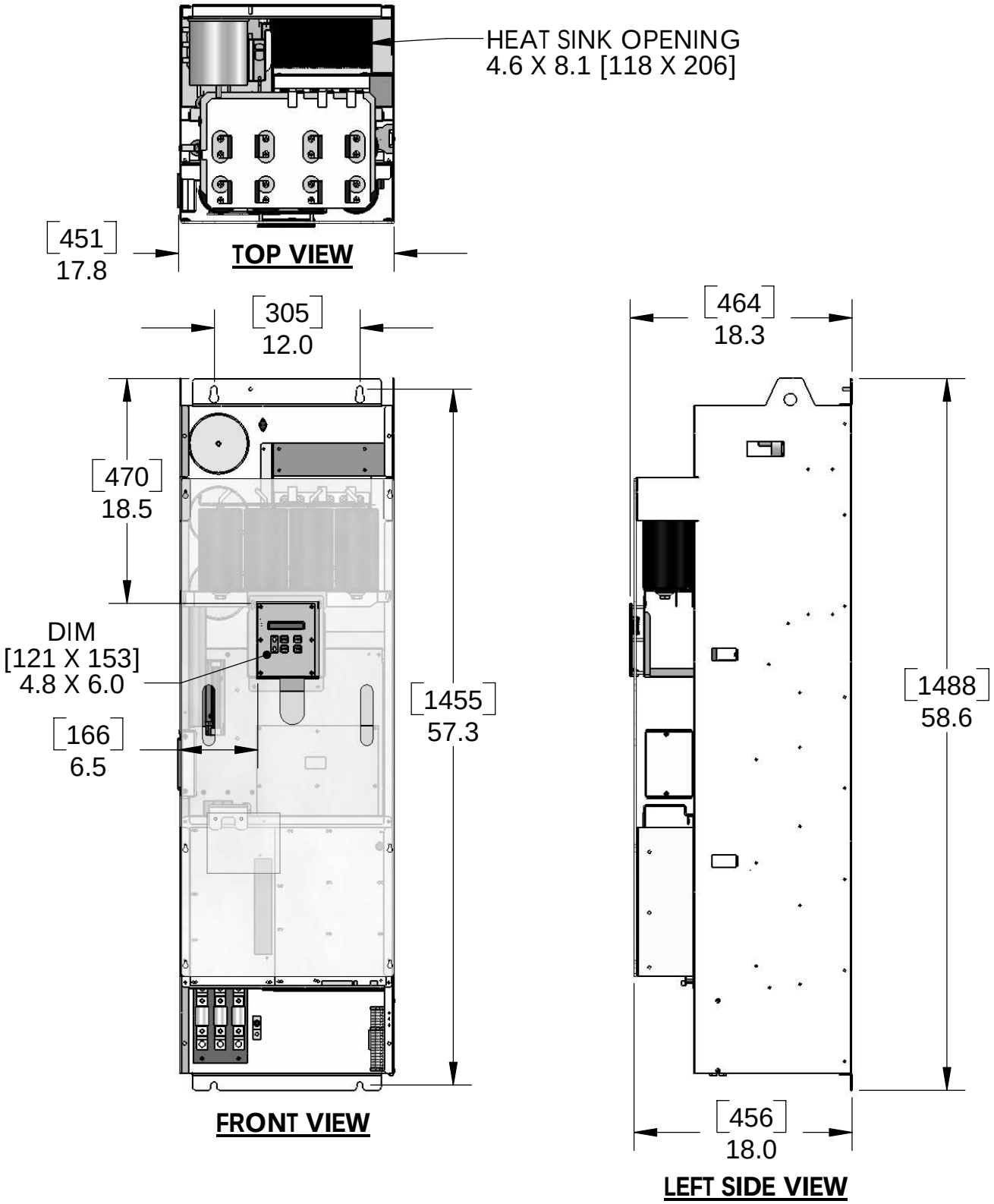


FIG. 3-5: 100A CHASSIS DIMENSIONAL DWG
11-AF100D5CHD REV -, GA
ALL DIMENSIONS INCHES [mm]
SCHNEIDER ELECTRIC

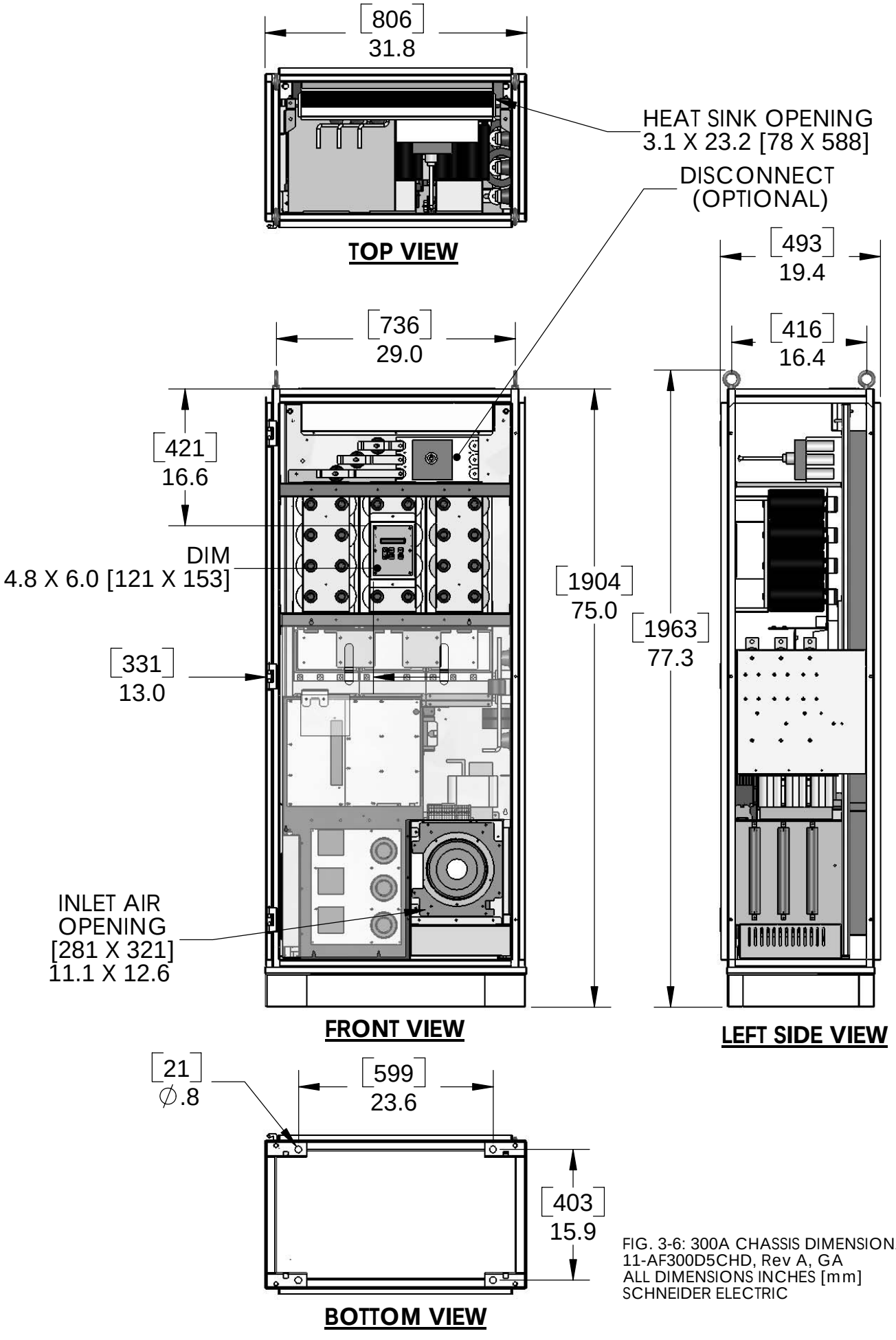


FIG. 3-6: 300A CHASSIS DIMENSIONAL DWG
11-AF300D5CHD, Rev A, GA
ALL DIMENSIONS INCHES [mm]
SCHNEIDER ELECTRIC

3.3 Power and Ground Connections

3.3.1 Connecting AccuSine PCS

Figure 3-7 shows four possible ways to connect AccuSine PCS within a power system. However, almost every individual installation will be somewhat different.

AccuSine PCS may not perform properly if capacitors (for example power factor capacitors, EMI or RFI filter, TVSS with capacitor input) are connected to the AC-bus down-stream from the current transformers (CT's) of the AccuSine PCS. Consult Section 3.5 in this manual to properly deal with this situation. In addition to stand-alone connection, power factor capacitors may be enclosed in equipment. Refer to site one-line diagrams/equipment schematics to verify their absence. Consult Square D if in doubt.

For all configurations the following points must be observed:

- The phase sequence of the 3-phase power wires feeding the AccuSine PCS must be positive sequence, i.e. a phase rotation meter should indicate "clockwise".
- DC-drives must have a 3-phase AC reactor of minimally 3% or a drive isolation transformer inserted between the AccuSine PCS connection point and the drive AC input.
- Variable-frequency AC-drives must have a 3-phase AC reactor of minimally 3% or a drive isolation transformer with electro-static shielding inserted between the AccuSine PCS connection point and the drive AC-input, unless the drive is a PWM type drive with a diode rectifier and has a DC-bus reactor of minimally 5% incorporated. In that case AccuSine PCS may be connected directly to the drive AC input terminals.
- A third CT (current transformer) is required if single– or three-phase line-to-neutral connected loads are present downstream from the chosen location of the two CT's needed by the Accusine PCS unit.

3.3.2 Circuit Breaker and Manual Disconnect Selection

An external circuit breaker or manual disconnect is required as an isolation device. Per NEC, this circuit breaker must be rated for at least 125% of the rated load current. A circuit breaker/manual disconnect rated at no less than 65Amps is suggested for the 50Amp AccuSine PCS, 125 Amps for the 100Amp AccuSine PCS, and 400Amps for the 300Amp AccuSine PCS.

Note: Local codes and regulations must be checked to ensure compliance**.**

3.3.3 Conduit Routing

Power cables connected to AccuSine PCS must be placed in metal conduit to reduce noise coupling. Entry for all power and control wiring has to be made through the removable conduit-entry plates on the bottom or top of the AccuSine PCS enclosure (see Figures 3.1, 3-2 and 3-3). In accordance with NEC rules, metal conduit has to be grounded to the AccuSine PCS ground-terminal located adjacent to the main fuses.

Instrumentation and CT wiring has to be routed in a separate grounded metal conduit. Per NEC, sizing of the conduit depends on the selected wire size (See Section 3.3.4)

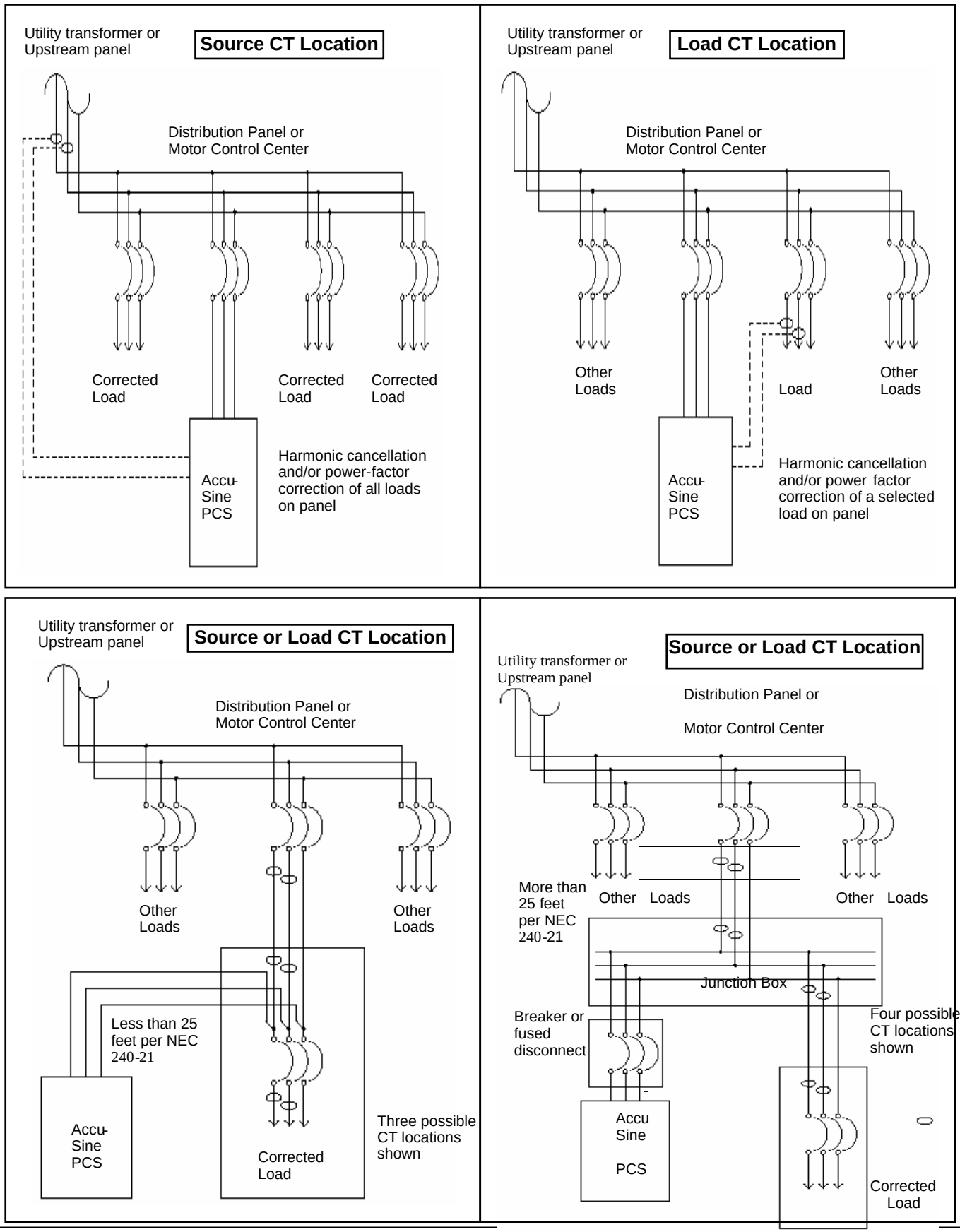
CAUTION

HAZARD OF EQUIPMENT DAMAGE

Remove the conduit entry plates for drilling and cutting conduit entry holes. The AccuSine PCS warranty is void if operational difficulties are found to being caused by metal particles from the installation process.

Failure to follow this instruction can result in equipment damage.

Figure 3-7: Installation Options



3.3.4 Power and Ground Wire Selection

Used as a harmonic current compensation device, AccuSine PCS produces currents at frequencies that are multiples of the AC line fundamental frequency. Power cables, as well as input disconnect devices, should be rated at 125% of the AccuSine rated current in order to avoid excessive heating due to any skin effect resistance increase of these higher frequencies.

Note: Local codes and regulations must be checked to ensure compliance. Accusine PCS has regulatory approval for use with copper wire only (rated 75 deg. C or higher)

3.3.4.1 50 & 100A Wire Selection

For purposes of selecting the size of the power wire, it is reasonable to assume that the full load current occurs at 400 Hz. When using copper wire, no de-rating is needed for wire sizes smaller than 3AWG. For copper wire sizes larger than 3AWG, Tables 3-1 and 3-3 list de-rating factors.

Table 3-1: Wire Derating Factors (50 & 100A models)

Wire Size (AWG|mm^2)	3|N/A	2|35	1|N/A	1/0|50	2/0|N/A	3/0|70	4/0|N/A
Diameter (DIA) in inches (mm)	0.260 (6.6)	0.292 (7.4)	0.332 (8.4)	0.373 (9.5)	0.419 (10.6)	0.470 (11.9)	0.528 (13.4)
Wire Derating Factor	1.00	0.99	0.98	0.95	0.93	0.89	0.86
Further Derating Factors can be calculated using the formula: Derating Factor = (2/Dc) * Sqrt (Dc * 0.13 – 0.0169), where Dc = Conductor Diameter in inches							

Table 3-2 lists the range of acceptable wire gauges and the required torque for the power terminations for the 50 Amp and 100 Amp AccuSine PCS model:

Table 3-2: Wire sizes and Terminal Torque (50 & 100A models)

AccuSine Model	Wire Size Range in AWG|mm^2	Required Terminal Torque in lbs.-in. (Nm)
PCS050D5xx	14 – 2/0 | 2.5-50	For 10–14 AWG | 2.5 – 6 mm^2: 35 (4.0)
		For 8 AWG | 10 mm^2: 40 (4.5)
		For 4 – 6 AWG | 16 – 25 mm^2: 45 (5.1)
		For 2/0 – 3 AWG | 25 – 50 mm^2: 50 (5.7)
PCS100D5xx	6 – 250MCM | 10 – 120	275 (31.1)

A dedicated ground conductor must be used. Per NEC, its size depends on the selected power cable. An 8 AWG (10mm^2) THHN copper ground wire is recommended for the 50 Amp unit, whereas a 4 AWG (25mm^2) THHN copper ground wire should be used for the 100 Amp unit.

All power wiring has to be routed directly from the conduit entry plate to the terminations on fuse-block FB1 (and the earth grounding terminal) without loops. Instrumentation and CT wiring has to be routed in a separate grounded metal conduit. Per NEC, sizing of the conduit depends on the selected wire size.

3.3.4.2 300A Model Wire Selection

Table 3-3: Wire Derating Factors (300A models)

Copper Wire Size	4/0 AWG (95 mm^2)	250 MCM (120 mm^2)	300 MCM (150 mm^2)	350 MCM (185 mm^2)	400 MCM N/A	500 MCM (240 mm^2)
Diameter (DIA) in inches (mm)	0.528 (13.4)	0.575 (14.6)	0.630 (16.0)	0.681 (17.3)	0.728 (18.5)	0.813 (20.7)
Wire Derating Factor	0.86	0.84	0.81	0.79	0.77	0.73
Further Derating Factors can be calculated using the formula: Derating Factor = (2/Dc) * Sqrt (Dc * 0.13 – 0.0169), where Dc = Conductor Diameter in inches						

Note: AccuSine PCS has regulatory approval for use with copper wire (rated 75 deg. C or higher) only.

Paralleling of conductors is another option to avoid this de-rating penalty. For general guidelines on employing conductors in parallel, refer to NEC. The 300 Amp AccuSine PCS model has been designed for paralleled power cables only. If only one single conduit is being used, 250 MCM (120 mm^2) cable must be used (2 conductors/phase, 75 deg. C min.). If two conduits are being used, 4/0 AWG (95 mm^2) cable (2 conductors/phase, 75 deg. C min.) is adequate.

A dedicated ground conductor must be used. Per NEC, its size depends on the selected power cable. A 1 AWG (50 mm^2) THHN copper ground wire is recommended for the 300 Amp rated unit.

All power wiring has to be routed directly from the conduit entry plate to the bus-bar terminations (and the ground terminal) without loops.

The terminal bus-bars are designed to accept 3/8” SAE Grade 5 (M10) bolts. The recommended fastener torque is 300 lbs.-in. (33.9 Nm).

Instrumentation and CT wiring has to be routed in a separate grounded metal conduit. Per NEC, sizing of the conduit depends on the selected wire size.

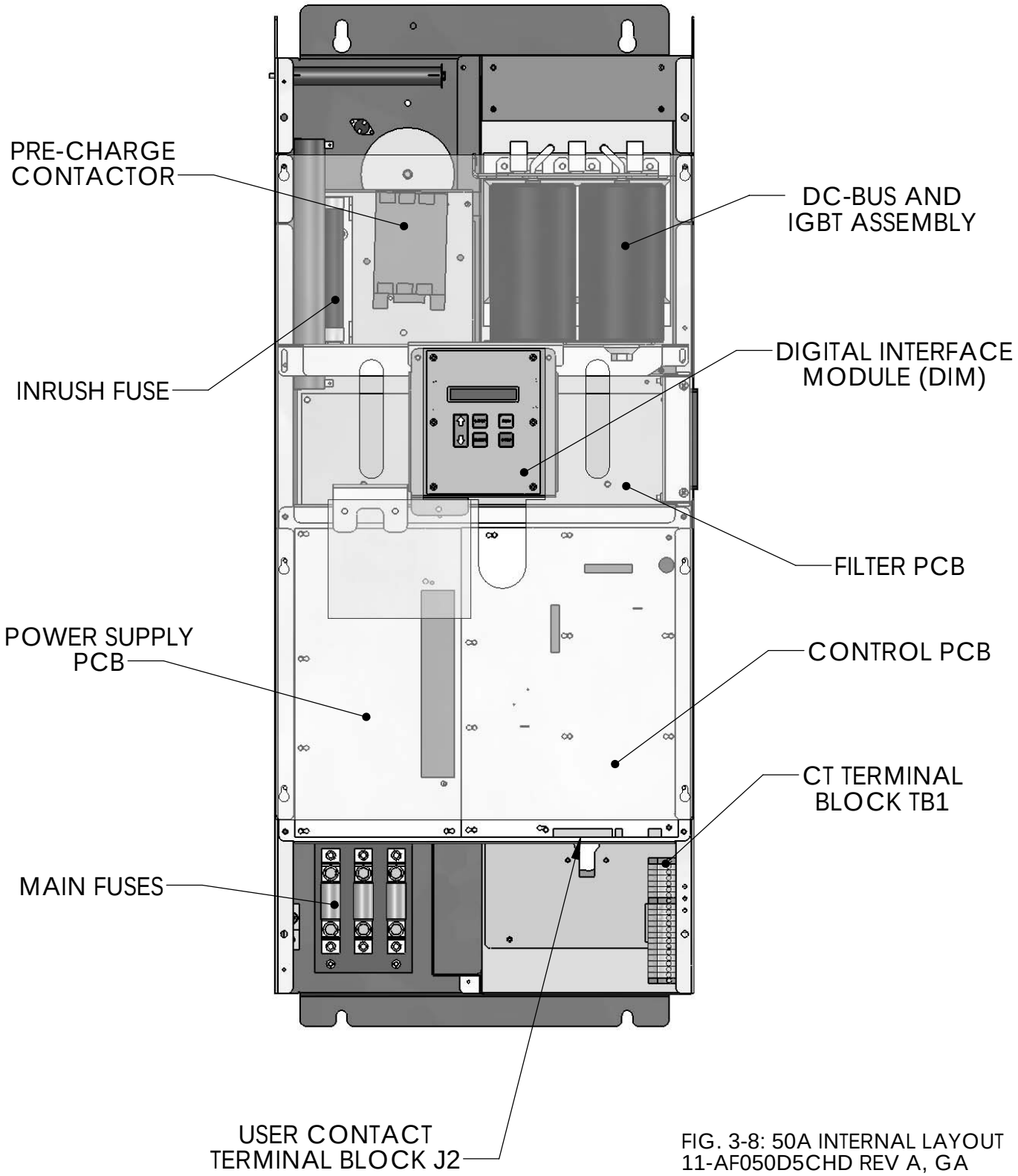


FIG. 3-8: 50A INTERNAL LAYOUT
11-AF050D5CHD REV A, GA
ALL DIMENSIONS INCHES [mm]
SCHNEIDER ELECTRIC

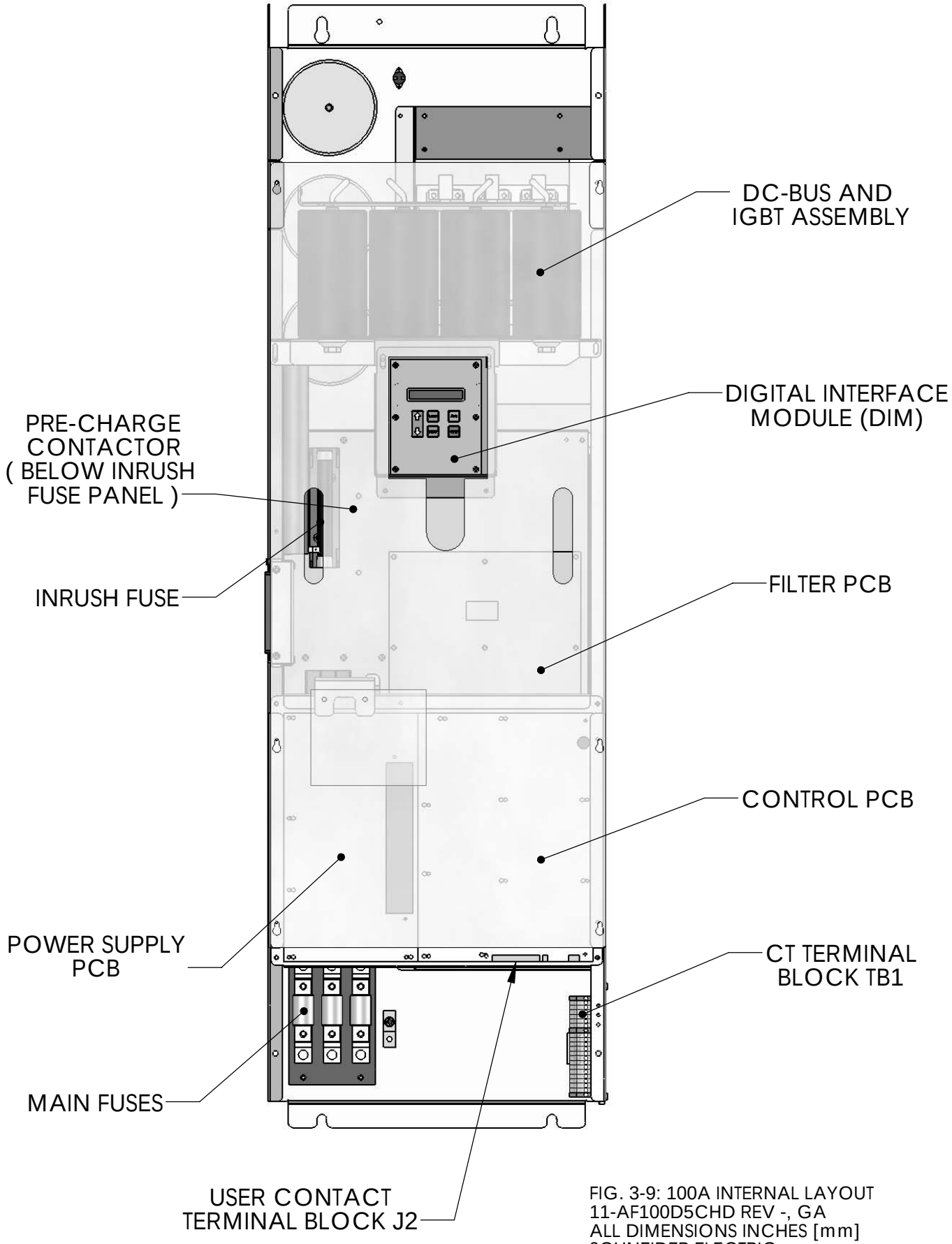


FIG. 3-9: 100A INTERNAL LAYOUT
11-AF100D5CHD REV -, GA
ALL DIMENSIONS INCHES [mm]
SCHNEIDER ELECTRIC

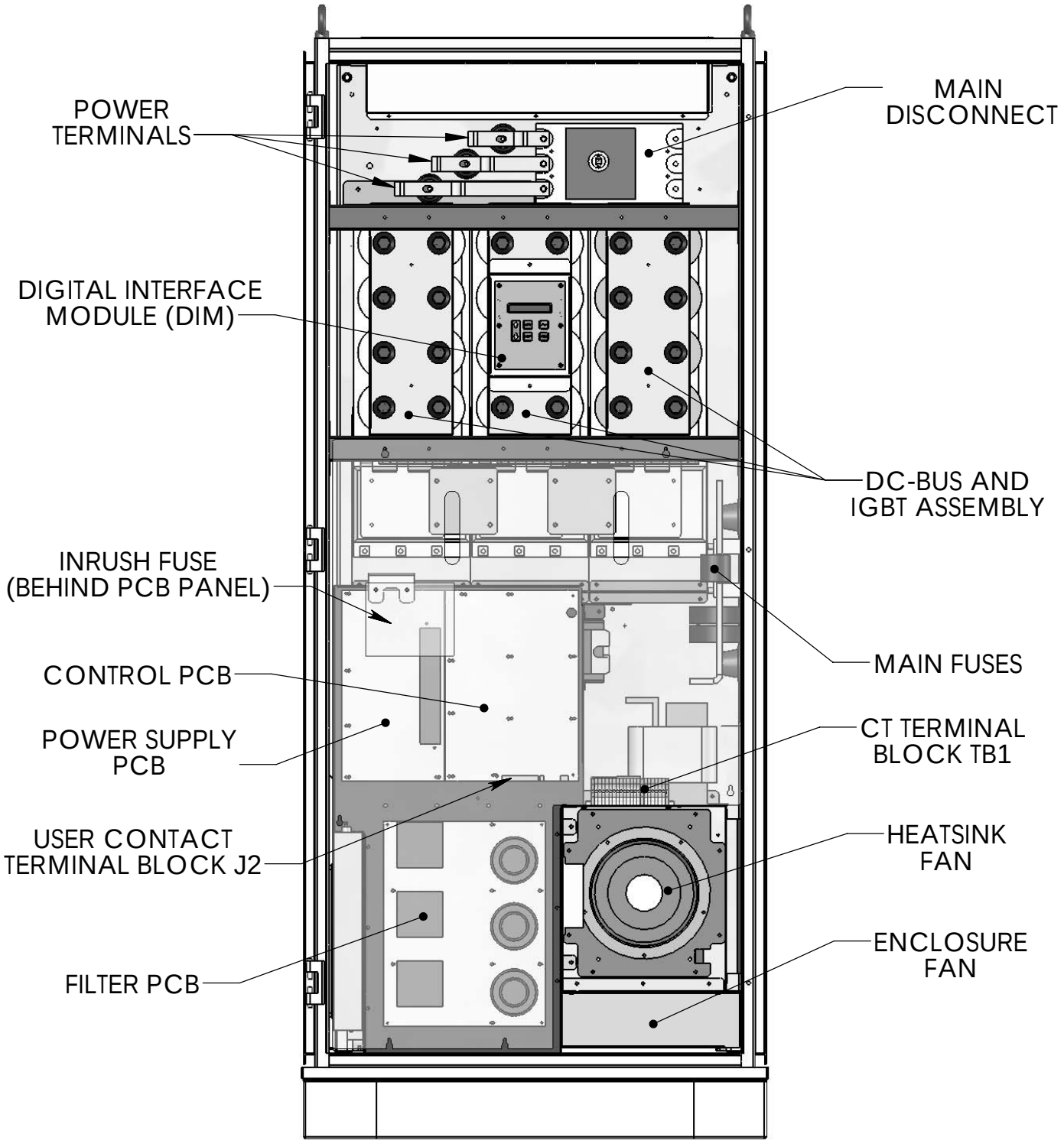


FIG. 3-10: 300A INTERNAL LAYOUT
11-AF300D5CHD, REV A, IA
ALL DIMENSIONS INCHES [mm]
SCHNEIDER ELECTRIC

3.4 User Contacts

Four relays with form C type contacts indicate the various operational states of AccuSine PCS. They may be used to power indicating lights or other low power control circuits. Each contact is an isolated, dry contact rated at 120/240 VAC and 1 Amp.
Table 3-4 shows the pin layout (1 – 12) of the user output contacts located on J2 of the AccuSine PCS Control. Use a tightening torque of 7 lb-in.

Table 3-4: Dry Contact Layout

Power On			Run			Fault			At Max. Capacity		
1	2	3	4	5	6	7	8	9	10	11	12
NC	C	NO	NC	C	NO	NC	C	NO	NC	C	NO

"C" means common terminal, "NO" means normally open, "NC" means normally closed. See section 6.2 for contact operation details.

3.5 Current Transformers (CT's)

AccuSine requires two (2) external current transformers (CT's) to measure the load current waveforms. Standard CT's rated for 400 Hz (accuracy better than 3%) can be used. AccuSine can be readily configured for CT's rated at 500A, 1000A, 3000A, and 5000A. The output rating for any of these CT's must be 5 amperes. Three (3) external CT's are required if line-to-neutral connected loads (4-wire systems) are included.

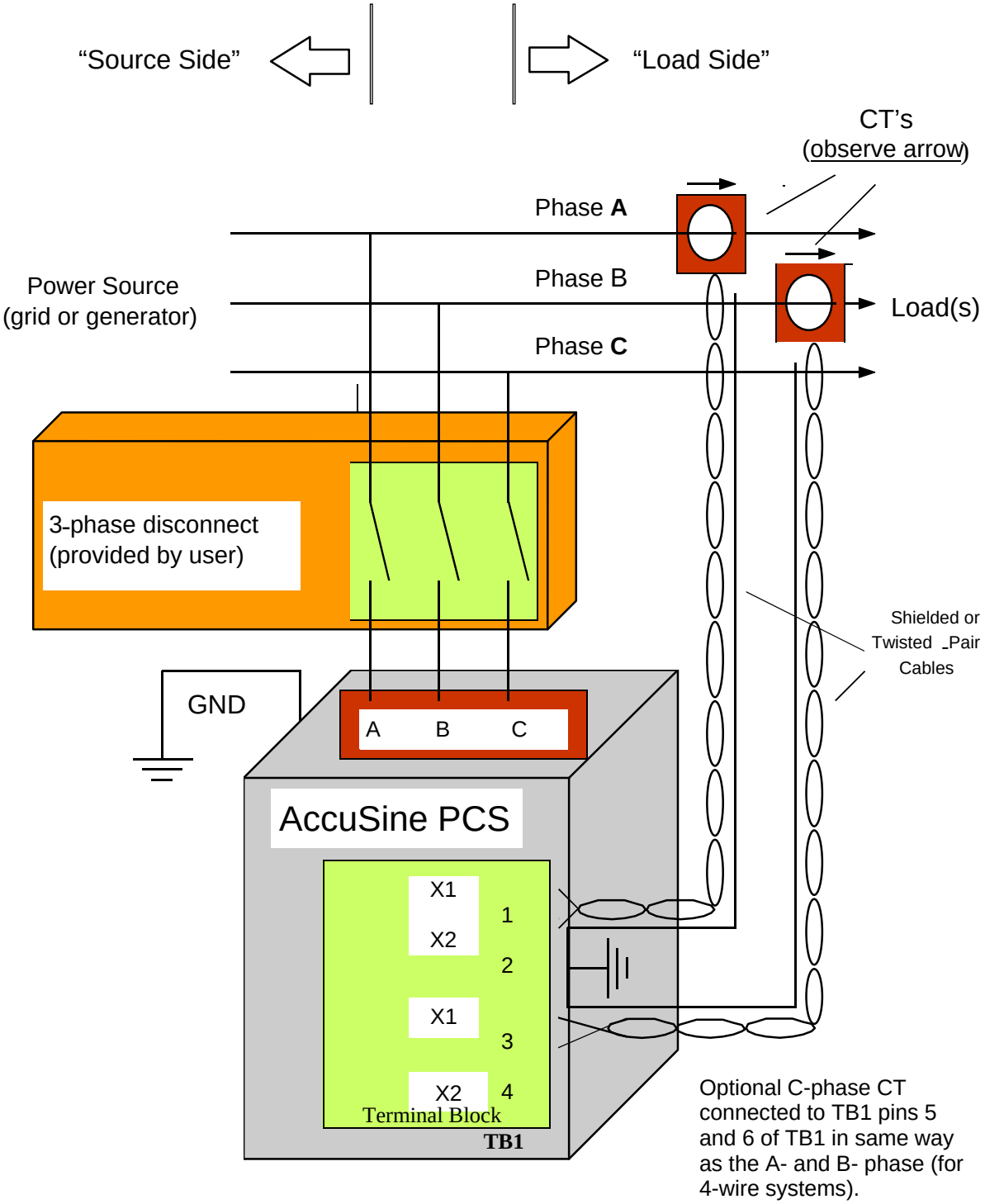
CT's must be selected for:
1) The maximum load current through the conductor on which they are installed with an output rating of 5 Amp.
2) The maximum burden (in VA) on the CT formed by the CT wiring and the AccuSine burden (*Note*: AccuSine burden is 2.5 VA, or 0.1 Ohms).
3) Wire size of the CT must be minimally 12 AWG (4 mm^2). This is critical to assure proper performance.

The CT's have to be mounted on phases A and B (and C, if required for 4-wire systems) with the orientation arrow pointing toward the load. CT's may be installed on the source side or on the load side of the AccuSine power connection, see Figures 3-11 and 6-2, Chap. 6-2., and Chap.5.3.3. for proper setup. See Table 3-6 for maximum allowable CT-wire lengths. Do not allow the conductor on which the CT is mounted to be lodged in the joint-area of a split-core CT because inaccurate operation of the filter will result.

Refer to Appendix B for details on the CT's which Square D provides for use with AccuSine PCS.

Note: AccuSine PCS may not perform properly if capacitors (for example power factor capacitors, EMI or RFI filters, TVSS with capacitor input) are connected to the AC-bus down-stream from the current transformers (CT's) of the AccuSine PCS. These capacitors may be part of existing equipment or connected separately. For proper functioning of the AccuSine PCS, the CT's need to be inserted downstream of these capacitors. However, if the CT's are needed to be inserted upstream of the capacitors, then the signals from these CT's are to be added with signals of additional CT's measuring the capacitor currents with the orientation arrows pointing toward the load.

Figure 3-11: Three-Phase Connection Diagram
(showing the CT's installed on the "Load Side" or downstream of AccuSine PCS)



⚠ DANGER

HAZARD OF ELECTRIC SHOCK< BURN OR EXPLOSION

If the power to the load cannot be shut down during installation and the CT's have to be installed on current-carrying conductors, the secondary leads of the CT's must be terminated on terminal block TB1 with a tightening torque of 7 lb-in before the transformers are installed on the power conductors. Failure to do so may result in damage to the CT's. High voltage may be present on the open secondary leads and may cause severe electrical shock.

Failure to follow this instruction can result in death or serious injury.

Shielded or twisted pair cable is required to connect the CT's to terminal block TB1 with a tightening torque of 7 lb-in. CT wiring must be routed in a separate metal conduit. Per NEC, this conduit must be grounded to the AccuSine PCS ground terminal. CT-wiring and wiring connected to J2 must be routed directly from the conduit entry-plate to TB1 (and J2 of the Control PCB). Terminal X1 of the Phase A CT is connected to terminal 1 of TB1, terminal X2 is connected to terminal 2. Terminal X1 of the Phase B CT is connected to terminal 3 of TB1, terminal X2 is connected to terminal 4. Terminal X1 of the Phase C CT (if required) is connected to terminal 5 of TB1, terminal X2 is connected to terminal 6. Terminate shields on one of the terminals marked "earth ground" on TB1.

Note: Do not connect any additional burden for other measurement purposes into the secondary circuit of the current transformers. Use an additional, separate current transformer if such measurements are required.

3.6 Parallel Operation

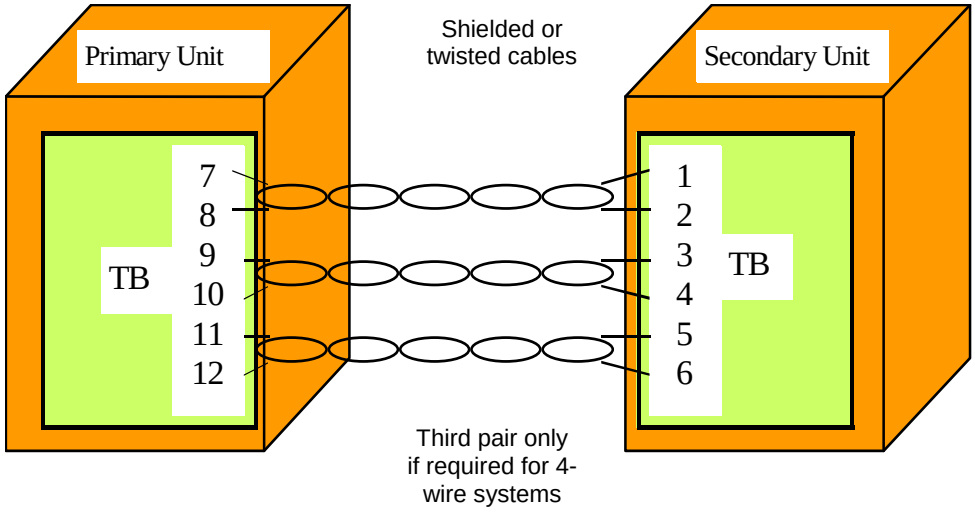
For multiple AccuSine PCS units connected in parallel, a common set of external CT's is to be used. This common set of external CT's may be either mounted on the load or the grid side of the multiple parallel AccuSine PCS units. For the case that the external CT's are desired to be mounted on the grid side, then additional CT's are required which are to be mounted on the input power wires of each AccuSine PCS belonging to these multiple parallel AccuSine PCS units. These additional CT's are to be connected in parallel to the external CT's. See Appendix C for discussion in further detail.

Up to a maximum of 10 parallel AccuSine PCS units can be installed using the same set of or more sets of external CT's. The number of units operating in parallel using the same external CT's has to be entered on the Digital Interface Module (See Chapter 5.3.3 and Table 5-2). In parallel operation, the total current supplied is divided amongst the units as an equal percentage of its rating.

Each AccuSine PCS includes on terminal block TB1 terminals for interconnection to TB1 of another AccuSine PCS unit, see Figure 3-12.

The primary unit is the unit receiving the CT secondaries on TB1, terminals 1, 2, 3, 4, 5, and 6. From this unit, TB1 terminals 7, 8, 9, 10, 11, and 12 are connected to TB1 terminals 1, 2, 3, 4, 5 and 6 of the next unit. Each additional unit is connected in the same manner. Observe the wiring diagram of Figure 3-12 and Table 3-6 for maximum allowable cable-length and wire gauge. The interconnection requires two (three if C phase requires a CT) shielded twisted-pair cables. Each wire pair carries up to 5 Amps current rated at not more than 10 volts.
Note: On the last unit in the loop, terminals 7-13 on TB1 should already have been shorted by jumpers in the factory. Do not remove these shorting jumpers.

Figure 3-12: Multiple Unit Interconnect CT Wiring



Using shielded or twisted-pair cable make the following connections on the terminal block TB1 of the primary unit (the unit which is connected to the current transformer) and TB1 of the secondary unit (see Figure 3-12).

Note: Connect shields to one of the TB1 terminals marked “earth ground” of the primary unit only. Do not connect shields to ground of secondary unit.

Table 3-5: CT Wiring for Multiple Unit Operation

	Primary Unit	Secondary Unit
Connect First Pair (for phase A)	Pin 7	Pin 1
	Pin 8	Pin 2
Connect Second Pair (for phase B)	Pin 9	Pin 3
	Pin 10	Pin 4
Connect Third Pair (for phase C) (If required for 4-wire system)	Pin 11	Pin 5
	Pin 12	Pin 6

⚠ DANGER

HAZARD OR ELECTRICAL SHOCK, BURN, OR EXPLOSION

An open circuit CT secondary may develop a lethal voltage. Short the CT terminals before and while working on CT circuits. Never open circuit the terminals of act connected to a live us.
If the current transformers to the primary unit are on current-carrying conductors, do not remove the shorting jumpers from terminals 7-8, 9-10, and 11-12 until the connections to the next unit have been established.

Failure to follow this instruction can result in death or serious injury.

Note:

- If AccuSine PCS units are connected in parallel, 3000 and 5000 Amp current transformers (CT) with CT ratios of respectively 3000:5 and 5000:5 are required.
- The preferred method of operation for paralleled units is with the CT's located on the "Load-Side" or downstream of the AccuSine PCS units.
- When it is desired to place the CT's on the "Source-Side" or upstream of the AccuSine PCS units, then for this case:
  - units connected in parallel, restricted to 10, must use common CT's,
  - observe the additional CT-requirements of **Appendix C**: Multiple Unit Operation with source-side connected CT's.

The CT's have a limited output-VA. Therefore, it is imperative to observe the wire-length limits (maximum total wire-length between the CT's and all AccuSine PCS units in line). In the following Table 3-6, formula's to calculate these wire-length limits are given. Observe that these limits depend on the chosen CT's which have different output VA for different transformer ratio's. Furthermore the wire-length limits also depend on the chosen wire sizes and the number of units (Nu) connected in parallel. Note that the obtained length from applying the formula is in ft. Divide this result by 3.3. to obtain the length in meters.

Table 3-6: CT Wire length limits

Nu = number of units in parallel, having a common set of CT's		**Maximum wire length from CT to all AccuSine units in line**
Wire Gauge (AWG|mm²)	12 | 4	(Output VA/25 - 0.1*Nu) * 257 [ft]
	10 | 6	(Output VA/25 - 0.1*Nu) * 257 *3.2 [ft]

Note: For 500:5 CT, Output VA = 3.
For 1000:5 CT, Output VA = 10.
For 3000:5 and 5000:5 CT's, Output VA = 45.
Note: Wire size of the CT must be minimally 12 AWG (4 mm²).

CAUTION

HAZARD OF EQUIPMENT DAMAGE

Compliance with the wire lengths limits specified in Table 3-6 is critical to assure proper performance of the AccuSine unit. Any splicing to the CT leads needs to be done with crimp style connectors and soldered. Matching of the CT wiring terminals must follow the code based on the X1 and X2 markings rather than relying on wire colors because color conventions used by CT vendors are not consistent.

Failure to follow this instruction can result in equipment damage.

4. START-UP

4.1 General

4.2 Installation Inspection

This section provides the sequence of steps required to start-up AccuSine PCS. Before applying power read and understand this information thoroughly.

⚠ WARNING

HAZARD OF ELECTRICAL SHOCK, BURN OR EXPLOSION

- AC line voltages applied to the input of AccuSine PCS are lethal. Certain parts of the unit, including printed circuit boards, are at hazardous voltage levels. These hazardous voltage levels persist for some time after the unit has been disconnected from the input power.
- Only qualified electrical personnel familiar with the construction and operation of AccuSine PCS should carry out installation, start-up, and subsequent maintenance of AccuSine PCS.
- Local and national codes should always be observed.

Failure to follow these instructions can result in death or serious injury.

Be sure the input voltage matches the voltage rating of the unit installed.

Inspect all connections for both power and control wiring. Insure that the correct termination points have been made for each wire. Insure that all connections are firmly tight prior to start-up.

4.3 Digital Interface Module (DIM)

The DIM is located on the front of the enclosure. See Figure 5-1. Note that for chassis-type units the DIM and its connection cable are optional and have to be ordered and mounted separately.

The pre-charge contactor activates within 3 seconds after application of AC power. The DIM will initialize within approximately 3 seconds. Refer to Chapter 5 for operating AccuSine PCS.

Note: If a 'Fault' message appears on the screen upon application of AC power, do not attempt to operate AccuSine PCS. Refer to Table 7-6 for fault diagnosis.

5. DIGITAL INTERFACE MODULE

5.1 General

The information provided in this chapter describes the various controls and indicators contained in the DIM. Read the entire chapter before proceeding.

Operation is with simple keystrokes. The DIM is used to access parameters and read status and warning codes. The commands entered through the keypad are seen on the display.

5.2 Keypad Functions

The full DIM is displayed on the next page.

Individual keys control functions as follows:

RUN - Starts the AccuSine PCS. A green LED lights up to indicate “RUN“-state. (Touchpad color: Green)

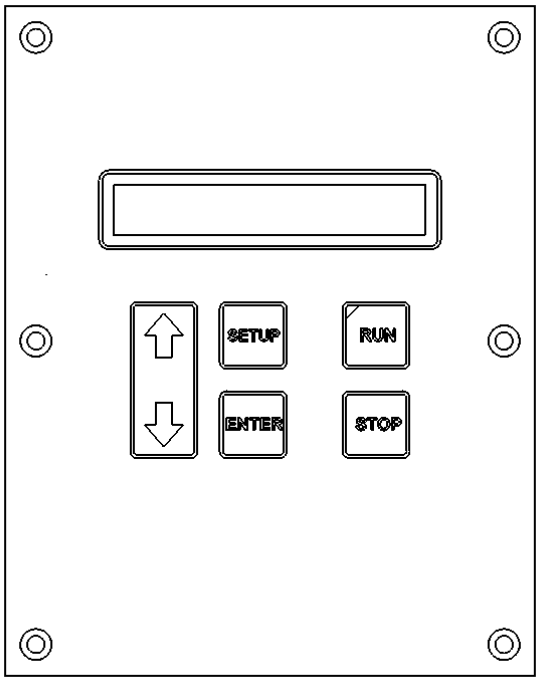
STOP - Stops the AccuSine PCS. Run light is extinguished when “STOP” is depressed. (Touchpad color: Red)

SETUP - Selects the SETUP mode to change parameters.

ADJUST - Moves the cursor up or down by one line at a time. The cursor cycles back to the first parameter at the end of the list.

ENTER - Selects the parameter to adjust in the SETUP mode. After the parameter has been adjusted with the **[ADJUST**] keys to the desired value, press **[ENTER]** again to move on to a new parameter.

Figure 5.1: Digital Interface Module



5.3 Operation/Parameter Adjustments

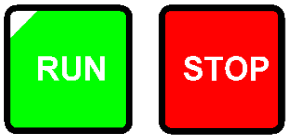
The DIM has three functions:

- running and stopping the unit,
- viewing display parameters, and
- adjusting setup parameters.

Each function is discussed in detail below.

5.3.1 Running and Stopping AccuSine PCS

The function keys are:



These commands are entered simply by pressing the appropriate key.
A green LED within the “RUN”-key lights up if **[RUN]** is activated. See Chapter 4.4 for conditions under which the unit will not operate or enter a stand-by mode (low-load condition).

5.3.2 Viewing the Display Parameters

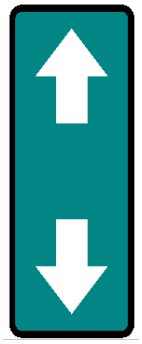
The DIM allows the operator to either view display parameters or to change the AccuSine setup parameters. Selection for any of these modes is by toggling with the **[SETUP]** key. The display parameters indicate the status of AccuSine PCS and include various measurements in the system. System parameters are displayed on the screen as the default set of parameters. They are tabulated in Table 5-1.

The **[ADJUST]** arrows enable the operator to view all of the display parameters by scrolling.

Table 5-1: Display Parameters

Display Parameter	Function
LINE VOLTS	AC rms line voltage
LOAD Irms A	Total rms current of load, A-phase
LOAD Irms B	Total rms current of load, B-phase
LOAD Irms C	Total rms current of load, C-phase
OUTPUT Ih A	Harmonic rms output current of AccuSine PCS, A-phase
OUTPUT Ih B	Harmonic rms output current of AccuSine PCS, B-phase
OUTPUT Ih C	Harmonic rms output current of AccuSine PCS, C-phase
LOAD Ih A	Harmonic rms current of load, A-phase
LOAD Ih B	Harmonic rms current of load, B-phase
LOAD Ih C	Harmonic rms current of load, C-phase
LOAD Ipf	Reactive rms current of load
OUTPUT Ipf	Reactive rms output current of AccuSine PCS
DC Bus Volts	DC bus voltage
CB Temp degC	Control PCB temperature (in deg. C)
UNIT RATING	AccuSine PCS unit rating
Temp HB3	Temperature (in deg. C) of right-side heatsink for AccuSines rated at 300 Amp (no significance for other ratings)
Temp 3ph HB1	Temperature (in deg. C) of heatsink (left-side heatsink for AccuSines rated at 300 Amp)

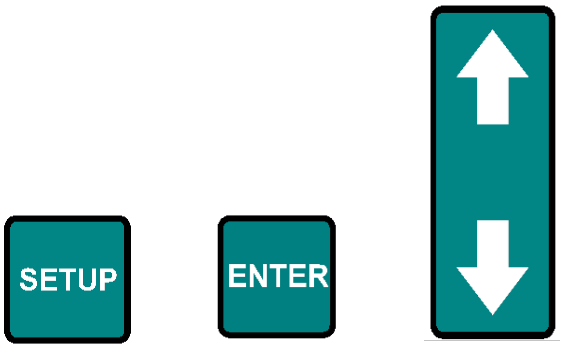
- Pressing an **[ADJUST]** arrow once scrolls the cursor or the display parameters by one line.



- Sustained pressing of an **[ADJUST]** arrow scrolls the cursor or the display parameters repeatedly, allowing the operator to move more quickly to the desired parameter.

5.3.3 Changing the Setup Parameters

The operator can change the setup parameters listed in Table 5-2 to control the operation of AccuSine PCS. To make such changes, the operator uses the **[SETUP]**, **[ENTER],** and **[ADJUST]** keys. Before changing any operator-adjustable parameter the operator has to input the password “0007”.



To enter the SETUP mode, press the **[SETUP]** key once. Then,

- Move the cursor to the parameter to be changed using the **[ADJUST]** arrows.
- If the parameter has a numeric value (incl. the password):
  - ❖ Press the **[ENTER]** key to begin the process of changing the parameter.
  - ❖ Change the value of the parameter using the **[ADJUST]** arrows. The parameter may be changed in this manner within permissible bounds. Attempts to exceed the bounds will activate a warning message.
  - ❖ Press the **[ENTER]** key to finish the process of changing the parameter.
  - ❖ Use the **[ADJUST]** arrows to move to another parameter, if desired.
- If the parameter is a toggle to be turned on or off or to choose between two modes of operation:
  - ❖ Toggle between choices using the **[ENTER]** key.
- Use the **[ADJUST]** arrows to move to another parameter, if desired.
- Anytime that it is desired to save any changes made to the parameter:
  - ❖ set the parameter “**SET DEFAULT**” to “**ON**”.
- To exit the SETUP mode after changing parameters press **[SETUP]**

Note: Some setup parameters critical to the operation of AccuSine PCS can only be adjusted by factory-trained personnel. These parmeters are not shown in Table 5.2.

Table 5-2 Setup Parameters

Parameter Name	Function	Factory Default	User Setting
Factory Set Up	Resets all parameters to their factory default settings	OFF	
Save to Mem	Stores all parameter settings into memory: battery backed-up DRAM	OFF	
Recall Mem	Resets all parameters to the settings last saved with "Save to Mem"	OFF	
Factory Pw	Password, required to change any parameter setting	0000	
Harm. Mode	Activates/deactivates harmonic correction mode	OFF	
P.F. Mode	Activates/deactivates power-factor correction mode	OFF	
P.F. %	Select the percentage to which the power factor should be corrected. Must be 30<P.F. PERCENTAGE<100 lagging	100	
CT Ratio	Select primary current rating of current transformers (CT) used. Note: The secondary current rating must be 5 Amp. Options for primary current ratings are 500 A, 1000 A, 3000 A and 5000 A.	1,000	
CT Position	Select whether the current transformers are installed on the source or load side of the AccuSine PCS.	LOAD	
AUTOSTART	If selected and the 3-phase AC line voltage has dropped out below 15% of nominal while the AccuSine PCS is in **RUN** mode, then the unit will start up automatically with a delay after the mentioned line voltage is back within 15% of nominal value.	OFF	
NO. OF 50As	Enter the number of paralleled 50 Amp units with same CT location.	0000	
NO. OF 100As	Enter the number of paralleled 100 Amp units with same CT location.	0000	
NO. OF 300As	Enter the number of paralleled 300 Amp units with same CT location.	0000	
4WireSystem	If selected, AccuSine PCS will properly correct harmonics and power-factor on line-to-neutral connected loads (except 0-sequence harmonics).	OFF	

Table 5-2: Setup Parameters (continued)

Parameter Name	Function	Factory Default	User Setting
PWR_SAVE_OFF	Percentage of rated output current below which the unit will shut down (default value is 10%; must be lower than PWR_SAVE_ON).	0010	
PWR_SAVE_ON	Percentage of rated output current above which the unit will start-up (default value is 15%; must be higher than PWR_SAVE_OFF).	0015	
DISPLAY FAULTS	Displays date– and time-stamped entries in the fault-log	OFF	
RESET FAULTS	Resets all entries in the fault log	OFF	
Gain Cal.	Feedback gain: unity if set to **0000**. For amplification, scroll to positive values. For attenuation: scroll to negative values.	0000	
AUTODETECT	Instructs controller to determine grid voltage range and frequency	ON	
ALC_VOL_SET	Grid voltage (Volt, RMS): adjusted automatically if parameter **AUTODETECT** is set to **ON**.	RMS voltage (Volt)	
FREQUENCY	Grid frequency (Hz): adjusted automatically if parameter **AUTODETECT** is set to **ON**.	Grid Freq (Hz)	
MONTH	Sets current month	Preset for correct date and Pacific Standard Time	
DAY	Sets current day of month		
YEAR	Sets current year		
HOUR	Sets current hour (24-hour clock)		
MINUTE	Sets current minute		
SET TIME	Stores current time and date information (Resets automatically from “ON” to “OFF”).	OFF	
AUTO_STRT_DL	Delay of **AUTOSTART** feature (in seconds)	0030	
FLT_RSTRT_DL	Delay of a restart of the AccuSine PCS after the occurrence of a non-critical fault (in seconds).	0030	

5.3.4 Power Factor Compensation Mode

The Power Factor Compensation Mode is obtained by entering the SETUP mode of the **DIM** followed by a selection of the **P.F. Mode.** As a result the unit will generate the proper amount of reactive current power factor to cause the power factor to adjust to the value as selected with the parameter **P.F. %**. When both the **Harmonic Mode** and the **P.F. Mode** are selected, the unit will use its output current capacity to produce both harmonic currents and reactive current as required by the requested “PF%”. When the rms-sum of the required harmonic current and required reactive current exceeds the rated rms-output current, the unit will supply the required harmonic current first. Any remaining capacity of the Accusine PCS will be used for the generation of reactive current up to the rated output of the unit. See also Chapter 6.2.

5.4 Diagnostics

There are two general conditions under which AccuSine PCS will not start or discontinue operation. These conditions are

- An insufficient load current level, or
- Fault conditions (See also Chapter 7 “Troubleshooting”)

5.4.1 Load-Dependent Operation

AccuSine PCS continuously senses and displays the rms-sum of the required load harmonic current and required load reactive current. Upon application of the “RUN” command AccuSine PCS will start operation only if this current level is at least as high as the percentage value placed in the **PWR_SAVE_ON** Parameter (Factory default is 0%). If the required rms output current level is below this threshold on startup, AccuSine PCS remains in a stand-by mode with the **[RUN]** key lighted.

If the required rms load-current level during operation drops below the percentage value placed in the **PWR_SAVE_OFF** parameter (Factory default is 0%), AccuSine PCS will stop and the fans will shut down. The unit will remain in the stand-by mode with the **[RUN]** key lighted. The unit will restart automatically when the required rms load-current exceeds the percentage value set in the **PWR_SAVE_ON** parameter.

This energy-saving feature can be disabled by setting both parameters to “0000”. In this case AccuSine PCS will operate continuously for as long as it is left in [RUN] mode.

5.4.2 Fault Handling

AccuSine PCS issues a fault message on the display in the event of a fault condition. A fault will cause AccuSine PCS to stop.

The fault diagnostics differentiate between internal and external, as well as between “critical” and “non-critical” faults.

“Internal” faults are defined as abnormal operating conditions inside AccuSine PCS. “External” faults are defined as abnormal conditions on the grid to which AccuSine PCS is connected or an improper installation of the external current transformers.

If a fault is critical, AccuSine PCS will not re-start until appropriate action is taken by an authorized service person. The **[RUN]** key is no longer lit, and a 'Critical Fault' message appears on the DIM display. If the fault is non-critical, AccuSine PCS will restart automatically 10 seconds after the fault condition clears. The **[RUN]** key is not lit as long as the unit is stopped. The display shows a 'Non-critical Fault' message which is followed by an 'Automatic Restart' message when the fault clears.

The user may shut down AccuSine PCS at any time by pressing the **[STOP]** key.

For an explanation and the treatment of faults see Chapter 7, “Troubleshooting”.

6 DESCRIPTION OF PERFORMANCE

6.1 General

This chapter provides information explaining how AccuSine PCS performs. Also, provided are the design and operating specifications.

6.2 Theory of Operation

The AccuSine PCS is a power electronic converter utilizing analog and digital logic to inject corrective current for harmonic currents, from the 2nd to the 50th orders, and for reactive current. If sized properly for both harmonics and power-factor correction, AccuSine PCS can improve the power factor as seen by the utility grid to near unity. An AccuSine version which only injects corrective currents for harmonic currents of odd harmonics up to the 25th order is described in detail in Appendix E.

Note: AccuSine PCS may not perform properly if power-factor correction capacitors or passive harmonic filters (“harmonic traps”) are connected to the AC-bus down-stream from the AccuSine PCS current transformers. These devices could be connected to the AC-bus separately or be part of existing equipment. Refer to site one-line diagrams/equipment schematics to verify their absence. Consult Square D if in doubt.

The power components of AccuSine PCS, see Figure 6-1, consist of line fuses, pre-charge contactor, carrier frequency filter, power converter, and bus capacitors. Control logic is not shown.

The input fuses are sized for the rated AccuSine PCS output current. The fuses will disconnect AccuSine PCS from the AC lines in the event that the unit malfunctions. The fuses are Class T rated at 200,000 AIC (amperes of interrupting capacity) for use on virtually any plant electrical system.

Upon application of power, the pre-charge contactor delays actuation until the bus capacitors are sufficiently charged to prevent inrush damage to the bus capacitors. This may take up to eight seconds. Once the bus voltage has reached the operating voltage, the pre-charge contactor closes to permit operation. This contactor will remain closed during all stop and fault conditions. It will open only upon removal of power or if the main input fuses clear.

The carrier frequency at which the power devices of AccuSine PCS are operating is blocked from entering the AC-lines by a tuned filter circuit which consists of the inductors and capacitors on the filter PCB.

The power converter performs two functions. One function is to control the voltage on the bus capacitors by utilizing the diodes of the converter IGBTs, S_1 through S_6, shown in Figure 6-1. The second function is to return power to the AC lines in a manner that cancels harmonic current and corrects poor power-factor caused by the loads to be corrected. [P.F. Mode is a user-selected feature. It must be enabled or disabled via the digital interface module (DIM)] The logic dictates this firing sequence based upon the data received.

Using the current transformers and the AC lines connection, AccuSine PCS measures the power-factor of the load. When P.F. Mode is activated, AccuSine PCS injects reactive current up to its rated total current capacity to bring the displacement power factor to the desired level.

The rated output current of AccuSine PCS is equal to the rms-sum of the harmonic and reactive current injected. The following table provides a representation of this relationship (all values in percent of rated output current)

Table 6-1: Harmonic and Reactive Current Percentages of Full Load Rating of AccuSine

Harmonic current drawn by load	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Maximum reactive current available	0%	44%	60%	71%	80%	87%	92%	95%	98%	99%

The following formula is used to calculate this current relationship:

$$I_{AS} = SQRT(I_h^2 + I_r^2)$$

Where I_{AS} is the total output current of AccuSine PCS,
I_h is the injected harmonic current of AccuSine PCS,
and I_r is the injected reactive current of AccuSine PCS.

Use these percentages to determine the amount of current available for each function. Multiply the above percentage with the AccuSine PCS rated current to obtain the approximate amount of correction provided by AccuSine PCS for each function.

AccuSine PCS is installed directly on the AC lines in parallel to the harmonic - producing load(s), see Figure 6-2. For three phase three-wire AC power systems, two current transformers (CT's) are placed on phases A and B to provide the logic with a representation of the load current. If single-phase line-to-neutral connected loads are present on the same bus, a third CT is required on phase C, and the parameter "4Wire System" has to be activated in the Setup Menu. The AccuSine PCS logic then deducts the fundamental frequency (50 or 60 Hertz) from this signal. At this point the logic inverts the remaining signal and directs the firing of the IGBTs to duplicate the inverted signal. The result is a cancellation of the current harmonics for the upstream electrical system. A low level of harmonic distortion will remain. If the AccuSine PCS has been selected to meet or exceed the total harmonic current produced by the load(s), then the remaining total harmonic current distortion will be less than 5% TDD. (total demand distortion – IEEE 519). This also assures that the total harmonic voltage distortion caused by these loads will be much lower than 5% upstream of the AccuSine PCS location. When operating on a 4-wire system, AccuSine PCS will correct for all harmonics caused by line-to-line connected loads. However, 33% of the harmonic current flowing in the neutral line will remain on the phase currents. Therefore, in this special case a TDD of more than 5% may remain.

Due to functions designed into the logic of AccuSine PCS, the IGBTs cannot be overloaded. The total rms current output of AccuSine PCS is monitored and limited to 100% of the AccuSine PCS current rating. The "At max. capacity" relay will be activated if output current attains these levels and the message "**At max. capacity, I_{out} > 95%**" will appear on the display. As a result, if the total harmonic current present on the AC lines exceeds the total current rating of AccuSine PCS, the total harmonic current distortion may exceed 5%.

In addition, the logic of AccuSine PCS will automatically reduce the total output current of AccuSine PCS if the power-semiconductor temperature

exceeds its rated operating level. This may happen if the ambient temperature exceeds the specified limit (see Appendix A), or if insufficient airflow is provided to a chassis-mount unit. The “Fault” relay will be activated in this case, and the message “**Thermal Limit**” will appear on the display. The unit will continue to run, however, until either the ambient temperature decreases which allows the unit to return to rated-output operation, or the unit shuts down due to an “**Over-Temperature**” fault. In this case, the unit will also resume operation as soon as the internal temperatures have decreased sufficiently.

Note the alternate placement for the CT’s in Figure 6-2. In this case the CT’s are on the AC source side of the AccuSine PCS power connections to the AC lines. The function is the same. However, the harmonic distortion will be effectively cancelled on the source side of the CT’s and not at the AccuSine PCS power connection point.

Figure 6-1: AccuSine PCS Power-Circuit Diagram

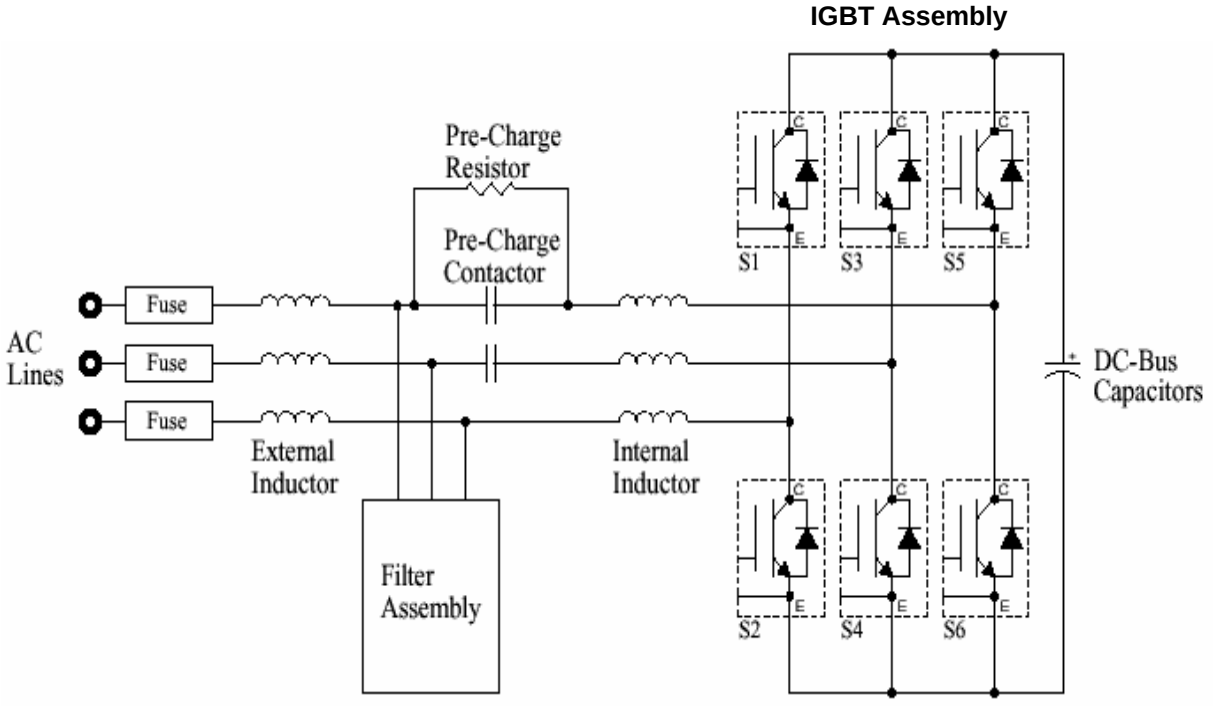
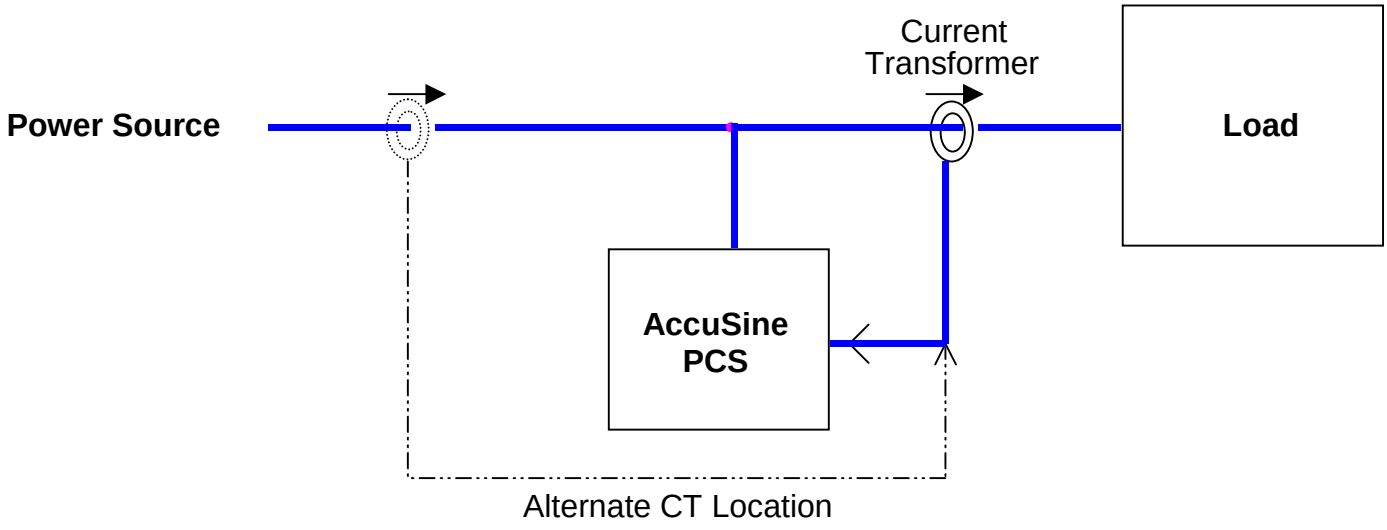


Figure.6-2 Installation One-Line Diagram



7. TROUBLESHOOTING

7.1 General

AccuSine PCS is designed for maximum reliability and should provide a long, trouble-free life when installed and applied correctly. A visual inspection should be performed every six months to insure tight wiring connections and to avoid the build up of any dust, dirt, or foreign debris which can reduce heat dissipation. AccuSine PCS should be mounted in a location that protects the internal circuits from moisture, liquid contaminants, or corrosive gases.

7.2 Potential Malfunction Causes

The most likely causes for malfunction of AccuSine PCS are incorrect installation, excessive heat, and severe grid over-voltages. The following tables provide a systematic approach to perform preliminary trouble-shooting which will be of significant help before consulting an authorized service provider for remedial action.

⚠ DANGER

HAZARD OR ELECTRIC SHOCK, BURN, OR EXPLOSION

The bus capacitor, C_s, stores a large amount of energy. DC-voltage will remain for up to 10 minutes after power removal. Physical contact prior to full discharge can be lethal. Always use a volt-meter to verify that the bus capacitors are discharged prior to contact.

Failure to follow this instruction will result in death or serious injury.

When a critical fault has been identified, the grid power must be removed from the unit to avoid the possibility of electrical shock. The troubleshooting and servicing of this equipment should be handled by a qualified service technician experienced in the area of high power electronics.

It is important to familiarize yourself with the following information before attempting any troubleshooting or service of the unit. Most preliminary troubleshooting can be performed using a digital multi-meter. Before consulting an authorized service provider, check that all power and control wiring is correctly installed per the recommendations given in this manual.

7.3 Fusing

The power and control circuits of AccuSine PCS are protected by 21 fuses. Their designators, types and locations are given in Table 7-1. Knowledge of the integrity of these fuses is most helpful during discussions with an authorized service provider. The integrity of these fuses can be readily checked with a digital multi-meter (DMM). Consult Section 7.5 whenever a fuse is discovered to be blown.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, BURN, OR EXPLOSION

Before attempting to determine the integrity of the fuses it is mandatory to verify that the power to the AccuSine PCS unit has been shut off and locked out and the unit has been powered down for at least 10 minutes. Always use a voltmeter to verify that the bus capacitors are discharged prior to contact.

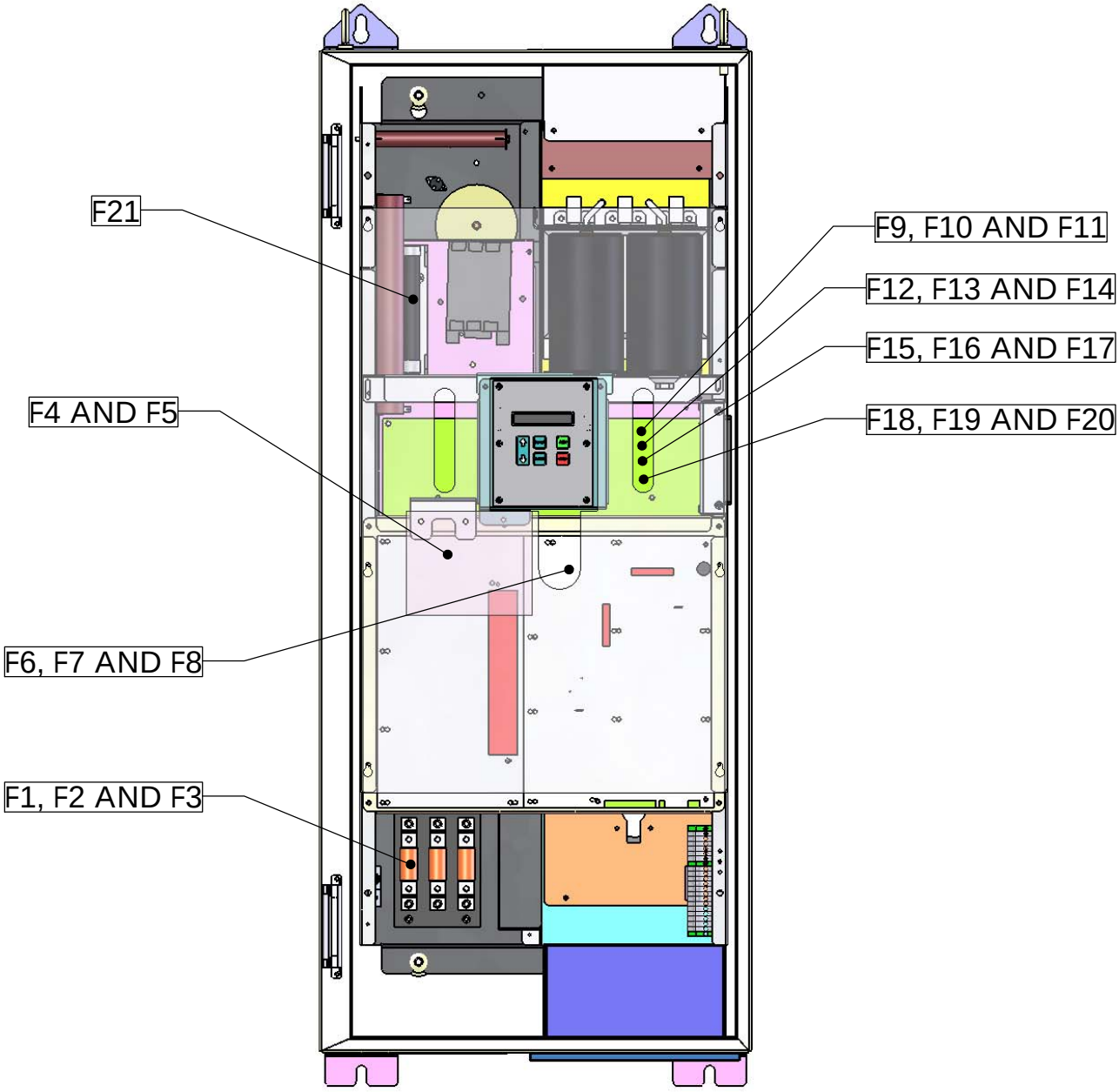
Failure to follow this instruction will result in death or serious injury.

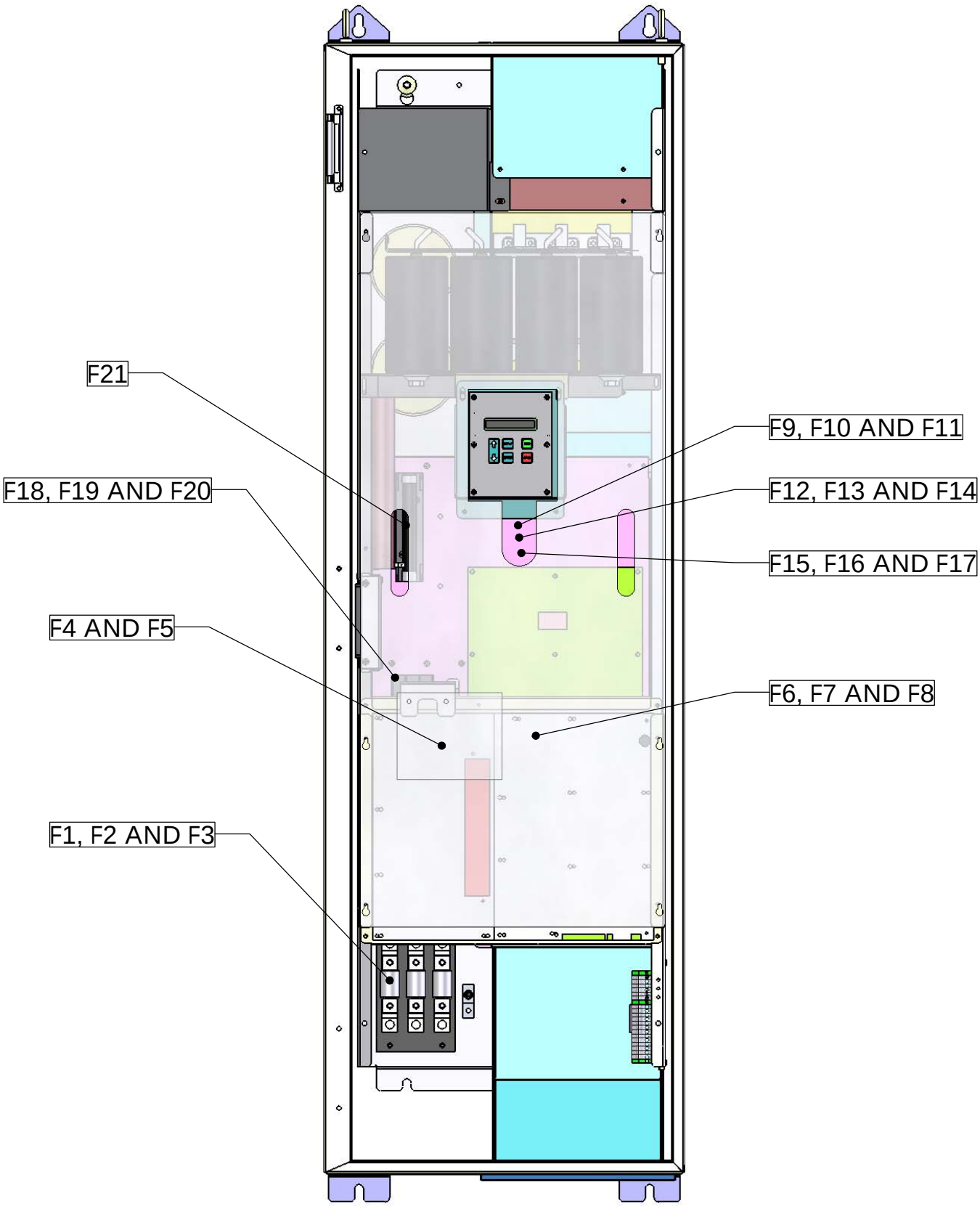
Table 7-1: Fuse Types, Fastener Torques, and Locations

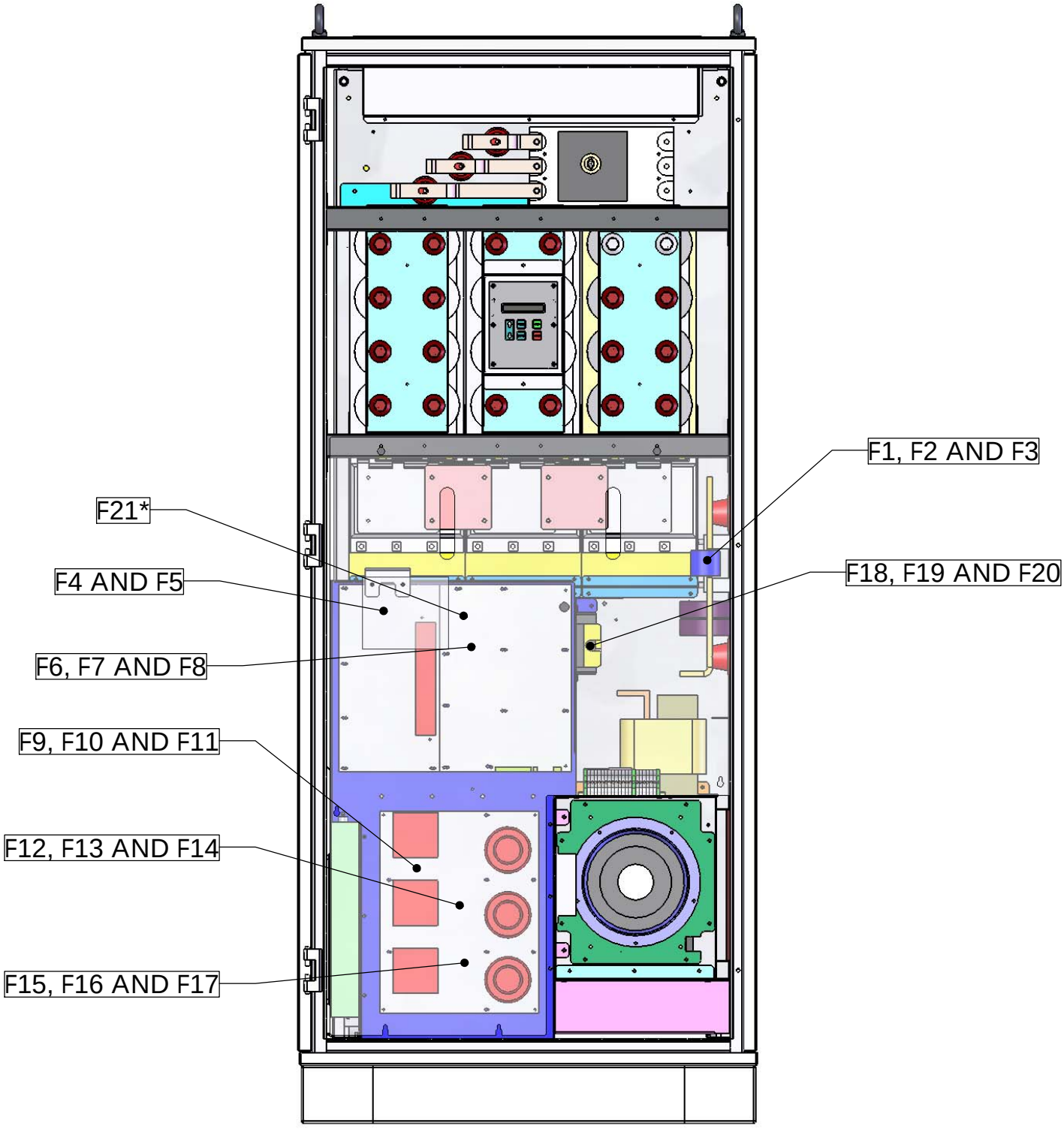
Fuse	Type			Location (see drawings on next pages)		
	50 A Unit	100 A Unit	300 A Unit	50 A Unit	100 A Unit	300 A Unit
AC-Line: F1 – F3	JJS 80 (Bussman) 70 lbs. –in. (7.9 Nm)	JJS 150 (Bussman) 120 lbs. –in. (13.6 Nm)	A6T450 (Shawmut) 192 lbs. –in. (21.7 Nm)	Bottom left		Center right (side panel)
Pwr. Sply: F4, F5	AJT5 (Gould)			PS PCB		
Control PCB: F6 (to 5 V supply, DIM)	451005 (Littelfuse)			Control PCB		
Control PCB: F7 (to +15 V supply, IGBT)	451007 (Littelfuse)			Control PCB		
Control PCB: F8 (to – 15 V supply)	451002 (Littelfuse)			Control PCB		
Filter PCB (L): F9 – F11	LP-CC-7.5 (Bussman)	LP-CC-15 (Bussman)	AJT30 (Gould)	Filter PCB		
Filter PCB (R): F12 - F14	LP-CC-3 (Bussman)	LP-CC-5 (Bussman)	LP-CC-12 (Bussman)	Filter PCB		
Filter PCB (Cll): F15 – F17	LP-CC-5 (Bussman)	LP-CC-9 (Bussman)	LP-CC-20 (Bussman)	Filter PCB		
Voltage sensing: F18 – F20	KTK-R-1/10 (Bussman) Note: Resistance of these fuses is 17 Ohm			Filter PCB	Center left	Center (side-panel mount)
Inrush: F21	FRS-R-2 (Bussman)	FRS-R-2½ (Bussman)	FRS-R-5 (Bussman)	Top left		Center (side-panel mount)

Note:

Bolt torque at 150 lb.in, except for F1, F2, F3 (see table above) and for snubbers at 54 lb.in. and for IGBT 3-phase power wires at 90 lb.in.


F21
F4 AND F5
F6, F7 AND F8
F1, F2 AND F3
F9, F10 AND F11
F12, F13 AND F14
F15, F16 AND F17
F18, F19 AND F20


F21
F18, F19 AND F20
F4 AND F5
F1, F2 AND F3
F9, F10 AND F11
F12, F13 AND F14
F15, F16 AND F17
F6, F7 AND F8



90-10019 Rev -, 300A CH, CHD and N1, Protection Device Locations
* F21 is located on the mounting panel behind this board

7.4 IGBT Test Procedure

Testing of the IGBT's requires a digital multi-meter (DMM) capable of performing "diode"- tests. The following procedure serves as a step-by-step guide.

WARNING

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

In conducting the work to test the IGBT's, power to the Accusine unit must have been shut off for at least 10 minutes to assure that the DC bus capacitors are fully discharged.

Failure to follow this instruction can result in death or serious injury

DMM Positive Probe	DMM Negative Probe	Expected DMM Reading ("Diode-Test" Setting)
PS PCB F4 (top)	IGBT, phase A terminal	OL
	IGBT, phase B terminal	
	IGBT, phase C terminal	
IGBT, phase A terminal	PS PCB F4 (top)	Approx. 0.33 Volts
IGBT, phase B terminal		
IGBT, phase C terminal		
PS PCB F5 (top)	IGBT, phase A terminal	
	IGBT, phase B terminal	
	IGBT, phase C terminal	
IGBT, phase A terminal	PS-PCB F5 (top)	OL
IGBT, phase B terminal		
IGBT, phase C terminal		

In the table above:

- PS PCB is the Power Supply PCB in the Accusine unit
- K1 is the pre-charge contactor in the Accusine unit.

CAUTION

HAZARD OF EQUIPMENT FAILURE

Upon detection that one or more IGBT 's has failed, it is most likely that the pre-charge contactor K1 has failed as well. It is, therefore, recommended to test this contactor as well.

7.5 Troubleshooting Test Procedure

The following is a list of trouble-shooting procedures that can be helpful in determining the cause of the malfunction. The first table, Table 7-3, reflects the trouble-shooting procedure when no power is applied to the unit. See for this pupose the location of the fuses in Section 7.3. The second table, Table 7-4, reflects the trouble-shooting procedure when the unit is powered on. Do not proceed with the second trouble-shooting procedure with power on unless the checks of the power-off trouble-shooting procedures have all been proven to be negative.

Table 7-3: Power-Off Trouble-Shooting Procedure

Indication	Possible Cause	Corrective Action
Any one main fuse F1 – F3 blown	Faulty or loose wiring on that phase of the power circuit	Correct wiring problem, replace fuse
Any two or all main fuses F1 – F3 blown	MOV block shorted	Replace MOV block and fuses
	IGBT(s) malfunction (follow separate IGBT check procedure)	Call Square D
Any one or more control fuses (F18-F20) blown	Incorrect wiring to control PCB	Replace fuse(s), correct wiring
	High-voltage input circuitry on control PCB malfunction	Call Square D
Any one or both power supply fuse(s) F4 & F5 blown	PS PCB malfunction	Call Square D
Any one of Filter PCB fuse(s) F9 – F17 blown	Excessive voltage harmonic distortion on the utility grid (> 10%), or AccuSine PCS resonates with “illegal” load (i.e., power-factor correction capacitors downstream of AccuSine CT’s)	Replace fuse(s), investigate cause
Inrush fuse F21 blown	Inrush resistor R1 shorted	Replace resistor and fuse
	DC-bus shorted	Call Square D
Control PCB fuse F6 blown	Control PCB malfunction	Call Square D
	DIM malfunction	Call Square D
Control PCB fuse F7 blown	Control PCB malfunction	Call Square D
	IGBT Driver in IGBT module malfunction	Call Square D
Control PCB fuse F8 blown	Control PCB malfunction	Call Square D

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, BURN OR EXPLOSION

Only qualified personnel familiar with the general operation of power electronic conversion equipment should attempt to perform the tests described below.

Failure to follow this instruction can result in death or serious injury

CAUTION

HAZARD OF EQUIPMENT FAILURE

Do not proceed with any of these tests if any of the previously described tests indicated a problem since additional damage may result if such problem was not properly resolved. Contact Square D if there is any doubt.

Failure to follow this instruction can result in property damage.

Table 7-4: Powering-On Trouble-Shooting Procedure

Indication	Possible Cause	Corrective Action
DIM blank, K1 open	480 VAC mains not energized (check F1 – F3)	Check feeder and AccuSine PCS disconnect/breaker/fuses
	PS PCB malfunction (check if 660-710 VDC is present between F4 and F5 on PS PCB)	Contact Square D
DIM blank, K1 closed	Loose or open connection between control PCB and DIM	Correct wiring problem
	DIM malfunction	Contact Square D
DIM normal, K1 closed, PS PCB has red LED's or less than 7 green LED's on	PS PCB malfunction	Contact Square D
DIM normal, K1 closed, Control PCB has less than 3 green LED's on.	Control PCB malfunction	Contact Square D
DIM normal, K1 closed, fan(s) not running after pressing RUN on the DIM (this RUN test should be real brief)	Fan-switch on PS PCB malfunction	Contact Square D
	Wiring between PS PCB and fan(s) incorrect	Correct wiring problem
	Fan malfunction	Contact Square D
DIM normal, K1 open	K1-switch on PS PCB malfunction	Contact Square D
	Wiring between K1 and PS PCB incorrect	Correct wiring problem
	K1 coil malfunction (open)	Replace K1 (or coil only)

7.6 Fault Messages

The following tables explain all possible fault messages that the AccuSine PCS controller could use to alert the operator to the fact that some corrective action is required. Faults are classified as “critical” and “non-critical”. After a “non-critical” fault, AccuSine PCS will automatically restart with a short delay after the fault condition ceases to exist. Conversely, AccuSine PCS will not attempt to restart if a “critical” fault has been detected. In this case, operator/service provider action is required.

AccuSine PCS has a built-in fault memory that is battery backed-up which stores the last 15 faults time – and date-stamped. To access the fault memory, in the “SETUP” mode enter the level II password (0007), scroll to parameter “DISPLAY FAULTS”, and press “ENTER”. It is now possible to scroll and record all fault occurrences. To exit, press “SETUP”.

Table 7-5: Fault Messages (Externally Generated Faults)

Fault Message	Explanation	Fault Level
AC Line loss	AC line voltage is below minimum limit (or at zero) on all phases	Non-critical
AC phase Flt	AC line voltage is below minimum limit (or at zero) on one phase	Non-critical
AC imbalance	AC line voltage imbalance between any two phases exceeds 5% or a voltage sensing fuses (F18, F19 or F20) is blown.	Non-critical
AC over volt	AC line voltage exceeds 110% of the rated line voltage on any phase	Non-critical
Sensor fault	AC current transformer shows a reverse phase sequence in relation to the AC line voltage	Critical

Table 7-6: Fault Messages (Internally Generated Faults)

Fault Message	Explanation	Fault Level
User Setup Flt	Internal RAM-data loss. AccuSine PCS is using Factory Default Parameters for operation. Re-entry of customer operating data from commissioning protocol required.	Critical
Flt Time-out	More than 5 non-critical faults occurred within 6 times the duration selected for the Set-Up parameter “Flt_RSTRT_DL at a minimum of 10 seconds.	Critical
3_PH_OT FLT	Heatsink over- temperature. Check for inoperative fan(s), object(s) obstructing AccuSine PCS intake or exhaust air flow, or excessive ambient temperature .	Non-critical
ENCL OT FLT	The enclosure internal temperature has exceeded its maximum operational limit. Check for inoperative fan(s), object(s) obstructing AccuSine PCS intake or exhaust air flow or excessive ambient temperature.	Non-critical
ENCL UT FLT	The enclosure internal temperature has fallen below its minimum operational limit. Check for excessively low ambient temperature.	Non-critical
FILTER FLT	An over-current condition has occurred in the high-frequency line-filter and a fuse was blown.	Non-critical
HBx FLT	The AccuSine PCS line current has exceeded its allowable instantaneous maximum on phase x (x=1,2,3).	Non-critical
Bus Over Vol	The DC-bus voltage has exceeded its allowable instantaneous maximum.	Non-critical
Bus Low Vol	The DC-bus voltage has dropped below its allowable instantaneous minimum.	Non-critical
5V UV FLT	The 5VDC power supply voltage is lower than its minimum allowable limit. Possible cause: drain due to short on 5V or 48 V Supply, or over-temperature of Power Supply PCB.	Critical
5V OV FLT	The 5VDC power supply voltage is higher than its maximum allowable limit.	Critical
15V UV FLT	The 15VDC power supply voltage is below its minimum allowable limit. Possible cause: drain due to short on 15V or 48V Supply, or over-temperature of Power Supply PCB.	Critical
-15V UV FLT	The -15VDC power supply voltage is below its minimum allowable limit. Possible cause: drain due to short on 15V or 48V Supply, or over-temperature of Power Supply PCB.	Critical
FREQ FLT	The switching frequency exceeded 20 kHz in a period of 8.3 millisecond. Possible cause: malfunction of input inductors or Filter PCB or presence of caps downstream of CT’s or insufficient reactance or grid voltage transients	Non-critical
CB OT FLT	Temperature of Control PCB exceeds 60 degrees Celsius.	Non-critical
110 C OT	IGBT heatsink temperature exceeds 110 C	Non-critical

Table 7-7: Keypad-related/General Messages

Stop First!	The parameter selected can not be changed while AccuSine PCS is running. Press “STOP”, change the parameter, then press “RUN”.
Password Reqd.	This parameter can not be changed unless the operator enters the correct password first and then returns to the parameter to make the desired change
Display_Param.	Display parameters can not be changed from the operator panel
Maximum_Limit	The attempted parameter change exceeds the allowed maximum for this parameter
Minimum_Limit	The attempted parameter change exceeds the allowed minimum for this parameter
Auto_Start	AccuSine PCS has been set-up by the operator to restart automatically with a 5 second delay after a shut-down or extended loss of AC power.
MAX. CAPACITY Iout > 95%	The AccuSine PCS output current is between 95 and 100% of its rated current. The “AT MAX. CAPACITY” relay has been activated
Thermal Limit	The AccuSine PCS unit attempted to operate at rated output current. However, due to high ambient temperature, the output current is being scaled back to prevent the unit from shutting down due to heat-sink over-temperature. The “FAULT” and “AT MAX. CAPACITY.“ relays have been activated

Appendix A Specifications

Voltage:	208 – 480V~, +/- 10%
Frequency:	47-63 Hz,
Operating Temperature:	0^0 to 40^0 C
Storage Temperature:	-40^0 to 65^0 C
Relative Humidity:	to 95%, non-condensing
Altitude:	to 1000 meters (>1000m, derate by 10%/1000m)
Enclosure:	NEMA 1 (Suffix "N1"), or Chassis (Suffix "CH")
Input Fuses:	600V~ rated, 200,000 AIC
Surge Withstand Capacity:	IEEE C62.41-1991
Logic Ride-through:	120 seconds upon full loss of input voltage
Output Current Performance:	Self limited to 100% rated
Corrective Capability:	<5% TDD(I) & to near unity displacement power factor
Digital Interface Module:	2 line, 20 character/line alphanumeric
Operators:	Run, Stop, Setup, Enter, Up & Down scroll
Indicator LED:	Run (green)
Information/Diagnostics:	English
Remote Contacts:	Power-on, Run, Fault, At-maximum capacity

Table A-1: Specifications

MODEL	Voltage (AC)	Frequency (Hz)	Total Current (A_{rms})	Maximum Harmonic Cancellation Current (A_{rms})	Maximum Reactive Current Compensation (A_{rms})	Maximum Corrective KVARs (at 480V)	Losses Full Load (kW) for cooling purposes	Exterior Dimensions H x W x D In inches (mm)	Weight In lbs (kg)	Needed CFM (airflow to the inlet)
PCS050D5N1S	480	47 - 63	50	50	50	41.6	1.8	51.8 x 20.7 x 18.5 (1,316 x 526 x 470)	250 (114)	300
PCS050D5CHS	480	47 - 63	50	50	50	41.6	1.8	42.3 x 17.6 x 18.2 (1,074 x 447 x 462)	185 (84)	300
PCS100D5N1S	480	47 - 63	100	100	100	83.1	3.0	68.7 x 20.7 x 18.5 (1,745 x 526 x 470)	350 (159)	500
PCS100D5CHS	480	47 - 63	100	100	100	83.1	3.0	58.0 x 17.6 x 18.2 (1,473 x 447 x 462)	275 (125)	500
PCS300D5N1S	480	47 - 63	300	300	300	250	9.0	74.8 x 33.2 x 19.5 (1,806 x 818 x 496)	775 (352)	1250
PCS300D5CHS	480	47 – 63	300	300	300	250	9.0	74.8 x 31.5 x 19.2 (1,806 x 800 x 488)	650 (295)	1250

Note: AccuSine PCS is factory-set to always perform harmonic correction (HARM Mode). Power factor control (P.F. Mode) is a feature which the user could select on the DIM.

Appendix B
Current Transformer (CT) Technical Data

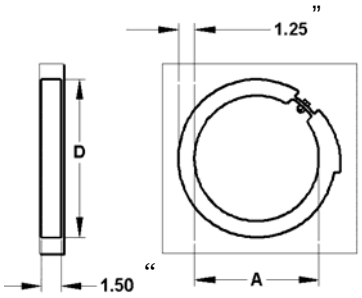
⚠ WARNING

HAZARD OF ELECTRIC SHOCK OR BURN

- Current Transformers must be installed by a qualified person. Do not attempt to connect or troubleshoot current transformers while power is on. This may involve contact with dangerous voltages that may result in DEATH.
- Disconnect the power to the electrical lines on which the CT's are to be mounted before installation. If there is no supply side disconnect available request that the local utility turn off power to the facility.
- Be sure that CT's are mechanically mounted such that they will not shift (due to vibration or any other reason) after installation. Centering CT's on the cable or bus assures greatest accuracy.
- Do not permit CT's to be energized with the secondary terminals open. Dangerous and harmful voltages can be present. Although CT's are voltage limited to less than 40 VAC when the secondary terminals are open circuited, it is not recommended practice to leave the terminals open. Damage to the CT's may also occur.
- The maximum voltage on which CT's can be connected is 600 VAC at 60 Hz.

Failure to follow these instructions can result in death or serious injury

Figure B-1: Round Split Core CTs



Specifications:
- Insulation Level: 600 VAC
- Ambient Temperature: - 45^0 to 200^0 C
- Frequency Range: 50 to 400 Hz
- Secondary leads: 12 feet

Table B-1: Round Split-Core CT's

	Dimensions (inches)					
Part Number	**A (ID)**	**D (OD)**	**Weight (lbs)**	**Accuracy**	**Burden Capacity**	**Secondary Current**
CT500SC	4.0	6.5	3.5	3%	3 VA	5A
CT1000SC	4.0	6.5	3.5	1%	5 VA	5A
CT3000SC	6.0	8.5	4.25	1%	45 VA	5A
CTFCL500058	8.0	10.5	5.5	1%	45 VA	5A

Appendic C
Parallel Units with CT's Installed Upstream

This Appendix provides information for the Installation And Operation of multiple, parallel-connected units with CT's (Current Transformers) which are installed up-stream ("Source-Sense" Configuration).

In addition to the installation steps performed in accordance with Chapters 3.5 and 3.6, the following hardware installation and set-up modification is required:

1) The maximum number of parallel units is restricted to 10 and only the use of one set of CT's upstream of all of these parallel units is allowed. Contact factory if more than 10 units in parallel is desired. See Table 3.1 for wire length limits.

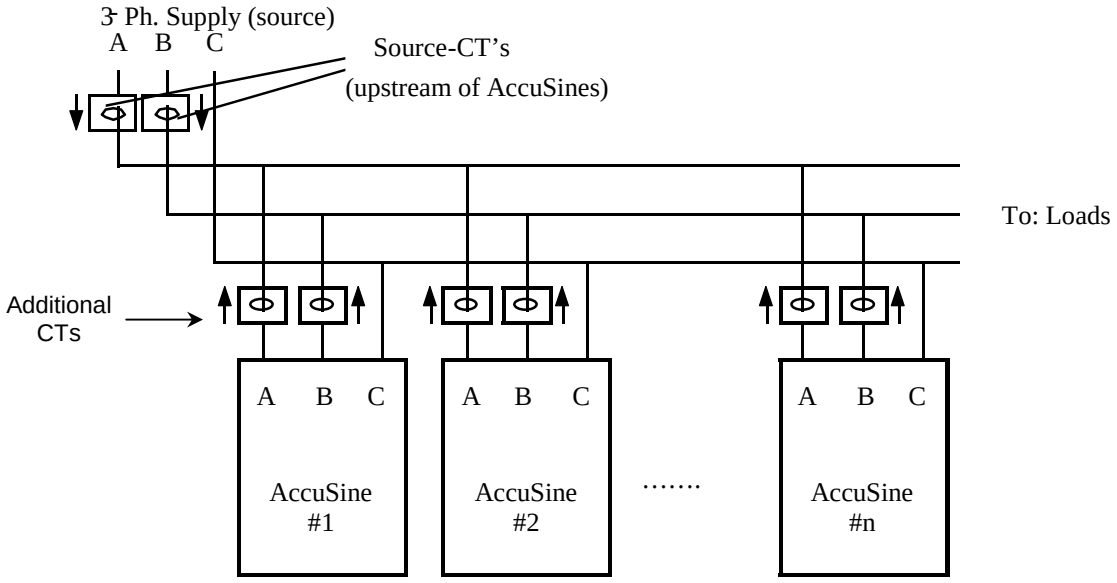
2) On phases A and B of each unit an **additional CT** (Current Transformer) has to be installed (See Figure C-1). Select the current-ratio of these **additional** CT's from the following selection table:

Table C-1: Current-Ratio of Additional CT's

Selected Source-CT Current-Ratio	Additional AccuSine CT Current-Ratio
3,000:5	600:1
5,000:5	1,000:1

Observe the orientation of these additional CT's! The arrow must point towards the load (or H1 at the side of the AccuSine power terminals and H2 on the side of the load).

Figure C-1: Additional CT Configuration



3) Connection of **Additional CT's**

The outputs of the **additional CT's** of all units are connected to TB1 of AccuSine #1 (in parallel with the already installed source-CT's) as follows:
X1 of A-phase additional CT's to TB1-1
X2 of A-phase additional CT's to TB1-2
X1 of B-phase additional CT's to TB1-3
X2 of B-phase additional CT's to TB1-4

4) Spefication:
- same vendor as used for the source CT's
- accuracy 1%

5) AccuSine Set-Up Modification

In the set-up menu (see Chapter 5), the parameter "**CT LOCATION**" must be set to "**LOAD**".

Appendix D: Spare Parts

Table D-1: Spare Parts for 50A and 100A models

Part Description	AccuSine PCS/Mfgr. Part Number		Suggested on-site spares
	50 Amp. Unit	100 Amp. Unit	
AC-Line Fuse (F1-F3)	51-10016/JJS80 (Buss.)	51-10014/JJS150 (Buss.)	3
Inrush Resistor Fuse (F21)	51-10049/FRS-R-2 (Buss.)	51-10051/FRS-R-2-½ (Buss.)	1
Power Supply Fuse (F4, F5)	51-10033/AJT5 (Gould)		2
Filter PCB Fuse (F9 – F11)	51-10045/LP-CC-7.5 (Buss.)	51-10039/LP-CC-15 (Buss.)	3
Filter PCB Fuse (F12 – F14)	51-10043/LP-CC-3 (Buss.)	51-10044/LP-CC-5 (Buss.)	3
Filter PCB Fuse (F15 – F17)	51-10044/LP-CC-5 (Buss.)	51-10038/LP-CC-9 (Buss.)	3
Control PCB Fuse (F6)	51-10025/451005 (Littelfuse)		-
Control PCB Fuse (F7)	51-10040/451007 (Littelfuse)		-
Control PCB Fuse (F8)	51-10026/451002 (Littelfuse)		-
Volt Sensing Fuse (F18 – F20)	51-10022/KTK-R-1/10 (Buss.)		3
MOV Block (MOV1)	45-10010		-
IGBT Assembly	18-10004	18-10005	-
DC-bus Assembly	13-10027	13-10028	-
Fans (2 total)	19-10005	19-10005 (enclosure) 19-10008 (heat sink)	- 1
Pre-charge Contactor (K1)	50-10015	50-10016 – ABB type 50-10019 – Schneider type	-
Inrush Resistor (R1)	40-10266		-
Filter Resistor (R2-R4)	40-10267	40-10269	-
External Resistor (R5-R7)	40-10268	40-10270	-
Filter PCB	12-10029	12-10028	1
Power Supply PCB	12-10022		1
Control PCB	13-10053	13-10054	1
Display Interface Module (DIM)	13-10018 (DIM) 17-10065 (DIM cable)		- -
Internal Inductor (L1–L3)	42-10026	42-10029	-
External Inductor (L4)	-	42-10027	-
FPGA (subject to update)	14-10005.02.02	14-10005.02.02	-
DSP (subject to update)	14-10006.03.09	14-10007.03.09	-
Bleeding resistor	40-10288		-
BF board for 50 Hz fundamental	12-10046		-
BF board for 60 Hz fundamental	12-10047		-

Table D-2: Spare Parts for 300A

Part Description	AccuSine PCS/Mfgr. Part Number	Suggested On-site Spares
AC-Line Fuse (F1-F3)	51-10046/A6T450 (Shawmut)	3
Inrush Resistor Fuse (F21)	51-10048/FRS-R-5 (Bussman)	1
Power Supply Fuse (F4, F5)	51-10033/AJT5 (Gould)	2
Filter PCB Fuse (F9 – F11)	51-10037/AJT30 (Gould)	3
Filter PCB Fuse (F12 – F14)	51-10053/LP-CC-12 (Bussman)	3
Filter PCB Fuse (F15 – F17)	51-10052/LP-CC-20 (Bussman)	3
Control PCB Fuse (F6)	51-10025/451005 (Littelfuse)	-
Control PCB Fuse (F7)	51-10040/451007 (Littelfuse)	-
Control PCB Fuse (F8)	51-10026/451002 (Littelfuse)	-
Volt Sensing Fuse (F18 – F20)	51-10022/KTK-R-1/10 (Buss.)	3
MOV Block (MOV1)	45-10010	-
IGBT Assembly (outside)	18-10012 (2 each)	2
IGBT Assembly (center)	18-10011	2
DC-bus Assembly	13-10029	
Fan, enclosure	19-10008	-
Fan, heatsink	62-10024	1
Pre-charge Contactor (K1)	50-10017	1
Inrush Resistor (R1-R3)	40-10278	-
Filter Resistor (R4-R9)	40-10280	-
External Resistor (R10-R12)	40-10281	-
Filter PCB	12-10027	1
Power Supply PCB	12-10022	1
Control PCB	13-10055	1
Display Interface Module (DIM)	13-10018 (DIM) 17-10065 (DIM cable)	- -
Internal Inductor (L1–L3)	42-10031 (3 each)	-
External Inductor (L4)	42-10025	-
FPGA (subject to update)	14-10005.02.02	-
DSP (subject to update)	14-10008.03.09	-
BF board for 50 Hz fundamental	12-10046	-
BF board for 60 Hz fundamental	12-10047	-

Appendix E
AccuSine Band-Pass Filter (BF board)

This Appendix covers the use of AccuSine if it is provided with an optional BF board. This BF board is a printed circuit board that can be attached to existing standoffs on the Control board of a standard AccuSine. It is well known that currents flowing into non-linear loads are often highly distorted relative to a sinusoidal waveform at the fundamental frequency, i.e. the currents contain in addition a spectrum of undesirable orders of harmonic currents. The standard AccuSine (without the BF board) injects corrective currents to reduce all distortion in these load currents. The use of the BF board allows AccuSine to operate as a filter which only injects corrective current at certain harmonic orders of the load current. This is beneficial in certain applications, in particular for capacitive loads that cause the existence of resonance at relatively high frequencies. AccuSine may inject currents at the resonance frequency of these capacitive loads that could lead to excessive current oscillations. The use of the BF board avoids this situation by assuring that AccuSine only injects corrective currents at frequencies limited to a value less than the mentioned resonance frequencies. In this version of the AccuSine BF board, the injected corrective currents are limited to odd harmonics up to the 25th order with the following stipulations:

- The 3rd harmonic order corrective current injection can be enabled and disabled as desired.
- The 9th harmonic order and higher order triplen are not injected at all. In most applications these harmonic orders are minimal.

Communication between the BF board and the Control board is through a 10-pin ribbon cable connected to connector **J51** on the Control board and connector **J1** on the BF board. In using the BF board, the following issues need to be understood and the associated requirements must be strictly followed.

(A) OPERATION OF BF BOARD

With the BF board installed, operation of AccuSine can be selected to bypass the BF board simply by moving the connection of jumpers on headers **JP1** and **JP2** on the BF board as shown on the Table E-1 below. Bypassing the BF board permits AccuSine to revert back to its standard operation of injecting corrective currents to reduce all distortion of the load current.

Table E-1: Use of BF board

	JP1 Header (for A-phase)	**JP2** Header (for B-phase)
BF board **in circuit**	Connect pin 1 to pin 2 Do not connect pin 2 to pin 3	Connect pin 1 to pin 2 Do not connect pin 2 to pin 3
BF board **bypassed**	Connect pin 2 to pin 3 Do not connect pin 1 to pin 2	Connect pin 2 to pin 3 Do not connect pin 1 to pin 2

Enabling or disabling the injection of corrective current for the 3rd harmonic order is done by moving jumpers on the headers as shown in Table E-2.

Table E-2: Injection of 3rd harmonic corrective current

	JP3 Header (for A-phase)	**JP4** Header (for B-phase)
3rd harmonic current injection **enabled**	Connect pin 1 to pin 2 Do not connect pin 2 to pin 3	Connect pin 1 to pin 2 Do not connect pin 2 to pin 3
3rd harmonic current injection **disabled**	Connect pin 2 to pin 3 Do not connect pin 1 to pin 2	Connect pin 2 to pin 3 Do not connect pin 1 to pin 2

(B) CONNECTION of CT's

In section 3.5 the use of CT's for standard AccuSines has been explained in detail. Fig. 6-2 shows that the CT's can be connected on either the grid (power source) side or on the load side, i.e. respectively upstream or downstream of AccuSine.

Fig. 3-11 shows the connection of the CT wiring **if the CT's are connected at the load side**. These CT's are needed to be installed on phase A and B. (for 4-wire systems a CT on the C phase is needed as well). This connection remains the same whether or not the BF board is used.

However, **if the CT's are desired to be connected at the source (grid) side**, i.e. upstream of the AccuSine, then in addition to these source-side CT's it is necessary to install **additional CT's** on phase A and B on the input lines of AccuSine as shown in Figure C-1 (Note: also on phase C for 4-wire systems). The requirements for these **additional CT's** are exactly the same to those of the **additional CT's** used for parallel AccuSine units which have their source-side CT's connected upstream of the AccuSines.

In conclusion, if CT's are installed at the source (grid) side of AccuSine, then the use of the BF board requires **additional CT's** to be installed on the 3-phase power cable feeding AccuSine and connected as shown in Figure C-1, and must meet all of the following requirements:

1. The current ratio of these **additional CT's** must be the same as those used for the source-side CT's already installed.
2. Orientation of these **additional CT's** must point towards the load (or H1 at the side of the power terminals of AccuSine and H2 on the side of the load).
3. The outputs of the **additional CT's** are connected to TB1 in parallel with the already installed source-side CT's :

- X1 of A-phase additional CT to pin 1 of TB1
- X2 of A-phase additional CT to pin 2 of TB1
- X1 of B-phase additional CT to pin 3 of TB1
- X2 of B-phase additional CT to pin 4 of TB1
- Note: for 4-wire systems, an additional CT for phase C is also needed, and for this additional CT the wires on X1 and X2 are to be connected to pins 5 and 6.

(C) PROGRAMMING ON DIM (Digital Interface Module):

As mentioned above, the CT's can be either connected at the grid (source) side or at the load side. The DIM requires the parameter "**CT Position**" to be specified. Make sure that this parameter for both cases is programmed as "**LOAD**".

(D) PART NUMBER of the BF board:

- For 50 Hz of fundamental frequency: 12-10046.
- For 60 Hz of fundamental frequency: 12-10047.

Appendix F
AccuSine Seismic Certification

Seismic Certification of AccuSine PCS:
AccuSine PCS units are seismically certified for site-specific seismic requirements of the model building codes and/or standards listed below. Optional construction features may be required, depending on the location of the installation and the particular code and/or standard of interest. Seismic certifications of compliance and equipment labels can be provided upon request. To maintain validity of this certification, the installation instructions provided in this section must be followed.

Responsibility for Mitigation of Seismic Damage:
For the purposes of the model building codes, AccuSine PCS are considered nonstructural building components. Equipment capacity was determined from tri-axial seismic shake table test results as defined in the International Code Counsel Evaluation Service (ICC ES) Acceptance Criteria for Seismic Qualification Testing of Nonstructural Components (AC156).

Unless otherwise indicated, an equipment importance factor of 1.5 (Ip=1.5) was used, indicating that equipment functionally was verified before and after shake table seismic simulation testing. This importance factor is indicative of critical facilities where maximizing the portability of post event functionally is a priority.

AC156 is published by ICC ES and has been recognized by the Building Seismic Safety Counsel (BSSC) as an appropriate methodology in the 2003 National Earthquake Hazard Reduction Program (NEHRP) commentary.
The National Institute of Building Sciences established the BSSC in 1979 to develop and promote regulatory provisions for earthquake risk mitigation at the national level.

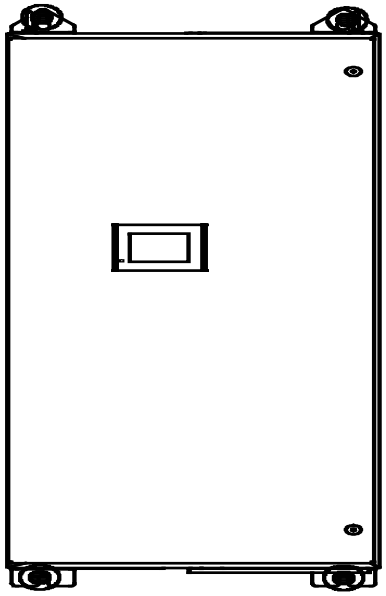
Incoming and outgoing cable and conduit must also be considered as related but independent systems. They must be designed and restrained to withstand the forces generated by the seismic event without increasing the load transferred to the equipment. For applications where seismic hazard exits, bottom entry and/or exit of cable and conduit is preferred.

Seismic qualification of nonstructural components by Schneider Electric is just one link in the total chain of responsibility required to maximize the probability that the equipment will be intact and functional after seismic event. During a seismic event, the equipment must be able to transfer the loads that are created through the mounting pad and anchorage to the load-bearing path of the building structural system.

The structural civil engineer or design engineer of record is responsible for detailing the equipment connection and anchorage requirements (including the lateral restraint system if appropriate) for the given installation. The installer and manufacturers of the anchorage and lateral restraint system are responsible for the specification and performance of these systems.

Securing AccuSine PCS Units to Wall and Floor, Seismic Hazard Designated Locations:
Each AccuSine PCS unit must be anchored per detail supplied by engineer of record to the load-bearing path of the building structural system. For the anchoring locations of 50A and 100A PCS units, see Figures F1 to F3 for units with the different types of enclosures (N1 wall-mounted or ground floor, N12 and IP). For the anchoring locations of the 300A PCS units, see Figures F4 and F5.

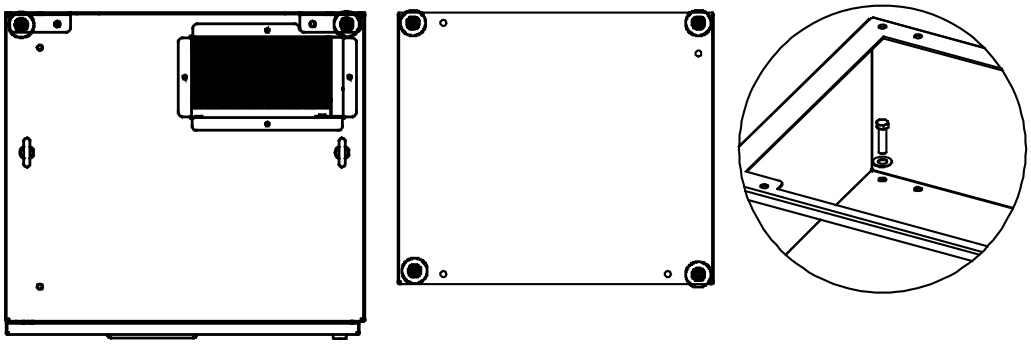
Figure F1, 50A and 100A PCS units with N1 enclosure:



To secure unit in place use 3/8-16 Grade 5 or higher bolts (furnished by others) and Belleville washers (furnished by Schneider Electric). Torque bolts to the value specified by the manufacturer of the anchor.

Figure F2: 50A and 100A PCS units with N1 and Floor Stand enclosure:

If the spectral acceleration value (S_s as defined by the International Building Code NFPA 5000) is in excess of 2.67g (such as the New Madrid seismic area), then the equipment must also be braced at the top using a lateral restraint system. A lateral restraint system is also required in situations where horizontal motion at the top of the AccuSine PCS is not be desirable (such as applications where top entry and/or exit of conduit are used). This system must be capable of transferring the loads created to the load-bearing path of the building structural system.

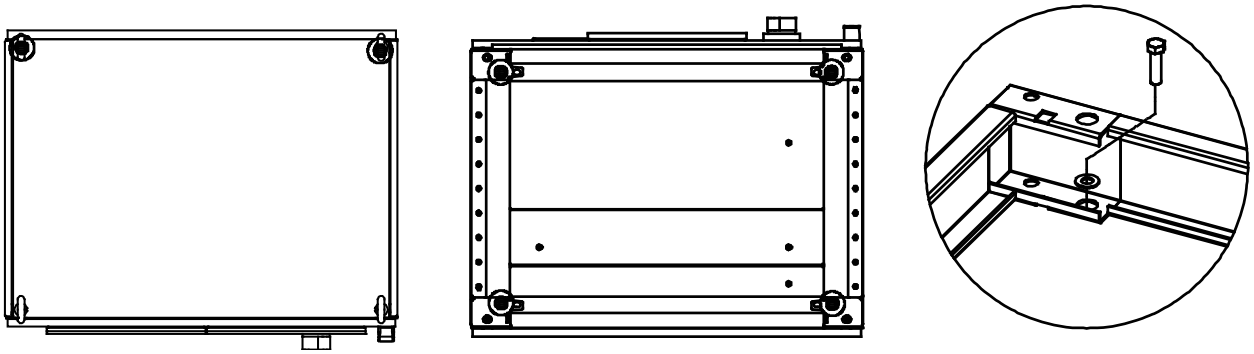


To secure unit in place, on floor, use 3/8-16 Grade 5 or higher bolts (furnished by others) and Belleville washers (furnished by Schneider Electric). Torque bolts to the value specified by the manufacturer of the anchor. To secure unit in place using lateral bracing remove the wall mounting brackets and then fit bracing to unit.

First view (left) is top of unit, second view (middle) is bottom of unit and third view (right) is mounting hole location, inside of Floor Stand.

Figure F3, 50A and 100A PCS units with IP or N12 enclosure:

If the spectral acceleration value (S_s as defined by the International Building Code NFPA 5000) is in excess of 1.88g (such as the New Madrid, California, Alaska and Hawaii seismic area), then the equipment must also be braced at the top using a lateral restraint system. A lateral restraint system is also required in situations where horizontal motion at the top of the AccuSine PCS is not be desirable (such as applications where top entry and/or exit of conduit are used). This system must be capable of transferring the loads created to the load-bearing path of the building structural system.

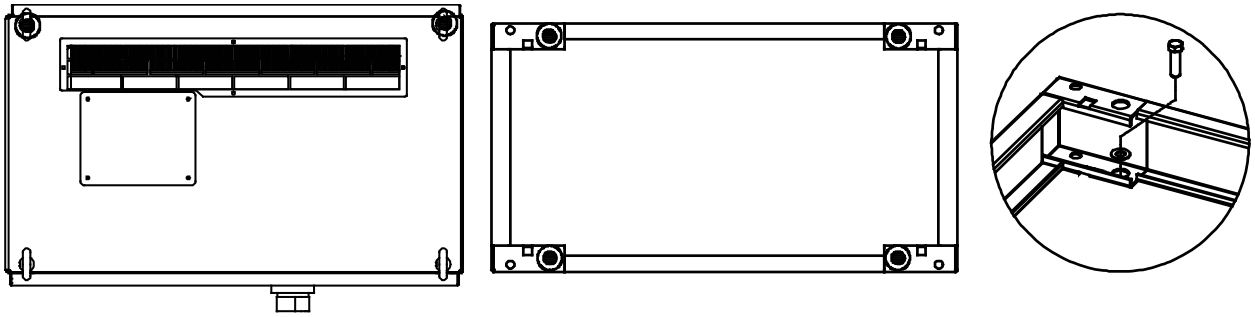


To secure unit in place, on floor, use 7/16-18 Grade 5 or higher bolts (furnished by others) and Belleville washers (furnished by Schneider Electric). Torque bolts to the value specified by the manufacturer of the anchor. To secure unit in place using lateral bracing remove the lifting eyes, fit bracing to unit and re-install lifting eyes.

First view (left) is top of unit, second view (middle) is bottom of unit and third view (right) is mounting hole location, inside of unit plinth.

Figure F4, 300A PCS units with N1 enclosure:

If the spectral acceleration value (S_s as defined by the International Building Code NFPA 5000) is in excess of 1.88g (such as the New Madrid, California, Alaska and Hawaii seismic area), then the equipment must also be braced at the top using a lateral restraint system. A lateral restraint system is also required in situations where horizontal motion at the top of the AccuSine PCS is not be desirable (such as applications where top entry and/or exit of conduit are used). This system must be capable of transferring the loads created to the load-bearing path of the building structural system.

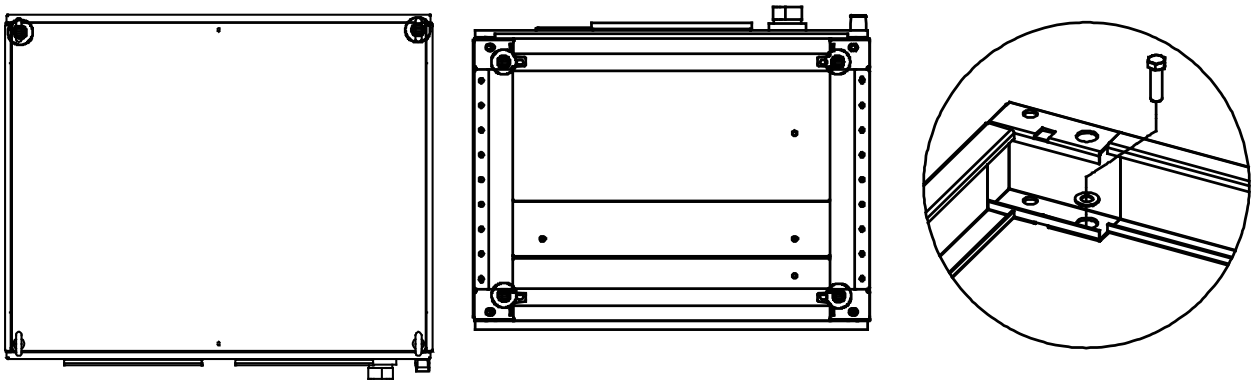


To secure unit in place, on floor, use 7/16-18 Grade 5 or higher bolts (furnished by others) and Belleville washers (furnished by Schneider Electric). Torque bolts to the value specified by the manufacturer of the anchor. To secure unit in place using lateral bracing remove the lifting eyes, fit bracing to unit and re-install lifting eyes.

First view (left) is top of unit, second view (middle) is bottom of unit and third view (right) is mounting hole location, inside of unit plinth

Figure F5, 300A PCS units with IP or N12 enclosure:

If the spectral acceleration value (S_s as defined by the International Building Code NFPA 5000) is in excess of 1.88g (such as the New Madrid, California, Alaska and Hawaii seismic area), then the equipment must also be braced at the top using a lateral restraint system. A lateral restraint system is also required in situations where horizontal motion at the top of the AccuSine PCS is not be desirable (such as applications where top entry and/or exit of conduit are used). This system must be capable of transferring the loads created to the load-bearing path of the building structural system.



To secure unit in place, on floor, use 7/16-18 Grade 5 or higher bolts (furnished by others) and Belleville washers (furnished by Schneider Electric). Torque bolts to the value specified by the manufacturer of the anchor. To secure unit in place using lateral bracing remove the lifting eyes, fit bracing to unit and re-install lifting eyes.

First view (left) is top of unit, second view (middle) is bottom of unit and third view (right) is mounting hole location, inside of unit plinth.

REV	DESCRIPTION	DATE
A	DOCUMENT RELEASED AS REV A	11/18/99
B	ECO: EC-047-00-01: ADDED TB1 ECO: EC-060-00-01: REVISED K1 TO SHOW AUX CONTACT BLOCK ECO: EC-061-00-02: REVISED VALES OF R8 TO R11 FROM 18K TO 22K	3/1/00
C	EC-157-02-01: TITLE BLOCK CHANGE	6/7/02

16 AWG BRN/BLK
16 AWG ORG/BLK
16 AWG YEL/BLK
16 AWG BRN
16 AWG ORG
16 AWG YEL
R2 15 100W
R3 15 100W
R4 15 100W
R5 4 50W
R6 4 50W
R7 4 50W
PW6
PW7
PW4
PW5
A
B
C
CW1 18AWG
MODULE LEADS 18 AWG BLACK
Black Black Black
MOV Module
MOV1
Green w/Yellow
MODULE LEAD 18 AWG GRN/YEL
BLACK
BLACK
CW10 20AWG
TS1
THERMAL SWITCH
J31 A
J34
J32 B
J33 C
J35
J28 A
J29 B
J30 C
J38 ENC OT / O.T RTN
J39 IND OT / O.T RTN
7.5A SLOW F10
3A SLOW F13
5A SLOW F16
7.5A SLOW F9
3A SLOW F12
5A SLOW F15
7.5A SLOW F11
3A SLOW F14
5A SLOW F17
1/10A FAST F18
1/10A FAST F19
J36 +5V / FLTR TRIP / OVERTEMP / GND
F20 1/10A FAST
BLK/RED
BLK/ORNG
BLK/YEL
BLK/GRN
ALL FILTER BOARD FUSES: 600VAC CLASS CC
FILTER FPCBA
J40 V1 V2 V3
BROWN
ORANGE
YELLOW
F21 2A 600V UL CLASS RK5
FB2
PW9
R1 10 225W
BRN 18 AWG
PW8 BRN 18 AWG
PW10 BRN 18 AWG
K1
4 AWG BLACK
L-IN
L1
L2
L3
150uH 50A
4 AWG BLACK
BLK/BLUE
BLK/RED
WHT/RED
WHT/BLK
CW4 18 AWG UL1452
BUS STRUCTURE
C1 10mF 450V
C2 10mF 450V
R8 22K 25W
R9 22K 25W
C3 10mF 450V
C4 10mF 450V
R10 22K 25W
R11 22K 25W
C9 470nF 1000V
C10 470nF 1000V
C11 470nF 1000V
SkiiP132GD120-318CTVU
SKIP
CW5
26 COND RIBBON CABLE
OPTIONAL
DIGITAL INTERFACE MODULE DIM
J2
CW6
LOCAL DISPLAY
J10
J14 SKiiP 3 PHASE
J9 +5V / FLTR_TRIP / OVERTEMP / GND
BLK/RED
BLK/ORNG
BLK/YEL
BLK/GRN
MOV2
MOV3
MOV4
NOTE: TB1 ASSEMBLY INCLUDES MOV'S, JUMPER WIRES, AND CABLE ASSEMBLY TO CPCBA J1
ALL JUMPER WIRES ON TB1: 14AWG BLACK
4 AWG BLACK
TB1
FROM CT'S OR UPSTREAM PCS
TO NEXT PCS (IF APPLICABLE)
CW2 22 AWG
CW3 18 AWG
F4 GOULD ATS 5A 500VDC
J22
F5 GOULD ATS 5A 500VDC
F6 5A LITTLEFUSE 451005
F7 7A LITTLEFUSE 451007
F8 2A LITTLEFUSE 451002
J18
J18
POWER SUPPLY PSPCBA
WHT/BRN
BLK/BRN
WHT/ORG
BLK/ORG
J20 OUTPUT CURRENT SENSE
SNS-A
RTN-A
SNS-B
RTN-B
BROWN
ORANGE
YELLOW
J21 INPUT VOLTAGE SENSE
V1
V2
V3
CONTROL BOARD CPCBA
J6 SPARE
RTN 6
AUTOSTART 5
RTN 4
RUN LP EN 3
RTN 2
REM RUN EN 1
RELAYS
J2
PWR ON NC
PWR ON COM
PWR ON NO
RUN NC
RUN COM
RUN NO
FAULT NC
FAULT COM
FAULT NO
AT MAX CAPACITY NC
AT MAX CAPACITY COM
AT MAX CAPACITY NO
J1
REMOTE DISPLAY POWER
J3 GND +5V
REMOTE DISPLAY
J4
SW2
J5 RS-485
RS-485 A
RS-485 B
RS-485 Y
RS-485 Z
CT1 150:5
CT2 150:5
J41
J42
BLK (CT1 X2)
WHT (CT1 X1)
BLK (CT2 X2)
WHT (CT2 X1)
BLK/BRN
WHT/BRN
BLK/ORG
WHT/ORG
CW9 16 AWG
PW1
PW2
PW3
FB1
80A 600V AC CLASS T
F1
F2
F3
Phase A
Phase B
Phase C
Earth Gnd
Input from Grid
WHT/BRN
BLK/TAN
WHT/ORNG
BLK/ORNG
WHT/YEL
BLK/YEL
14 AWG
J43
J44
FAN 1 HEATSINK
FAN 2 ENCLOSURE
RED
BLK
RED/WHT
BLK/WHT
CW7 20AWG
CW8 20AWG
AUX INPUT
J26 GND +48V
AUX DISPLAY POWER
J27 GND +5V
NOTE: J23, J24 & J25 SWITCHED 48V DC
J23 CNTCR-
J24 CNTCR+
J25 FAN-
FAN+
WIRE SIDE VIEW
ULESS OTHERWISE NOTED
1. ALL WIRE LARGER THAN 10AWG IS UL AWM, CSA TEW
2 ALL WIRE 10AWG OR SMALLER IS UL 1015, CSA TEW

APPROVALS	INITIAL	DATE
ENG		
CHK		
MANF		

50A ACTIVE FILTER WIRING DIAGRAM

DWG NO 11-AF050D5-WD

REV C

REV	DESCRIPTION	DATE
A	ECO: EC-047-00-01: ADDED TB1 ECO: EC-060-00-01: REVISED K1 TO SHOW AUX CONTACT BLOCK ECO: EC-061-00-02: REVISED VALES OF R8 TO R15 FROM 18K TO 22K	3/1/00
B	EC-065-01-01: FUSES F18 AND F20 INTERCHANGED BETWEEN A AND C PHASES EC-157-02-01: TITLE BLOCK CHANGED	6/7/02

100A ACTIVE FILTER WIRING DIAGRAM

DWG NO 11-AF100D5-WD REV B

APPROVALS: INITIAL / DATE — ENG, CHK, MANF

FILTER FPCBA

J28, J29, J30, J31, J32

ALL FPCBA MOUNTED FUSES
CLASS CC 600V SLOW

F14	F11	F17	F12	F9	F15	F13	F10	F16
5A	15A	9A	5A	15A	9A	5A	15A	9A

R4 7.5 225W, R3 7.5 225W, R2 7.5 225W

YELLOW, ORANGE, BROWN — PW6 16 AWG

BLACK — TS1 THERMAL SWITCH — CW10 20AWG

J30: ENC OT, OT RTN
J31: IND OT, OT RTN
J32: +5V, FLTR TRIP, OVERTEMP, GND — BLK/RED, BLK/ORNG, BLK/YEL, BLK/GRN

CW1 18 AWG

BUS STRUCTURE

C1–C6: 10mF 450V
R8–R13: 22K 25W
C7–C8: 10mF 450V
R14–R15: 22K 25W
C9–C11: 470nF 1000V

SKIP SkiiP342GD120-314CTVU

CW5 26 COND RIBBON CABLE

OPTIONAL — DIGITAL INTERFACE MODULE DIM — J2 — CW6

F21 2 1/2A 600V AC CLASS RK5 — FB2

PW18 BROWN 18 AWG — R1 10 225W

PW17 BROWN 18 AWG — PW19 BROWN 18 AWG

K1

PW4, PW5

1 AWG BLACK

L4 "L-EXT" 25uH 100A

"L-IN" 75uH 100A — INDUCTOR LEADS

1 AWG BLACK

PW8, PW9, PW10 — PW11, PW12, PW13 — PW8 - PW13 BLACK 14AWG

R5 1.5 100W, R6 1.5 100W, R7 1.5 100W

PW14 BROWN 18 AWG
PW15 ORANGE 18 AWG
PW16 YELLOW 18 AWG

FB3: F20, F19, F18 — 1/10A 600V AC CLASS CC FAST

BROWN, ORAGE, YELLOW — CW2 22 AWG

MODULE LEADS 18 AWG BLK

MOV1 CS9107B3 — MOV Module Collmer — Black, Black, Black — Green w/Yellow

MODULE LEAD 18 AWG Grn/Yel

MOV2, MOV3, MOV4

WHT/ORNG, BLK/TAN, WHT/BRN — BLK/YEL, WHT/YEL, BLK/ORNG

TB1

NOTE:
TB1 ASSEMBLY INCLUDES MOV'S, JUMPER WIRES, AND CABLE ASSEMBLY TO CPCBA J1

ALL JUMPER WIRES ON TB1: 14AWG BLACK

FROM CT'S OR UPSTREAM PCS — TO NEXT PCS (IF APPLICABLE)

PW1, PW2, PW3

CT1 300:5 — BLK (CT1 X2) — WHT (CT1 X1) — J41 — BLK/BRN, WHT/BRN

CT2 300:5 — BLK (CT2 X2) — WHT (CT2 X1) — J42 — BLK/ORG, WHT/ORG

FB1: F1, F2, F3 — 150A 600V AC CLASS T

CW9 16 AWG

INPUT FIELD WIRING TERMINALS — Phase A, Phase B, Phase C — Earth Gnd

FAN 1 HEATSINK — J43 — RED, BLK — RED/WHT, BLK/WHT

FAN 2 ENCLOSURE — J44 — RED, BLK — RED, BLK

CW7 20AWG — RED/WHT, BLK/WHT

CW8 20AWG — RED, BLK

BLK/BLUE, BLK/RED — CW3 18 AWG

WHT/RED, WHT/BLK — CW4 18 AWG UL1452

POWER SUPPLY PSPCBA

F4 GOULD A3T5 5A 500VDC — J22 — F5 GOULD A3T5 5A 500VDC

J18

J26 AUX INPUT: GND, +48V
J27 AUX DISPLAY POWER: GND, +5V
NOTE: J23, J24 & J25 SWITCHED 48V DC
J23: CNTCR-, CNTCR+
J24: FAN-, FAN+
J25: FAN-, FAN+

CONTROL BOARD CPCBA

F6 5A LITTELFUSE 451005
F7 7A LITTELFUSE 451007
F8 2A LITTELFUSE 451002

J14 SKiiP 3 PHASE

LOCAL DISPLAY — J10

J9: +5V, FLTR_TRIP, OVERTEMP, GND — BLK/RED, BLK/ORNG, BLK/YEL, BLK/GRN

J20 OUTPUT CURRENT SENSE: SNS-A, RTN-A, SNS-B, RTN-B — WHT/BRN, BLK/BRN, WHT/ORG, BLK/ORG

J21 INPUT VOLTAGE SENSE: V1, V2, V3 — BROWN, ORANGE, YELLOW

J6 SPARE: RTN, AUTOSTART, RTN, RUN LP EN, RTN, REM RUN EN

RELAYS J2: PWR ON NC, PWR ON COM, PWR ON NO, RUN NC, RUN COM, RUN NO, FAULT NC, FAULT COM, FAULT NO, AT MAX CAPACITY NC, AT MAX CAPACITY COM, AT MAX CAPACITY NO

SW2

J1

REMOTE DISPLAY POWER — J3: GND, +5V — REMOTE DISPLAY — J4

J5 RS-485: RS-485 A, RS-485 B, RS-485 Y, RS-485 Z

WIRE SIDE VIEW — WHT/BRN, BLK/TAN, WHT/ORNG — BLK/ORNG, WHT/YEL, BLK/YEL

ULESS OTHERWISE NOTED
1. ALL WIRE LARGER THAN 10AWG IS UL AWM, CSA TEW
2. ALL WIRE 10AWG OR SMALLER IS UL 1015, CSA TEW
3. * DENOTES WIRES TWISTED TOGETHER

REV	DESCRIPTION	DATE
A	ECO: EC-047-00-01: ADDED TB1	3/17/00
B	ECO: EC-060-00-01: REVISED K1 TO SHOW AUX CONTACT BLOCK	3/17/00
C	ECO: EC-061-00-02: REVISED VALES OF R10 TO R33 FROM 18K TO 22K	3/17/00
D	ECO: EC-080-00-02: CHANGED F12, F13, & F14 TO 12A	4/26/00
E	EC-065-01-01: FUSES F18 AND F20 INTERCHANGED BETWEEN A AND C PHASES EC-157-02-01: TITLE BLOCK CHANGED	6/7/02
F	EC-247-03-01: FILTER BOARD REV CHANGE	JAN 15, 2004
G	EC 21506-1: HEATSINK FAN CHANGE, FIM ELIMINATED GROUNDING WIRES ADDED TO TB1/8, TB1/10, TB1/12	FEB 12, 2007

PW25 16 AWG BLACK
PW26 16 AWG BLACK
PW27 16 AWG BLACK
R4 2 225W
R5 2 225W
R6 2 225W
R7 2 225W
R8 2 225W
R9 2 225W
BROWN
ORANGE
YELLOW
PW24 16 AWG
J31
FILTER FPCBA
J33
ENC OT 1
2
OT RTN 3
J34
IND OT 1
2
OT RTN 3
J32
+5V 1
FLTR_TRIP 2
OVERTEMP 3
GND 4
BLK/RED
BLK/ORNG
BLK/YEL
BLK/GRN
30A 600V CLASS J
F9
30A 600V CLASS J
F10
12A 600V CLASS CC SLOW
F12
12A 600V CLASS CC SLOW
F13
12A 600V CLASS CC SLOW
F14
30A 600V CLASS J
F11
20A 600V CLASS CC SLOW
F15
20A 600V CLASS CC SLOW
F16
20A 600V CLASS CC SLOW
F17
J28
YELLOW
ORANGE
BROWN
2 x 12 AWG
CW1 18 AWG
BLACK
BLACK
20AWG
CW12
TS1
THERMAL SWITCH
F21
5A 600V AC CLASS RK5
FB1
PW28-PW32 16 AWG BLACK
PW28
PW29
R3 10 225W
R2 10 225W
R1 10 225W
PW30
PW31
PW33 BROWN 18 AWG
PW34 BROWN 18 AWG
PW35 BROWN 18 AWG
K1
1/0 BLACK
1/0 BLACK INDUCTOR LEAD
"L-IN" 25uH 300A
L1
L2
L3
1/0 BLACK INDUCTOR LEAD
BLK/RED
BLK/BLUE
PW19
PW20
PW21
PW22
BUS STRUCTURE
C1 10mF 450V
C2 10mF 450V
C3 10mF 450V
C4 10mF 450V
C5 10mF 450V
C6 10mF 450V
C7 10mF 450V
C8 10mF 450V
C9 10mF 450V
C10 10mF 450V
C11 10mF 450V
C12 10mF 450V
C13 10mF 450V
C14 10mF 450V
C15 10mF 450V
C16 10mF 450V
C17 10mF 450V
C18 10mF 450V
C19 10mF 450V
C20 10mF 450V
C21 10mF 450V
C22 10mF 450V
C23 10mF 450V
C24 10mF 450V
C25 470nF 1000V
C26 470nF 1000V
C27 470nF 1000V
C28 470nF 1000V
C29 470nF 1000V
C30 470nF 1000V
C31 470nF 1000V
C32 470nF 1000V
C33 470nF 1000V
R10 22K 25W
R11 22K 25W
R12 22K 25W
R13 22K 25W
R14 22K 25W
R15 22K 25W
R16 22K 25W
R17 22K 25W
R18 22K 25W
R19 22K 25W
R20 22K 25W
R21 22K 25W
R22 22K 25W
R23 22K 25W
R24 22K 25W
R25 22K 25W
R26 22K 25W
R27 22K 25W
R28 22K 25W
R29 22K 25W
R30 22K 25W
R31 22K 25W
R32 22K 25W
R33 22K 25W
SKPA SkiiP942GB120-317CTV
SKPB SkiiP942GB120-317CTVU
SKPC SkiiP942GB120-317CTV
OPTIONAL
DIGITAL INTERFACE MODULE DIM
J2
CW8
CW7
CW5
CW6
CW4 18 AWG UL1452
WHT/RED
WHT/BLK
14 COND RIBBON CABLE
PW7
PW8
PW9
250MCM BLACK
L4
"L-EXT" 8uH 300A RMS
R10 0.3 225W
R11 0.3 225W
R12 0.3 225W
PW16 BROWN
PW17 ORANGE
PW18 YELLOW
PW10 BROWN
PW11 ORANGE
PW12 YELLOW
PW13 BROWN
PW14 ORANGE
PW15 YELLOW
PW10-PW15 10 AWG
18 AWG
MODULE LEAD 18 AWG BLK
MOV Module
MOV1
MODULE LEAD 18 AWG Grn/Yel
CW3 18 AWG
FB2
F20
F19
F18
1/10A 600V AC CLASS CC FAST
BROWN
ORAGE
YELLOW
CW2 22 AWG
F4
GOULD AJT5 5A 500VDC
J22
F5
GOULD AJT5 5A 500VDC
J18
J18
F6 5A LITTLEFUSE 451005
F7 7A LITTLEFUSE 451007
F8 2A LITTLEFUSE 451002
J15 SKiiP A PHASE
J16 SKiiP B PHASE
J17 SKiiP C PHASE
LOCAL DISPLAY
J10
J9
+5V 1
FLTR_TRIP 2
OVERTEMP 3
GND 4
BLK/RED
BLK/ORNG
BLK/YEL
BLK/GRN
POWER SUPPLY PSPCBA
CONTROL BOARD CPCBA
WHT/BRN
BLK/BRN
WHT/ORG
BLK/ORG
J20
SNS-A
RTN-A
SNS-B
RTN-B
OUTPUT CURRENT SENSE
BROWN
ORANGE
YELLOW
V1
V2
V3
INPUT VOLTAGE SENSE
J21
J6 SPARE
RTN 6
AUTOSTART 5
RTN 4
RUN LP EN 3
RTN 2
REM RUN EN 1
SW2
RELAYS
J2
PWR ON NC
PWR ON COM
PWR ON NO
RUN NC
RUN COM
RUN NO
FAULT NC
FAULT COM
FAULT NO
AT MAX CAPACITY NC
AT MAX CAPACITY COM
AT MAX CAPACITY NO
J1
AUX INPUT
J26
GND
+48V
AUX DISPLAY POWER
J27
GND
+5V
NOTE: J23, J24 & J25 SWITCHED 48V DC
J23
CNTCR-
CNTCR+
J24
FAN-
FAN+
J25
FAN-
FAN+
REMOTE DISPLAY POWER
J3
GND
+5V
REMOTE DISPLAY
J4
J5 RS-485
RS-485 A
RS-485 B
RS-485 Y
RS-485 Z
CT1 1000:5
CT2 1000:5
J41
J42
BLK (CT1 X2)
WHT (CT1 X1)
BLK (CT2 X2)
WHT (CT2 X1)
BLK/BRN
WHT/BRN
BLK/ORG
WHT/ORG
CW9 16 AWG
BUSSBAR
450A 600VAC CLASS T
F1
F2
F3
BUS1
BUS2
BUS3
BUS4
BUS5
BUS6
BUS7
BUS8
BUS9
PW1
PW2
PW3
PW4
PW5
PW6
1/0 BLACK
K2 400A 600V MOLDED CASE SWITCH
OPTIONAL
A1
B1
C1
A2
B2
C2
NOTE:
TB1 ASSEMBLY INCLUDES MOVS, JUMPER WIRES, AND CABLE ASSEMBLY TO CPCBA J1
ALL JUMPER WIRES ON TB1: 14AWG BLACK
INPUT FIELD WIRING TERMINALS
Phase A
Phase B
Phase C
Earth Gnd
MOV2
MOV3
MOV4
WHT/ORNG
BLK/TAN
WHT/BRN
BLK/YEL
WHT/YEL
BLK/ORNG
TB1
ØA
ØB
ØC
FROM CT'S OR UPSTREAM PCS
TO NEXT PCS (IF APPLICABLE)
FAN 1 HEATSINK
FAN LEAD 4 COND
BLUE
RED
YELLOW
BLACK
(WIRE SIDE VIEW OF CONNECTORS)
J43
RED/WHT
BLK/WHT
FAN 2 ENCLOSURE
J44
RED
BLK
CW10 18AWG
CW11 20AWG
RED/WHT
BLK/WHT
RED
BLK
BLK/RED
BLK/BLUE
WIRE SIDE VIEW
WHT/BRN
BLK/TAN
WHT/ORNG
BLK/ORNG
WHT/YEL
BLK/YEL
NOTES
1. ALL WIRE LARGER THAN 10AWG IS UL AWM, CSA TEW
2 ALL WIRE 10AWG OR SMALLER IS UL 1015, CSA TEW
3. * DENOTES WIRES TWISTED TOGETHER

APPROVALS	INITIAL	DATE
ENG	VSJ	FEB 12, 2007
CHK		
MANF		

300A ACTIVE FILTER WIRING DIAGRAM

DWG NO 11-AF300D5-WD
REV G

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